Chapter 4
Commingled Remains and Human Rights Investigations

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Introduction

The investigation of human rights violations presents a number of difficulties that usually result from limited access to different types of data. The complexity of a case is increased when the evidence consists of commingled skeletonized remains. In fact, the management of large concentrations of such remains for their reassociation, identification, and return to the victims' families, as well as the determination of the cause and manner of death, presents a number of stage-specific challenges that deserve revisiting.

EAAF (*Equipo Argentino de Antropología Forense*/Argentine Forensic Anthropology Team) is a nonprofit scientific NGO that applies forensic sciences—mainly forensic anthropology and archaeology—to the investigation of human rights violations in Argentina and worldwide.[1] The team was founded in 1984 in response to the need to investigate the disappearance of at least 10,000 people by the military regime that ruled Argentina between 1976 and 1983 (Fig. 4.1). In close collaboration with victims and their relatives, we seek to shed light on human rights violations, thus contributing to the search for truth, justice, reparation, and the prevention of future violations. EAAF members also serve as expert witnesses and advisors for local and international human rights organizations, national judiciaries, international tribunals, and special commissions of inquiry, such as Truth Commissions. EAAF has worked in over 30 countries throughout the Americas, Asia, Africa, and Europe to identify victims of disappearances and extrajudicial killings; return their remains to their relatives; present evidence of violations and patterns of abuse to relevant judicial and nonjudicial bodies; and train local professionals to continue this work at a local level. EAAF's guiding principle is to maintain the highest respect for the

[1] EAAF's experience has expanded significantly during the past 20 years, although the team remains a small group of committed professionals, including most of its founding members and a small support staff. Headquarters are in Buenos Aires, Argentina; a New York satellite office was opened in 1992. The Board of Directors depends mostly on international funds, both public and private, for the financial support of the organization. Additionally, EAAF receives funding from the UN for participation in field missions.

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Fig. 4.1 Since April 1977, the mothers of many of the kidnapped and disappeared have been gathering at Plaza de Mayo in Buenos Aires to demand information on the whereabouts of their loved ones (photo by Viviana D'Amelia)

perspective and concerns of victims' relatives and communities and to work closely with them through all stages of the investigation process.

This chapter will present three examples from investigations that EAAF has conducted in El Salvador, Zimbabwe, and Argentina. Our goal is to contribute our experience to a discussion of the best forensic anthropological practices for the treatment of these particularly complex cases. We will further offer some considerations relative to recovery procedures, osteological analysis, and the use of background information as well as the limitations of these methods when working with commingled remains.

Skeletonized Remains and Standards of Practice

There exist at present a handful of international recommendations establishing basic procedures for investigations involving corpses at different stages of decay, particularly in the context of mass disasters and human rights violations. Most important among these are the "United Nations' Manual on the effective prevention and investigation of extra-legal, arbitrary and summary executions," Interpol's Disaster Victim Identification (DVI) autopsy protocol, and relevant sections of the International Committee of the Red Cross's (ICRC) document "The Missing—The Right to Know." These protocols, among others, testify to the growing acknowledgment of forensic anthropologists as necessary experts in the field and stress the need for

basic acceptable standards of practice. However, none of them touches upon the particular difficulties involving the recovery and analysis of commingled remains.

The challenge for the forensic investigator is greater when cases involve the large-scale analysis of bones that are difficult to associate with a given individual. The specifics of such an investigation are not addressed by the general protocols. These cases pose a number of practical questions to be addressed by all those experts involved in the investigation, e.g., how to proceed when DNA testing is not operationally feasible, or how to manage bones that cannot be assigned to any one individual.

Proposed methods for the management of commingled skeletonized remains have their origin mainly in archeology and physical anthropology; in fact, it is only in recent years that protocol proposals have involved the application of these methods to forensic science. Among the scientific tools available are morphological techniques (Adams and Byrd 2006; Kerley 1972); osteometrics (Byrd and Adams 2003); mathematical models; statistical methods (Adams and Konigsberg 2004; Rösing and Pischtschan 1995; Snow and Folk 1965); and X-ray, fluorescence, chemical, and molecular analysis. An overview of these methods and useful summaries of the literature related to these issues can be found in Ubelaker's contribution to this volume (See Chapter 1) and his chapter in Haglund and Sorg's *Advances in Forensic Taphonomy* (2002). Every case under investigation is unique to some extent and will call for one or more of these approaches. However, we consider it possible to add a number of recommendations toward a general systematic management of large-scale commingled remains. We have derived these considerations mainly from our forensic investigation of human rights violations in El Salvador, Zimbabwe, and Argentina.

El Salvador

Historical Background

On January 16, 1992, after 12 years of civil war in which an estimated 75,000 people died, the *Frente Martí de Liberación Nacional* (Farabundi Martí National Liberation Front—FMLN) and the Salvadorian government signed a Peace Agreement mediated by the United Nations. The agreement included the establishment of a UN Truth Commission to investigate gross human rights violations committed by both the armed forces and the guerrillas.

The Truth Commission conducted its investigation during 1992 and published its findings on March 15, 1993 in a report titled "From Madness to Hope." The report included recommendations for removing a number of individuals from their positions of power, providing reparation to victims and their families, creating monuments and holidays to commemorate victims, and implementing various judicial and institutional reforms. The report did not recommend prosecution since, in the Commission's opinion, the judiciary at the time could not guarantee a fair trial.

Instead, it provided extensive recommendations for judicial reform.[2] Five days later, on March 20, 1993, the Legislative Assembly passed a general amnesty provision—Legislative Decree 486—for all those involved in human rights violations.

