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Geophysical survey at the frontier of medieval Iberia: The castles of Molina de Aragón and Atienza (Guadalajara, Spain)

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Abstract

This paper presents the results of geophysical surveys conducted within two castles in central Iberia: the fortifications of Molina de Aragón and Atienza, both located within the modern province of Guadalajara in Spain. They represent essential case studies for understanding the transformations of the frontier societies of medieval south-western Europe, because both were founded during the Andalusí period, both played a fundamental role at the time of the military confrontations between opposing Islamic and Christian states, and both became capitals within the feudal dependencies of the Crown of Castile during the Late Middle Ages. At present, these castles are uninhabited and protected archaeological sites, with no modern developments within their wards; the adjacent towns have developed on the outskirts of their outer walls. Although both castles have been the focus of uneven amounts of archaeological research, geophysical surveys, the first conducted at these sites, have proved to be a fundamental tool not only for planning future archaeological investigations but also for the data that they have provided on the potential roles of these castle wards.

KEYWORDS

castles, frontiers, geophysical survey, Islamic archaeology, medieval archaeology, Spain

1 | INTRODUCTION

Castles are iconic monuments that define the formative period of the Middle Ages in Europe and can be broadly defined as fortified residences with a diverse range of social, administrative, military and economic roles, connected with distinct and varied territories. In recent decades, castle scholarship has moved beyond architectural description with an emphasis on fortification and purely military features to consider the multiple roles of these structures, as well as their broader landscape context (e.g., Creighton & Liddiard, 2008; Dempsey, 2019; Molero García, 2022). On the Iberian Peninsula, castles number in the thousands, with the umbrella terms *castillo* and *castro* encompassing

relatively simple fortified structures such as single towers, through to larger complexes that include castles in both the sense of a single fortified residence and a fortified settlement. The proliferation of this type of construction in Iberia relates to a period defined by frontier societies, with opposing social, economic and cultural forms on either side. With the Islamic Arab-Berber conquest from AD 711, al-Andalus became the dominant Iberian polity until at least the 11th century, after which the gradual southwards expansion of the northern Christian kingdoms culminated in the political dominance of Aragon and Castile by the late 15th century. This entire process is associated with the controversial term 'Reconquest' (*Reconquista*), which remains widely used in international historiography because it refers to a

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specific temporal and spatial context, although it is strongly criticized within Spanish scholarship for its overt political, cultural and presentism connotations (García Sanjuán, 2018; Ríos Saloma, 2011; Torró, 2000).

The substantial number of fortified structures in Iberia is commonly interpreted as the result of the political instability of this period, with successive waves of conquests and migration, as well as the creation of new frontiers and internal borderlands not only between Muslim and Christian states but also between neighbouring territories of broadly culturally aligned lordships, crowns and (in the case of al-Andalus) Taifa kingdoms. According to the Spanish association concerned with the preservation of castles (*Asociación española de amigos de los Castillos*),¹ there are more than 10 000 fortifications across the country, of which at least 3000 could be considered to date to the medieval period. Although there is no official inventory, it is possible to estimate on the basis of existing scholarship that around 500 castles have been excavated and published, which accounts for less than approximately 2% of the total (Bazzana et al., 1983; Ferreira Fernandes, 2002, 2013; Gallego, 2016; Gutiérrez González & Suárez Manjón, 2007; Malpica Cuello, 1998, 2003; Martín García et al., 1999; Molina & Eiroa, 2009; Palacios Ontalva, 2019; Quirós Castillo & Tejado Sebastián, 2012; Retuerce Velasco & de Castro Fernández, 2018; Retuerce Velasco & Cobos Guerra, 2004; Valor Piechota & Gutiérrez González, 2014, pp. 148–175).

Within the category of medieval castles, there is a distinctive group that served for a period of time as centres of governance for frontier territories. Their occupation phases are typically aligned with the history of regime change, with earlier Islamic fortifications often replaced by more substantial Christian structures. Following military conquests and territorial annexations, existing fortified centres were granted to representatives of the new regime, whether private individuals who were members of the nobility or institutions such as military orders, along with associated lands. These lordships were connected to the Castilian, Aragonese and Portuguese crowns through a hierarchical power structure that is widely referred to as ‘feudal’ in the scholarly literature. However, as with marcher lordships elsewhere in medieval Europe, frontier authorities in Iberia could exercise a substantial amount of private power, expressed in judicial, fiscal, military and symbolic terms. Changes in the ownership of castles following the imposition of a new regime were typically accompanied by a phase of castle expansion and the reassignment of the use of internal spaces, although this was not always immediate and could represent investment from several generations of owners. This, in turn, reflected the changing character and size of the castle’s community, as well as the purchasing power of its owners. Integrated analyses of the castle’s standing fabric and buried archaeology are essential for understanding the diachronic development of these complex structures, as well as the changing functions of their spaces, encompassing a variety of residential, military, religious, artisanal and agricultural roles.

