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Case Report

Discovery of a mass grave from the Spanish Civil War using Ground Penetrating Radar and forensic archaeology

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ABSTRACT

An estimated 500,000 people died from all causes during the Spanish Civil War between 1936 and 1939, with a further 135,000 killed after the war ended. There are currently over 2000 known mass burial locations throughout Spain but many more are unknown. This study details the successful search for an unmarked mass grave in mountainous terrain in the Asturias region of Northern Spain. Two approximate locations were known due to eyewitness accounts. A phased site investigation approach was undertaken, which included Ground Penetrating Radar. Results showed a clear geophysical anomaly on 2D GPR profiles. The identified area was subsequently intrusively investigated by forensic archaeologists and human remains were successfully discovered. Careful and sensitive investigations are essential in these approaches where living relatives are involved.

1. Introduction

In April 2014, the Cienfuegos family contacted the research team that comprised of geophysicists, archaeologists and forensic scientists, to assist with their longstanding efforts to locate the grave of their grandfather, who was shot and buried together with probably ten other victims in a mass grave located in Parasimón in the mountains of Lena, in Asturias in the North of Spain.

Around 500,000 people died in total during the Spanish Civil War between 1936 and 1939, with a further 135,000 estimated to be killed throughout Spain for several years after the war ended [1–3]. There are currently known to be over 2000 mass burials throughout Spain (Fig. 1), with many victims having been exhumed and reburied, especially in the Valle de los Caídos "Valley of the Fallen", but these reburials have not been robustly documented or indeed undertaken scientifically [4–6].

Many other mass graves from this period remain whose locations are unknown in Spain. Successful mass grave detection has been undertaken globally, for example, in 19th Century Irish mass burials [7], USA race riot victims [8], World War Two burials [9,10], in post-WW2 Polish repression mass burials [11], the Northern Ireland 'Troubles' mostly isolated burials [12], the 1990s Balkan wars mass burials [13,14], and sadly in active civil wars with both isolated and mass burials [15].

Mass grave geometries are known to be highly varied, taking the forms of a trench, pit, well organised or sectioned and with variable body densities (see [4,5,17]).

Current forensic search methods to detect both isolated and mass clandestine burials of murder victims are highly varied and have been reviewed elsewhere [18], with best practice suggesting a phased approach, moving from large-scale remote sensing methods [19] to ground reconnaissance and control studies before full searches are initiated [20]. These full searches have involved a variety of methods, including forensic geomorphology [21], forensic botany [22] and entomology [23], scent-trained search dogs [24,25], physical probing [26–28], thanatochemistry [29] and near-surface geophysics [30–37].

Geophysical exploration in mountainous terrains is complicated in terms of logistics, data collection and coverage of large areas

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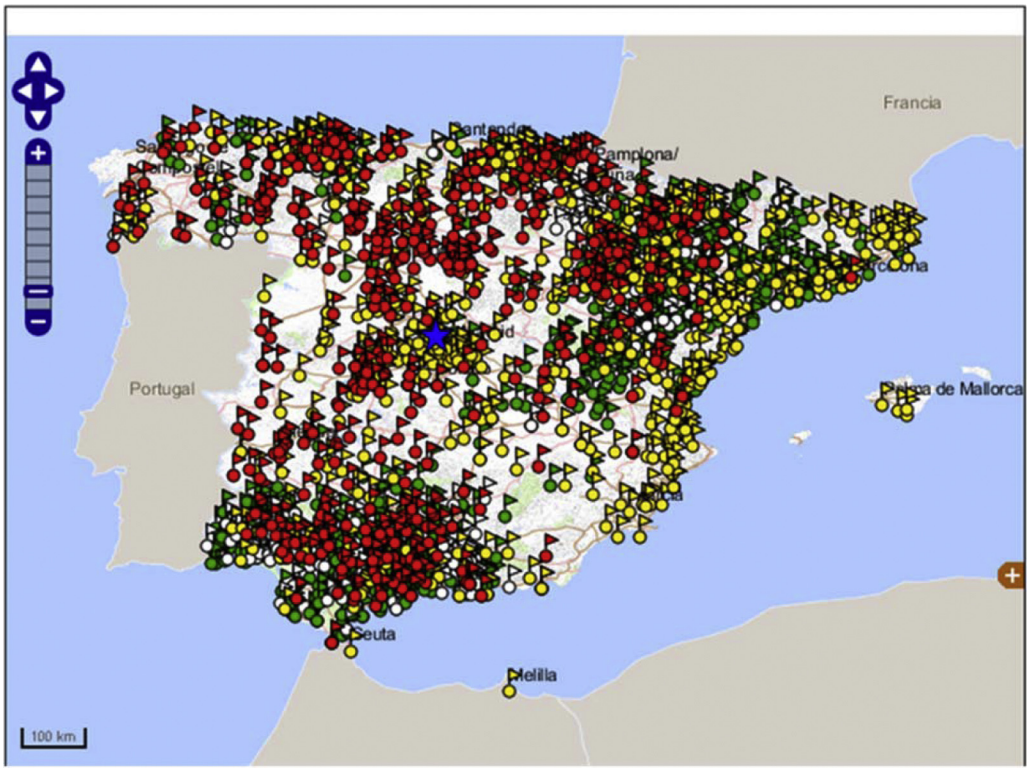