The amnesty law was interpreted as not only foreclosing the possibility of bringing perpetrators to trial but also halting all investigations into human rights violations. Several petitions challenging the constitutionality of the amnesty law were submitted to the Salvadorian courts, but none succeeded.[3]

To date, no judge has suspended enforcement of the amnesty law for a human rights case. Moreover, most cases relative to the civil war have been abandoned by judges or prosecutors. However, trials have continued before U.S. courts and the Inter-American Commission on Human Rights[4] (Doretti and Carson 2003).

The Massacre at "El Mozote"

Between December 6 and 16, 1981, the Salvadorian armed forces initiated a major offensive, "Operation Rescue," in Morazán, a province in the northeast of El Salvador. The purpose of this operation, led by the elite U.S.-trained Atlacatl counterinsurgency battalion, was to force the guerillas from the area, destroy their clandestine radio station, and eliminate any support for them among the civilian population. After several confrontations in hamlets near El Mozote, the FMLN guerillas left the area on December 9, and the army established a base camp in El Mozote. Over the next few days, government troops conducted daytime attacks on the nearby villages of La Joya, Jocote Amarillo, Ranchería, Los Toriles, and Cerro Pando. In each of them, as part of their scorched-earth policy of overwhelming retaliation against FMLN sympathizers, the Army reportedly murdered residents, burned houses and fields, and slaughtered livestock (United Nations 1993).

Soldiers remained in the area for two weeks. When they went back to their camp in El Mozote every evening, survivors from other villages returned to the massacre sites under the cover of darkness and buried as many of the dead as possible. These victims were buried in common graves close to where their bodies were found. However, many bodies remained unburied for fear of army reprisal and were left

[2] "From Madness to Hope," United Nations Truth Commission Report, March 1993, pp. 114–119.

[3] CEJIL 11/16/01. www.cejil.org/comunicados.cfm?id=263.

[4] In 2005, the Organization of American States (OAS) decided to reopen the investigation into Salvadorian government complicity in or approval of the massacre at El Mozote. This decision came in March 2005 when the Center for Justice and International Law (CEJIL) and *Tutela Legal*—the legal office of the Archbishop of San Salvador—presented a petition before the Inter-American Commission on Human Rights (IACHR), an organ of the OAS that sees to the promotion and protection of human rights, with additional forensic information. The case was originally at the OAS, but was shelved by the IACHR in 2000. Initially, the IACHR rejected the petition as a result of arguments presented by the Salvadorian government. CEJIL and *Tutela Legal* responded by sending additional observations and urging the IACHR to admit the report of admissibility in order for proceedings to begin before the Inter-American Court. The IACHR then decided to compile and review the new forensic evidence collected by EAAF and determine whether the Salvadorian government was aware of the massacre and permitted it.

where they had fallen. During this period, the Salvadorian army allegedly killed approximately 800 civilians in 6 neighboring villages. The villages in this region were mostly abandoned until 1989, when survivors began to return. El Mozote itself remained deserted until several years later (Doretti et al. 2005).

On October 26, 1990, survivors represented by *Tutela Legal*[5] opened criminal proceedings at a court in San Francisco Gotera, Morazán, to investigate and prosecute those responsible for the massacre. Also, in 1992, the mandate of the UN Truth Commission—created as part of the Peace Agreement—conferred the capacity to investigate major crimes, including ordering exhumations and conducting a thorough investigation of the massacre at El Mozote, one of several emblematic Salvadorian civil war cases. In 1991 and 1992, at the request of *Tutela Legal* and acting as expert witnesses in the local court case and as technical consultants for the UN Truth Commission, EAAF conducted an initial assessment of the case and proceeded to exhume and analyze evidence from one massacre site. Released in March 1993, the UN Truth Commission report cites evidence from the forensic work at El Mozote and concludes that government forces were responsible for the massacre of several hundred civilians, mostly women and children, who were victims of a planned mass extrajudicial execution. However, because of the passage of the amnesty law that followed the release of the Truth Commission's report, the work on the massacre at El Mozote was halted for 6 years. In 1999, *Tutela Legal* successfully appealed to the Supreme Court for the resumption of exhumations on humanitarian grounds to return the remains to the families of the victims.

To date, EAAF has conducted forensic investigations related to the case—specifically in 1992 and from 1999 to 2004—under the authority of the same court where the process began in 1990. The investigation involved the entire area affected, i.e., the hamlets at El Mozote, Jocote Amarillo, Ranchería, Los Toriles, Cerro Pando, and La Joya.

Some burial sites were initially marked by *Tutela Legal* and EAAF in 1992 according to indications from witnesses and people who had helped to bury the bodies. However, the bodies of many of the people killed in the fields had been left where they fell. Burials also took place three weeks after the incidents, once the army had withdrawn from the area. According to the people who buried these remains, they were eaten and dismembered by animals and were highly skeletonized. Thus, remains were gathered from the surface for burial, with the consequent commingling of body parts of different individuals in the same mass grave. The investigation conducted by *Tutela Legal* and expanded by EAAF revealed that the Salvadorian army allegedly killed an estimated 811 civilians in these 6 neighboring hamlets during the operation. According to interviews with surviving relatives, over 40% of the reported victims were children under the age of 10.[6]

EAAF has worked at a total of 27 burial sites containing abundant ballistic

[5] *Tutela Legal*, the legal office of the Archbishop of San Salvador, serves as the legal representative for the victims and their family members.