However, soils and sediments have been investigated only infrequently during castle excavations using geoarchaeological methods, except to assess the geological and geomorphological aspects of

castle locations in relation to the strategic, military roles (Banerjea et al., 2019). The spatially diverse character of occupation within the castle site can be partially reconstructed from these structural analyses, alongside archaeological analyses of food, manufacturing and other consumption waste, as well as physical and chemical geoarchaeological signatures of specific activities such as artisan activities, stabling and the storage of agricultural produce (Banerjea et al., 2019, 2020). Soil geochemistry is well established in archaeology as a method for understanding the use of settlements (Banerjea et al., 2017); land use, which has included areas around fortifications (Brown et al., 2015); and as a prospection tool (García Porras, 2021). To be applied effectively, it requires robust sampling protocols that target key soil horizons and record them and clear archaeological questions developed between geochemist and archaeologist and to examine to what extent is the geochemical methodology complementary to conventional surveying techniques (Oonk et al., 2009). Regrettably, none of these principles were applied in a recent geochemical study at Molina de Aragón (Expósito-Suárez et al., 2023), which has negatively impacted the value of these data for archaeological prospection. For example, the study analyses samples collected from *Prao de los Judios*, which had already been subjected to archaeological excavations and backfilled with sand during the conservation works.

The use of geophysical survey, combined with other types of remote sensing, such as Lidar, is an essential first stage in mapping the internal use of space within a castle site and guiding the placement of excavations to recover data on the diachronic use of space, the character of the castle’s changing community and the connections between the site and its historical territory.

However, of those castles in Iberia that have been excavated and published, comparatively few, alongside other categories of medieval site, have been the focus of geophysical surveys. In the province of Ciudad Real, four sites have been surveyed in this way: the castle of Montiel (Sánchez et al., 2016), the fortified village of Peñafior (Torrejón Valdelomar et al., 2019); the fortified church and castle of Santa Catalina de Fuenllana and the fortified village of Alarcos; in the province of Málaga, the castle of Marbella, the castle of Álora, the castle of Fuengirola (Martín Ruiz, 2019, p. 45) and the castle of la Estrella in Teba; in Huelva the castle of Gibraleón, in Sevilla, only the fortification of Dos Hermanas; in Cádiz, the castle of Barbate; in Burgos, the castle of Mota de Judíos; in Asturias, the fortification of Curiel in Peñaferruz, Gijón (García García, 2003a, 2003b); and in Guipúzcoa, the castle of Munoandi (García García et al., 2009) (some of these geophysical studies have been collected in Birto-Schimmel & Carreras, 2005) (Figure 1). The range of techniques used in these surveys has varied depending on the type of site and nature of the soils and has included magnetic methods, ground-penetrating radar (GPR) and electrical resistivity tomography (ERT).

This paper presents the results of geophysical surveys at two castles in the province of Guadalajara—Molina de Aragón and Atienza—within the framework of the ‘Landscapes of (Re)conquest’ project (LoR) (Figure 2).² This project investigates the character of medieval frontiers in south-western Europe from a socio-environmental perspective, focusing on the relationship between castles and their

FIGURE 1 Medieval sites in Spain for which geophysical surveys have been published. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/arp.1899)]