Fig. 1. Map of Spain showing current known positions of ~2000 mass graves (see key and text for details). Modified from [16].

as [37] states. This paper aims are to firstly detail the geoforensic search for an unmarked Spanish Civil War mass grave in the mountains in Asturias in Northern Spain, secondly to document the resulting forensic archaeological excavation and thirdly to compare results to other mass grave search studies in similar environments.

2. Materials and methods

2.1. Desk study and site description

The proposed search area was in the Parasimón area in the mountains of Lena, in Asturias, in the North of Spain (Fig. 2). Two contemporary witnesses stated the approximate location of a mass grave, although not with certainty due to the time elapsed. Previous archaeological investigations had been performed on site in 2013 and they successfully identified the execution location by recovering munition expendables (bullet cartridge cases, cartridges and a few bullets) of the execution firing line, rather than the mass burial site itself [38].

The search for the mass burial site was prioritised in two areas identified by the contemporary witnesses, designated zone A and zone B in Fig. 2. Zone A was considered to be more probable based on previous archaeological investigations [38]. Recovered munitions had also been reported in this area, although initial surface and botanical investigations did not reveal any obvious potential burial sites and it was relatively common for burials to be exhumed and re-buried in other places during this time [4,5]. Zone B is included because other oral testimonies mentioned it as a potential location. However, witnesses statements were of events more than seventy years ago, witnesses were also positioned more than 500 m away from the study sites and the surface terrain has undergone major changes since those times to the present day.

The bedrock geology in this area consists of a calcareous formation of Carboniferous age. Areas A and B are situated on colluvium deposits filling a hollow between two limestone outcrops to the west and east. The colluvial deposits found here are unconsolidated sediments with abundant presence of angular heterolithic rock fragments interspersed in a silty matrix. The thickness of the soil ranges from 10 cm to 30 cm below ground level (bgl), with sparse bushes and grassy vegetation present (see Fig. 2).

2.2. Geophysical data acquisition

Once the main search zones had been identified, trial geophysical surveys were then undertaken to determine which techniques would be appropriate and their respective equipment configurations following best practise (see [18]). From contemporary witness accounts it was not expected that any metallic items would be buried along with the human remains, and this, together with the presence of high voltage cables and a nearby road (Fig. 2), precluded the use of magnetic and electro-magnetic surveys in this study.

A GPR MALÅ^{TM} ProEx System was used to collect 2D trial profiles (Fig. 3). Whilst other authors in similar mountainous terrains (e.g. [37]) had determined 250 MHz frequency antennae to be optimal, the 500 MHz antennae was determined to be optimal here due to better quality data, when compared to 250 MHz data, and for data acquisition logistics in such mountainous terrain and steep slopes. Lower frequency antennae had also been suggested for detection by control simulated clandestine grave studies (e.g. see [40,41]), but the 500 MHz frequency was judged here to be a good compromise between data quality, acquisition time and successful chance of detection due to adequate resolution.

Full GPR survey grids were then acquired in both zones A and B. There were no geophysical anomalies identified in zone B so only zone A results are discussed here. Zone A had nine local grid survey