[6] "From Madness to Hope," United Nations Truth Commission Report, March 1993.

Table 4.1 Burial Sites and Graves Related to the Massacre at "El Mozote" at Which EAAF Worked: Characteristics and Minimum Number of Individuals (MNI)

EAAF Missions	1992	2000	2001	2003	2004
Graves containing articulated remains		La Joya 1, 2B, 4, 5, 16, and 17 Jocote Amarillo 1, 2, 3A, 3B, 3C, 4	Los Toriles 1, 2, 3	Cerro Pando 1A and B	
Graves containing commingled remains			Los Toriles 4	Ranchería 2A, 2B, and 3 Mozote 3 Los Toriles 5	
Interior of houses containing commingled remains	Mozote 1		Mozote 2	Ranchería 1 and 2	Mozote 5 and 6
MNI	**143**	**37**	**29**	**57**	**3**

evidence and personal effects associated with the remains. Of these, 12 were mass graves containing articulated remains, 10 were graves with commingled remains, and 5 were houses containing commingled remains (Table 4.1). Especially when victims were killed inside their houses, their remains were severely damaged when the houses were set on fire by the soldiers and the roofs and adobe walls collapsed over them, resulting in the recovery of extensively fragmented commingled human bones (Fig. 4.2).

EAAF recovered the remains of a minimum of 269 individuals. At least 40 of them were identified as female, 26 as male, and 203 as of undetermined sex, mostly children, from newborns to age 12.

As regards the recovery of nonbiological evidence, with the help of a metal detector, ballistic evidence was found in most of the burial sites and adjacent areas. All ballistic evidence was analyzed by ballistic experts, who classified it as either bullets (whole or fragmented) or cartridge cases. In most cases, we found clothing associated with the remains, and personal effects such as belt buckles, combs, mirrors, barrettes, coins, etc. In the graves containing the skeletons of children, several toys were found. Inside the houses, household items such as plates, boxes, plastic containers, etc. were mixed with the remains and clothing.

The communities in northern Morazán built a monument in El Mozote's new plaza, and most of the recovered remains were reburied there after the forensic examination. In some cases, the tentative identification and circumstantial evidence were sufficient for a judge to issue death certificates for victims. Considering the difficulty of re-individualizing part of the exhumed remains and getting the final

Fig. 4.2 Ruins of a 4.63-meter × 6.94-meter adobe structure adjacent to a church where a minimum of 143 individuals, most of them children, were exhumed. A total of 263 M16-rifle bullet fragments and 245 spent cartridges was found. The majority of the bullets were in direct relation to the concentration of skeletons. (Photo: Mercedes Doretti, EAAF)

positive identifications for each and every victim, the community decided to place the fragmented remains in boxes identified according to the exhumation place, i.e., "human remains recovered at the Arguetas' house." Apart from this, memorial plaques with the names of the victims surround the area of exhumation.

Zimbabwe

Historical Background

Between 1970 and 1987, thousands of Zimbabweans died amidst political violence, first during the war against the white-settler Rhodesian government (1970–1980) and then during a period of internal conflict (1981–1987) following liberation. The suffering inflicted upon black Africans during the colonial period and the war for liberation is well recognized and documented, and the government of Zimbabwe has made major efforts to assist the survivors. In contrast, most of the massive human rights violations that occurred after 1980 were neither investigated nor even officially recognized by the Zimbabwean government. Nationally and internationally their existence remained virtually unknown except to those who suffered them, until 1997 when the Catholic Commission for Justice and Peace (CCJP) and the Legal Resources Foundation in Zimbabwe published a detailed report on human rights abuses in Matabeleland and the Midlands during the 1980s.

The war of independence against the white-settler Rhodesian government (1970–1980) was waged by two separate forces. The larger of these was the Zimbabwean African National Union (ZANU) and its armed wing, the Zimbabwean African National Liberation Army (ZANLA). The other was the Zimbabwean

African People's Union (ZAPU) and its armed wing, the Zimbabwean People's Revolutionary Army (ZIPRA). While the two forces cooperated in the struggle against the white-settler government, there was also considerable animosity between them. ZANU-ZANLA came to be associated with Zimbabwe's Shona-speaking majority and ZAPU-ZIPRA with the Ndebele-speaking minority, although each force included large numbers of members from both ethnic groups. In some cases, the tensions arising from these differences led to clashes between the two armies. By April 1980 the liberation armies had defeated the white-settler government. In the subsequent national elections, ZANU gained a large parliamentary majority in a national vote that fell predominately along ethnic lines. ZANU and ZAPU entered into a coalition government, and efforts were made to combine their armed forces into a single national army.

Relations between the two groups rapidly deteriorated, however, and the political situation in the country became increasingly tense. In 1982, so-called dissidents began staging attacks and robberies in a number of areas in the country. There is no conclusive evidence suggesting that the rebel groups were part of an organized large-scale plot to overthrow the Zimbabwean government. Nor were the rebels numerous; according to the CCJP's report, probably no more than 400 of them were active at any one time. The ZANU-dominated Zimbabwean government, however, responded as though the rebels were mounting a major insurrection. State security forces were directed to take counterinsurgency measures and to repress the Ndebele-speaking civilian population in the Matabeleland and Midlands regions of the country, where the armed dissidents were most active. The government justified the repression of civilians on the grounds that the Ndebele-speaking population supported the rebels, although there was very little substantial evidence to support this claim.

