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Mass Graves Constitute a Unique Niche for Forensic Biological Traces

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Mass graves constitute a unique depositional environment. Each individual human body introduces its own diversity of biological traces in the form of microscopic invertebrates, mites being the most prevalent. The probative value of these mites as forensic evidence has not yet been appreciated.

***Keywords**: mass burials; grave pits; arthropods; insects; mites; Acari; micropalaeontology; pollen; biotaphonomy.*

Братські могили — унікальна ніша для криміналістичних біологічних слідів

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Братські могили — це унікальне середовище для осаду мікроорганізмів. Кожен людський організм додає своє різноманіття біологічних слідів у вигляді мікроскопічних безхребетних, серед яких найпоширенішими є кліщі. Доказова цінність цих кліщів як судових доказів дотепер не оцінено.

***Ключові слова**: масові поховання; могильні ями; членистоногі; комахи; кліщі; Акарі; мікропалеонтологія; пилок; біотафономія.*

Modern mass graves, grave pits, and sites of mass burials are investigated widely [1, 2]. Examples of the survey of historical mass grave sites carried out by Ukrainian researchers range from the late Roman time near Komariv in Middle Transnistria [3], the Netaylovka cemetery of the Saltovo-Mayatskoe culture of the 8th and 9th Centuries [4], to the early medieval necropolis of Shestovytsia in Chernigov, Ukraine [5].

Recent studies are showing that mass graves are in many ways different from single graves. The increasing use of simulated mass graves including ones containing human remains, is driving research that reveals these differences. Geophysical imaging using ground penetrating radar (GPR), electrical resistivity tomography (ERT), and electromagnetics (EM) show that physical properties of the soil differ between mass graves and individual burials [6—9]. ERT showed still differences to the surrounding environment after 8 years of burial in southwestern Nigeria [10]. Thermal imaging detects mass graves in arid environments for 7 months [11]. The dynamics of gases emitted by mass graves causes changes in soil pores [12]; the microbiology alters as well [13], so does the chemistry of the soil [14]. Surface anomalies such as differences in vegetation can last for more than 3 years [15].

Mass graves are characterized by differential decomposition or differential preservation, also known as the feather(ed) edge effect, where decomposition progresses much faster at the periphery leading to the skeletonization of corpses while in the centre of the mass grave, the soft tissue of corpses is still well preserved [16—21]. The misinterpretation of differential decomposition in a mass grave by the defence in the trail of Radovan Karadžić is exemplified in Barker, Alicehajic and Naranjo Santana [16].

Adipocere persists longer in mass graves than in single graves [22—25]. Brain tissue is one of the soft tissues to autolyse first and most completely during decomposition [26]. Yet, there are many reports about the preservation of the brain where other soft tissues have gone [27—29]. We propose that preservation of the brain is much more common in mass graves than in individual graves [30—32].

The examination of mass graves requires an interdisciplinary effort to secure a maximum of forensic evidence [33].

The forensic importance of biological traces found in mass graves has been realized early on. In 1994, the skeletons of 32 young males were found in a common grave in the centre of the city of Magdeburg, Germany. It was estimated that the mass grave was 40 to 50 years old, which led to two competing hypotheses. The victims were killed at the end of World War II in the spring of 1945 by the secret police of Nazi Germany (GESTAPO) or the skeletons belonged to Russian soldiers killed in the summer of 1953 by the Soviet secret police following the suppression of an uprising in the former German Democratic Republic (DDR). Analysis of the pollen of the nasal cavities showed that the victims died during midsummer [34].

Pollen was also instrumental in proving that the corpses of seven primary mass graves in northeast Bosnia were relocated to many secondary mass graves three months after the first interment [35, 36]. Pollen in mass graves became crucial evidence in the United Nations International Criminal Tribune for the former Yugoslavia (ICTY).

One would expect that the forensic analysis of insects, and mites and ticks (Acari) in mass graves would have followed suit. Forensic entomology [37—40] and more and more forensic acarology have demonstrated their value in legal investigations [41—47]. Yet, this has not yet translated to mass graves. Protocols for forensic entomological work on mass graves are in place since quite a while, but have not seen much application [48]. Body lice were recovered from a mass grave in Vilnius, Lithuania, of soldiers of Napoleon's army [49]. Charabidze, Lavieille and Colard [50] proposed that the pupation chambers the larvae of larder beetles create in human bones can help in resolving he chronology of deposals in mass graves. This is pretty much it.

Mites have been reported from mass graves but not identified [51]. The decomposing bodies in a mass grave create a microenvironment different from single graves [2]. Mass graves form a unique biological niche different from other environments of human decomposition. While biological traces like pollen will likely stay the same as they had been introduced during interment, insects and fungi might develop to a limited degree, while mites and other microinvertebrates and microorganisms will reproduce and go through numerous generations affecting the decomposition process. Forensic research into mites and other non-human biological traces in mass graves is urgently needed to extract as much forensic evidence as possible from these crime scenes.

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