Various dissident groups allegedly committed a number of serious human rights violations, including the rapes and murders of civilians. According to the CCJP's report, however, the human rights violations committed by the state security forces vastly exceeded those committed by the dissidents. Security forces, particularly the notorious Fifth Brigade, reportedly carried out arbitrary executions, forced disappearances, beatings, rapes, and the torture of thousands of civilians. Zimbabwean and international human rights organizations estimate that between 3,000 and 5,000 persons were killed or "disappeared" by state security forces during this period. Zimbabwean human rights organizations have compiled two databases, one with the names of nearly 1,800 victims known to have been killed or "disappeared" during the 1980s conflict and a second, larger database of unidentified victims. They have also identified the sites of a number of mass graves that allegedly contain the remains of victims of human rights violations. The period of massive violence finally ended in 1987 with a general amnesty and the signing of a "unity accord" between ZANU and ZAPU leaders. The Zimbabwean government, however, has never officially recognized the crimes committed by state security forces during this period. One of the most significant consequences of the violence of the 1980s for the surviving residents of Matabeleland and the Midlands was that they could not find their dead to properly mourn and bury them. In some cases this happened because the victims were buried in unofficial mass graves. In other cases the victims were "disappeared,"

and the survivors never learned their fates, or state security forces killed victims in the presence of their relatives or neighbors and then refused to allow the survivors to bury or even mourn the dead.

In 1999, EAAF conducted the first forensic anthropology work in the region of Matabeleland South on a mission involving both teaching and research. This mission was conducted at the request of the Amani Trust,[7] and one of the five cases we worked on was that in Sitezi (Doretti 1999).

Sitezi

A Fifth Brigade unit was based at Sitezi A1 Rest Camp in the district of North Gwanda during the 1984 curfew and turned the rest camp into a detention center. Amani has had many accounts of torture and murder that took place there during this time. Once the Fifth Brigade moved out, the camp was left derelict and has remained deserted to this day. The only additions that have been made are graffiti on the walls of buildings saying that the Fifth Brigade came and murdered the children of the region. Amani became involved when a person in Mapane revealed that he had climbed alive out of a mass grave in Sitezi. He reported that he and many others had been held and tortured at Sitezi Camp.

The next testimonial in connection with the site came from a woman who said that her father had been murdered and lay in a mass grave in Sitezi. She was disturbed by the fact her father's grave had never been honored and wanted to know if there was any chance of recovering his remains. A Gwanda informant was finally able to locate the site, which was then immediately confirmed by others as the mass grave.

The archaeological exhumation began on August 4, 1999, and members of the victims' families as well as community representatives were present during the two days that the work demanded. The bones were disarticulated, burned, and blackened, and, except for a few phalanges, all of them were fragmented as a result of fire. The extensive damage limited our ability to keep all but the largest bone fragment remains in place. All bone remains were mixed with fragments of charcoal, indicating that logs and firewood had been used to start the fire and to keep it alive. Some of the bones and charcoal had the brightness associated with the use of accelerant. Due to the burning, fragmentation, and mixing of bone remains, it was not possible to individualize them, i.e., to assign bones to a specific skeleton or to a larger body part. However, we conducted a thorough study on them, from which we obtained the following results:

1. All of the recovered bone remains were human.

[7] Amani Trust is a Zimbabwean-registered NGO headquartered in Bulayo and established in 1993 for the purpose of providing rehabilitation services to victims of human rights violations, particularly torture, repressive violence, and institutionalized violence. Amani (Swahili for "peace") operates on a nonprofit basis, and its services are free of charge.

2. Most of them were completely burned and blackened (Fig. 4.3).
3. A chemical fuel was used to accelerate the destruction of the corpses.
4. Based on the quantity and estimated ages of proximal epiphyses of right ulnae (6) and of proximal epiphyses of left ulnae (6), we determined an MNI of six adults of undetermined sex. Due to the extensive fragmentation of the bones, it was impossible to proceed to individualization.
5. The condition of the site and remains was consistent with the intentional destruction of evidence.
6. Ballistic evidence (a gun cartridge and a bullet), personal effects, and an identification card were also recovered.

The Sitezi case is one typical scenario of remains found in mass graves where some major bones are recovered; experts should be able to decide what procedure to follow in the face of such a situation. Since extreme burning destroys the potential for DNA analysis, the only available techniques for identification are usually anthropological in nature.

Despite the challenges, even limited anthropological findings have in this case yielded important benefits to victims' families. The existence of the grave itself was established, a fundamental element for the historical record as well as for possible future legal actions. Because it was impossible to individualize the remains of victims at Sitezi, the families agreed to have a common inhumation performed. The funeral was attended by over 500 people (Doretti 1999).

Fig. 4.3 Burned remains at Sitezi during the sorting procedure (photo by Anahí Ginarte, EAAF)

Argentina

Historical Background

During the 1970s, a number of South American countries, particularly Argentina, Bolivia, Brazil, and Chile, were shaken by periods of intense violence and repression. During that decade, severe human rights violations were committed, primarily by military governments (CONADEP 1986).

In the early 1980s, these countries began to move toward reinstating democracy. With the establishment of democracy came the immediate need to investigate the human rights violations of the recent past. In these cases, the role of the judiciary, which had been extremely limited or complicit with the authoritarian regimes, was questioned and in some cases redefined. It became clear that improvements to the administration of justice were crucial to reinforcement of the new democracies. However, while these investigations led to the conviction of guilty parties in some countries, in others various amnesty proclamations allowed those responsible for the crimes to avoid prosecution, even when investigations are ongoing.

Argentina returned to democracy in December 1983. The newly elected president, Dr. Raúl Alfonsín, created the *Comisión Nacional sobre la Desaparición de Personas* (National Commission on the Disappearance of Persons; CONADEP). The commission documented around 10,000 cases of people who had been "disappeared" under the previous military regime (1976–1983), although, according to independent human rights groups, the figure is much higher. The vast majority were abducted, taken to illegal detention centers, tortured, and killed by security forces between 1976 and 1978.

In Argentina, an abductee was typically taken to a clandestine detention center (CDC) where he or she was subjected to interrogation under torture for several weeks or months before being released, held as a legal prisoner, or executed extrajudicially. Some CDCs dumped their victims, bound and sedated, from military aircraft flying over the Argentine Sea; others buried them under the notation NN (for "No Name") in municipal cemeteries. In the latter case, shortly after the killings the bodies were typically deposited in public places, and an "anonymous" call would be made to the local police precinct. The police, sometimes accompanied by local judges, would go to the site and recover the bodies. Prior to anonymous burial in local cemeteries, the bodies were often photographed, fingerprinted, and given a perfunctory examination by a police or judiciary forensic doctor who issued a death certificate, and the registry office would provide a burial certificate. Such thorough official documentation is unusual for bodies that were intended to be buried in anonymous graves. These records have been vital to the identification of victims in EAAF investigations. In 1984, before CONADEP issued its report on the inquiry, judges began to order exhumations in cemeteries known to contain the remains of disappeared persons. The exhumations were attended by relatives of the disappeared desperate to find out what had happened to their loved ones and hoping to recover their remains. However, the process was complicated by a variety of factors.

First, official medical doctors in charge of the work had little experience in the exhumation and analysis of skeletal remains; in their daily professional experience they generally worked only with cadavers. Thus, exhumations were carried out by cemetery workers in a completely unscientific manner (Fig. 4.4). In particular, when bulldozers were used, the bones were broken, lost, commingled, or left inside the graves. As a result, much of the evidence that would have served to identify the remains and support legal cases against those responsible for these crimes was destroyed. In addition, some forensic doctors had been complicit, either by omission or commission, with the crimes of the previous regime. In Argentina, as in most Latin American countries, forensic experts are part of the police and/or the judiciary. During nondemocratic periods their independence is severely limited.

Because most of these initial unscientific exhumations took place in the Province of Buenos Aires, many of the remains were under the jurisdiction of *Asesoría Pericial de La Plata* (the Medical Legal Institute belonging to the judiciary of the Province of Buenos Aires). In 1984, a group of U.S. forensic scientists visited Argentina at the request of CONADEP and *Abuelas de Plaza de Mayo* (Grandmothers of the Plaza de Mayo), a local human rights organization that had requested their help with the identification of disappeared people and the search for disappeared children. The scientists visited *Asesoría Pericial*, saw the bags of remains that had come from the poorly executed exhumations, and made an immediate call to stop the destructive practice so that archaeological and forensic anthropological methods could be used to recover and analyze the skeletal remains. Among these scientists

Fig. 4.4 The first exhumations ordered by the justice system were not conducted archaeologically, by as a result of which most of the remains were damaged, commingled, or left in the graves. Mothers of the victims view the remains recovered as a result of these exhumations. Avellaneda, Buenos Aires, 1984. (Photo: Roberto Pera.)

was U.S. forensic anthropologist Dr. Clyde Snow, who, at the request of judges and families of victims, organized the first investigations using archaeological and forensic anthropology techniques to exhume and analyze the remains of disappeared people. He trained EAAF members over the next 5 years.

The bags of remains from these initial exhumations were kept in precarious storage conditions at *Asesoría Pericial.* In time, institutional interest in these cases deteriorated and most judges stopped working on them, abandoning the remains in the storage facility. Requests for information about the remains were met with an inadequate response and eventually led to the conclusion that the information was inaccessible.

At the same time, the results of the historical investigation conducted by EAAF through interviews with survivors of the CDCs and relatives of disappeared people, cemetery and judicial records, fingerprints, and other sources led us to believe that the remains of some disappeared persons could be found and identified from the boxes stored at *Asesoría Pericial*. *Asesoría* agreed to work with EAAF to produce a detailed inventory of the skeletons in the depository and their origin, which was then given to the Buenos Aires Federal Court (*Cámara Federal*). The Court in turn ordered that the remains be entrusted to EAAF for laboratory study with the hope of identifying them.

In December 2002, under the authority of the Buenos Aires Federal Court, 91 significantly deteriorated bags and boxes containing bone material, clothes, ballistic evidence, and labels with partially legible references were transferred from *Asesoría Pericial* to EAAF custody for analysis. These skeletal remains and their associated evidence were severely commingled when we retrieved them (Doretti and Carson 2003).

The bags and boxes received came from at least 10 cemeteries in the provine of Buenos Aires, according to the labels on most of the boxes. These labels indicate the cemetery where the remains were recovered[8] and/or the corresponding judicial file. We also received eight boxes of remains bearing no labels or other indication regarding where they had been exhumed. The skeletal remains in each of these boxes often belonged to more than one individual and were commingled and incomplete.

In the context of the historical and documentary investigation relative to the cases coming from *Asesoría Pericial*, EAAF drafted a spreadsheet showing which box or bag of remains corresponded or might have been related to judicial files about the "discovery" of bodies in wastelands and the exhumation of cadavers. These files often contain information about where the bodies were found, autopsy reports, fingerprints and photos of the cadavers, etc. Similarly, the files relative to the 1984 exhumations also contained information about the date when the exhumation took place, the graves that were exhumed, how the exhumations were conducted, any examination performed, etc. The study of this information yielded results that

[8] Moreno, Boulogne, Rafael Calzada, General Madariaga, Lomas de Zamora, Campana, Vicente López, Morón, Mercedes, and Isidro Casanova.

became one more variable to be considered for bone reassociation and the subsequent formulation of identification hypotheses (Fig. 4.5).

In this way, it was possible to cluster most containers—but not all—as corresponding to a given cemetery or judicial case. An assessment of the degree of commingling and a decision regarding the most convenient reassociation procedure then ensued, attending to

- First, the container the remains came from
- Then, all containers coming from the same cemetery
- Finally, all the containers received

For each container, a dated record was made of the existence of ballistic evidence, labels, and clothing.

To date, we have conducted laboratory analysis of 54 of the 91 containers and have obtained the following results:

- Twenty containers (37%) held the remains of only one individual each.
- The Minimum Number of Individuals (MNI) for these 54 boxes has been established as 78, 74 of which were represented by the right tibia and estimated to be adults, while 4 were estimated to be subadults.
- The Most Likely Number of Individuals, MLNI (Adams and Konigsberg 2004), obtained by adult femur pair-matching, was 87 individuals, with a 96% CI of 85–93 individuals (MLNI total: 87; 74 right, 69 left, 58 pairs). Note that the MNI estimate for adults was 74.
- Twenty-three skeletons have been morphologically reassociated.[9] When this total is combined with the 20 containers containing only one individual each, the result is 43 associated individuals from Asesoría. Fourteen of them were determined to be female and 29 male. Thirty of them (19 males and 11 females) presented perimortem injuries consistent with gunshot wounds, mainly to the skull.
- Of the total number of containers, 131 body parts[10] have been morphologically reassociated. One hundred twenty-seven belonged to adults and four to subadults and children. Forty-eight were determined to be male, 8 probably male, 22 female, 3 probably female, and 50 of undetermined sex. A considerable number among these presented perimortem injuries consistent with gunshot wounds, mainly to the skull.

[9] The sorting of the remains is based on such morphological techniques as joint match, age and sex similarities, visual pair-matching, process of elimination, and taphonomic appearance.

[10] In this study, body parts refer to groups of bones from the same anatomical part of a skeleton (e.g., lower limbs and pelvis) that are formed by bones that articulate with each other (such as the right femur, the right coxae, and the sacrum) and/or are visually similar (with right and left sides of bilateral bones matching, e.g., the right and left humeri). Those pieces that did not articulate with any other bones and could not be associated with other bones in any way were classified as "isolated."

Fig. 4.5 Reasssociated remains coming from different containers originally in the storeroom of Asesoría Pericial de la Plata and exhumed in 1984 at the Cemetery of Lomas de Zamora, Province of Buenos Aires. The numbers correspond to the containers originally holding them. Arrows indicate the presence of perimortem injuries. (Photo: Sofia Egaña, EAAF)

In general terms, the characteristics of remains coming from *Asesoría Pericial* strongly correlated with those of the disappeared at large (Snow and Bihurriet 1984) both biologically (sex and age) and pathologically (perimortem trauma). DNA analysis will further assist in the sorting process and the identification effort.

General Discussion

In all three cases (El Salvador, Zimbabwe, and Argentina), our team implemented a basic research methodology consisting of the following three stages:

1. **Research.** EAAF began by collecting extensive background information on the cases. Techniques included thorough historical research; interviewing relatives, witnesses, and survivors; reviewing military, police, and other official archives; gathering antemortem information about the victims; studying NGO, UN, and other human rights reports; and analyzing hospital and cemetery records, among others. We correlated this information in order to formulate hypotheses about the location of clandestine or anonymous burial sites, the possible name and number of the victims, their biological profile, and the alleged cause of their death. All of this information is instrumental toward planning the strategy for their recovery.
2. **Scene investigation and recovery.** Once the site was located and appropriate permits were obtained, archaeological and forensic techniques were applied to investigate suspected killing and burial sites, analyze the terrain, excavate and carefully recover such evidence as skeletal remains, bullets, clothes, personal belongings, etc. We made a point of documenting every stage of the process by means of written records, video, and photography.
3. **Laboratory analysis.** The recovered remains were then analyzed in a laboratory according to current standards of forensic practice for the management of skeletal remains. In cases in which the remains corresponded to one individual, we conducted routine anthropological analyses, including an estimation of sex, age, height, and laterality as well as a description of antemortem pathologies and old lesions, perimortem trauma, dental information, postmortem alterations, clothing, and nonbiological evidence associated with the remains. We applied the knowledge and techniques of forensic anthropology, pathology, radiology, odontology, and genetic analysis, among others, in an attempt to establish the identity of the victim and to provide information about the cause and manner of death. In cases in which the remains were mixed, we analyzed them as an assemblage or a concentration of commingled skeletal remains. The analysis aimed to reassociate the largest possible number of individual skeletons from the mixed remains in order to conduct individualized studies leading to their identification. We also established an MNI for the entire set of remains under consideration. Where possible, the remains of identified victims were then returned to the relatives or communities, and the evidence was submitted to all pertinent institutions.

The results of the analysis were charted and added to EAAF's Forensic Anthropology Database (FAD) with the purpose of enabling further consultation, searches, and/or matches.

Our experience indicates that the application of this standard procedure for the management of large-scale analysis of commingled skeletonized remains has a number of advantages and limitations that deserve further discussion.

Recovery and Recording of Findings

The results demonstrate that the choice of strategy in initial intervention for recovery and recording of findings has a dramatic impact on the success of subsequent stages. This is particularly true in cases in which the complete, articulated skeleton is not the unit of exhumation and analysis.

The use of archeological methods maximizes the quality and quantity of data obtained, which in turn contribute reliable evidence both for laboratory analysis and for the comparison and matching of forensic records with data obtained from the preliminary investigation. Our experience in La Plata's mortuary facility case also demonstrates that an archeological recovery procedure conducted by trained personnel is needed even in simple cases involving clearly marked individual graves in a cemetery.

The choice of a single technique for recording and recovering remains in all cases is unfeasible. A decision in this regard must be made on the basis of site features. However, adequate recording and description in the field will indicate the level of reliability for the association of commingled remains and can make an enormous difference, as expected, when they are later studied at the laboratory.

As an example, at El Mozote strategies varied according to whether the remains were found in graves or homes, their state of articulation, their spatial distribution, and their state of preservation (Figs. 4.6 and 4.7). Thus, the type or features of each site led to our choice of technique for the recording, lifting, and bagging of the bones. In each case, then, the remains—both biological and nonbiological—were recovered according to level, square, assemblage, or anatomical section/body part.

Osteological Analysis

One of the main objectives of osteological analysis of commingled remains in forensic contexts—and that which presents the greatest difficulties—is the reassociation of bones for the purpose of identifying and restoring the remains to the families.

In Argentina and in El Salvador, our strategy for the reassociation of remains considered a variety of data sources: archeological, biological, and taphonomic, as well as that resulting from the preliminary investigation, all of which contributed to the degree of reliability of reassociation, whether on the basis of body parts or of complete skeletons.

Our criteria to associate bones were

- Archeological information about the arrangement of the remains at exhumation
- Preliminary investigation results (documental and testimonial sources)
- Age and sex
- Joint match
- General morphology
- Continuity in the pattern of traumatic injury
- Consistency of specific antemortem features
- Consistency of postmortem changes

Our results indicated that, for cases that involve large bone concentrations, the sorting of the remains made on the basis of gross morphological techniques presents some limitations that reduce its reliability.

Contributing factors could be summarized as follows:

- Estimations and reassociations were made on the basis of qualitative methods of analysis involving the visual inspection of features (general morphology, joint match, continuity of the traumatic or pathological pattern, etc.); thus, intra- and inter-observer variability increased the probability of bias.
- Reassociation was limited by the extent of preservation of the remains. In El Mozote, the poor state of preservation of the bones and the postmortem loss of a large number of pieces while they were on the surface led to reduced reassociation, limited to very few clear cases. In Sitezi, the degree of fragmentation of

Fig. 4.6 General plan of the exhumation strategy in a case involving remains deposited inside a house at El Mozote. The archeological strategies of square, assemblage, and anatomical section were used simultaneously. (Photo: Mercedes Doretti, EAAF)

Fig. 4.7 Burial site at El Mozote showing a typical bone concentration (photo: Silvana Turner, EAAF)

bones due to intentional burning of the corpses did not permit any reassociation of identifiable bone elements.

- For homogeneous bone concentrations, i.e., those composed of remains estimated to belong to a group of like-aged, same-sex individuals of the same ethnicity (mostly young adult Caucasian males, for instance), potential morphological similarities among bones belonging to different individuals neither confirmed nor excluded reassociation with only one individual among the group. On the other hand, it was possible to exclude two individuals who were morphologically incompatible because of their different age ranges. We can confirm that an adult pelvis and a child's lower limbs do not yield a morphological match, but in many cases we cannot visually confirm or exclude a match with a morphologically similar adult lower limb. This said, in cases of obvious morphological differences (e.g., a very robust femur and a very gracile humerus), it is possible to sort by exclusion.

These limitations led to the necessary conclusion that reliability of association will be greater as the number of variables contributing to positive association increases. The larger the number of features in common, the higher the likelihood that two bones will belong to the same individual.

The standard procedure for the analysis of commingled skeletonized remains also involves a determination of the MNI, the Lincoln Index (LI), and/or the Most Likely Number of Individuals (MLNI) (Adams and Konigsberg 2004) for the bone concentration as well as a determination of the biological profile, i.e., the represented age range and sex. (See Chapter 12 for more detail on quantification methods of determining number of individuals.)

To determine the MNI, we considered in the first place the duplication of bone type, side, and likely age range at death. Particularly for large-scale cases, our results offer pointers toward a reliable, feasible characterization of sites. However, in some cases—especially when recovery of major elements is nowhere near 100%—it is possible to use the alternative techniques derived from pair-matching mentioned above, i.e., the LI or the MLNI. This information may not be directly instrumental in the formulation of identification hypotheses but serves to correlate with the information resulting from the preliminary investigation.

For biological profiling purposes, for every assemblage we took into account (1) each and every bone element in the concentration presenting significant features to that end (e.g., skull, pelvis) and (2) morphologically reassociated units (skeletons).

It is evident that the value of the information obtained from biological profiling depends on the extent of survival of bone elements. When the skeleton is well-preserved, the determination of sex and age is clearly instrumental in the formulation of identification hypotheses. In any case, this information is significant for correlation with that provided by witnesses or documentary sources.

Another objective of the forensic management of commingled skeletonized remains is to provide information on the cause and manner of death of the exhumed individuals by recording, among other factors, the existence of perimortem injuries. For the three cases described above, such injuries were recorded according to which bones presented trauma within the total assemblage and/or reassociated large units (skeleton or anatomical sections). In Argentina and in El Salvador, the existence of perimortem injuries and their type as well as the associated ballistic evidence, when it existed, correlated with the information yielded by the preliminary investigation and testimonial records. Nevertheless, observations relative to cause and manner of death of a given individual are limited by the possibility and reliability of reassociations.

Our results strongly indicate the value of a thorough preliminary investigation, including witness testimony as well as the examination of cemetery, morgue, judicial, and police records, among others.

The Argentine case provides an example in this regard. Some of the containers at La Plata's mortuary facilities had labels on them bearing the judicial record number of their exhumation orders from 1984. Those judicial records included both police autopsy reports and photos of the remains at the time of their exhumation and/or first examination by facility staff members. Analysis led to a confirmation of either consistency or variability in the number of remains and their condition both at the time of their first autopsy and 20 years after exhumation.

In El Salvador, the information collected during the preliminary investigation also permitted drawing up a database for possible victims that included name, sex,

age, and dental data among other antemortem information, as well as any existing relationships between victims and their potential burial site.

The Use of DNA Analysis in a Context Involving Commingled Skeletonized Remains

Discovering the identity of victims from their skeletal remains involves comparing physical data obtained from the study of the remains (postmortem) with physical information about victims such as age at death, sex, height, dental records, and others (antemortem), usually obtained from victims' families and friends. Unfortunately, in many of our investigations antemortem information is frequently unavailable or insufficient for a positive identification. However, since the late 1980s, when it became possible to recover DNA from bones, genetic testing has become a key tool in investigations. In association with genetic laboratories, EAAF has already made identifications using genetic testing for individual cases of disappearances in Argentina, Haiti, and Ethiopia.

In a number of cases, we can formulate a strong hypothesis on the identity of remains and only need confirmation through genetic testing. However, DNA analysis is still expensive, and few genetic laboratories work on the extraction of DNA from bone remains. Another element presenting further complexity in cases involving the large-scale analysis of commingled skeletonized remains is the sampling strategy for genetic analysis. Ideally, genetic confirmation or exclusion of the possibility that a particular person's remains will be present in a given concentration should take place only after each and every bone element has been analyzed. Unsurprisingly, in addition to the prohibitive cost of extensive DNA testing, cases involving large concentrations of incomplete, disarticulated remains have presented a number of technical limitations, such as the state of preservation of the DNA (which may vary with the type of bone recovered) and the laboratory's technical capacity, among others. It is in these cases that morphological reassociation plays a particularly significant role by contributing to a reduction in the number of samples to be sent for genetic processing. In this sense, DNA testing can indeed contribute to confirming the morphological reassociation of anatomical sections. Likewise, when an individual's skeleton is poorly represented—by only one bone, for instance, typically the cranium, jaw, or pelvis—genetic testing can contribute to confirming or excluding the presence of a given person in the concentration, even when it will be impossible to restore the complete skeleton to the family.

In the case of Argentina, EAAF has a blood bank of relatives of the disappeared, but mass DNA testing is not readily accessible. Therefore, cases are processed according to the following priority:

1. Reassociated skeletons or anatomical sections with highly reliable association and presumptive identification, the result of matching ante- and postmortem data and background investigation

2. Single skeletal elements permitting preliminary anthropological identification, e.g., jaw and/or maxillae with significant dental features

Conclusions

When following the aforementioned standards for recovery and analysis of large concentrations of commingled skeletonized remains, we can expect reliable results in the following areas:

- A record of conditions in which the remains and associated nonbiological evidence were found
- A determination of the MNI for the total assemblage on the basis of bone inventorying and additional analyses available (such as LI and MLNI) that may be appropriate in certain scenarios
- A biological profile for the assemblage based on skeletal elements or reassociated skeletal units
- A preliminary morphological reassociation of complete or partial remains
- A record of perimortem injuries for the assemblage or for reassociated units

These results are instrumental for comparisons with the information derived from the preliminary investigation and for the formulation of identification hypotheses.

On the other hand, limitations on the analysis of commingled skeletonized remains mainly relate to identification and to the determination of the cause and manner of death. Given the limitations of morphological reassociation, identification based on osteo-anthropological data must be considered preliminary in most cases and necessarily followed up with DNA testing. This is particularly true in cases involving (1) a large number of commingled remains resulting in a high MNI, (2) "open" or virtually open cases with a large potential list of candidates for those remains, and (3) poor or nonexistent antemortem information. Positive identification will ultimately result from the combined evaluation of osteo-anthropological data and DNA testing results. Additionally, circumstantial evidence—i.e., burial site, body-part–associated personal effects, clothing, etc.—as well as documentary and witness testimony information must also be considered toward identification.

Our ethical, legal, and scientific mandate is to consider a corpse identified only when sufficient reliable evidence has been collected in accordance with national and international protocols and recommendations. To this end, our observations confirm the need for specific standardized guidelines within the framework of forensic protocols for the anthropological management of commingled skeletonized remains that should include consideration of a variety of both biological and nonbiological data sources.

In many cases, it may prove technically impossible to reassociate the whole of the concentration or to genetically test a large number of bone samples in order to maximize the potential for identification of all the persons present in the assemblage. It

is important that participating anthropologists provide information to the authorities and the victims' families on the condition of the remains and on the technical difficulties hindering their identification so that their final disposition may be determined on that basis.

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