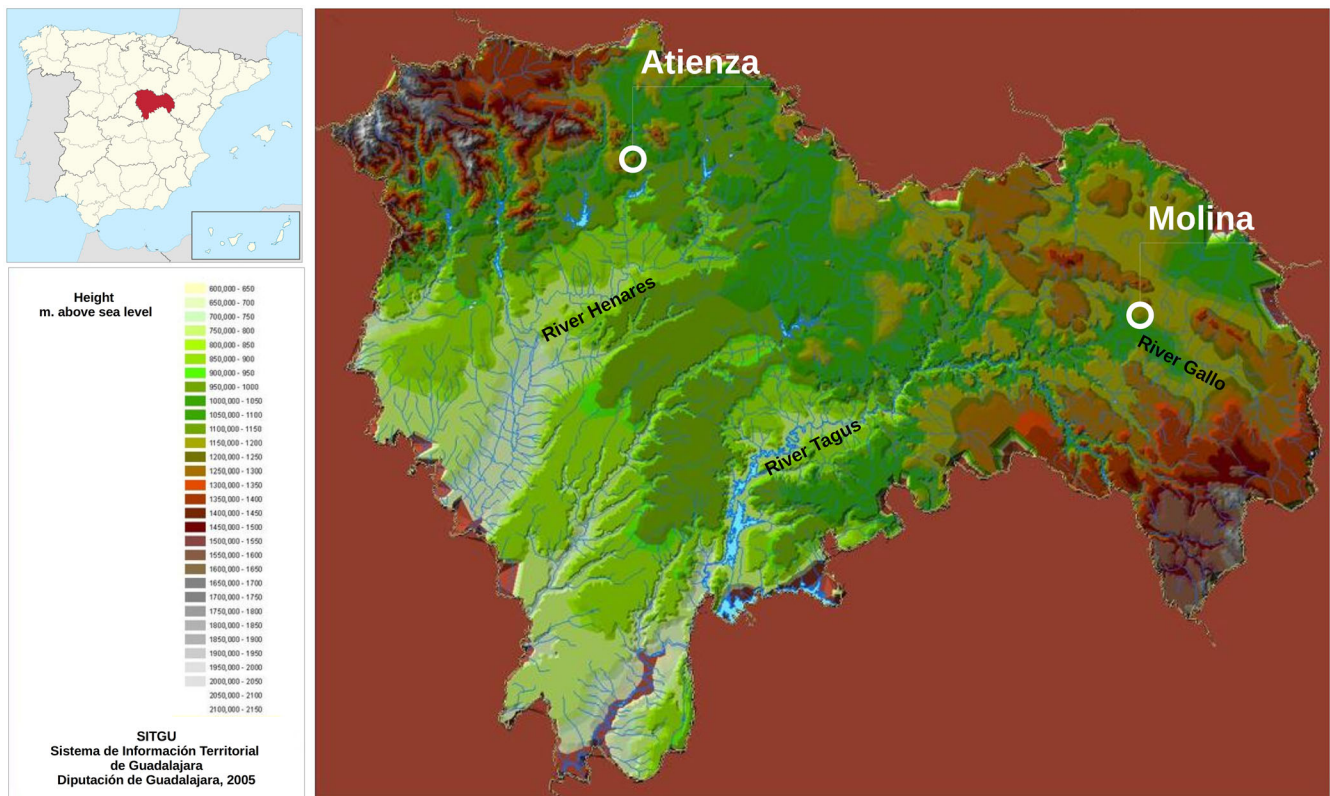
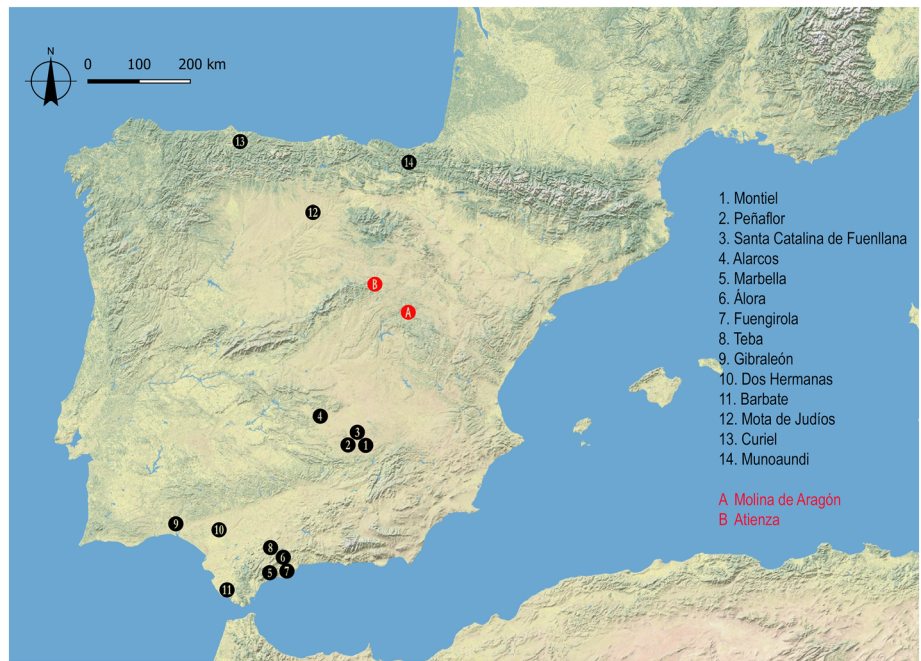


FIGURE 2 The castles of Molina de Aragón and Atienza within the province of Guadalajara, Spain (data from Diputación de Guadalajara). [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/arp.1899)]

associated territories within the context of the creation and dissolution of frontiers (García-Contreras Ruiz, 2018, 2020). The main pilot for LoR was developed at Molina de Aragón (García-Contreras Ruiz et al., 2016), whose historical territory is partly encompassed by the

Molina-Alto Tajo UNESCO Geopark, dominating the eastern part of Guadalajara province. Both castles are defined by a principal fortified residence connected with one or more substantial enclosed wards, as well as outer fortified elements. Both are also associated with the

creation of adjacent towns following the Christian conquests, which contained Christian, Jewish and Muslim (or Mudejar) communities, as well as a fluctuating pattern of rural settlement within their territories. The results of the geophysical surveys demonstrated that the interiors of these castles were complex spaces, reflecting the long-term biographies of these sites from the time of their initial construction through to the present day.

2 | GUADALAJARA PROVINCE

The territories within the modern province of Guadalajara, located in the centre of the Iberian Peninsula, date back to the medieval period. They were created following the southwards expansion of the kingdom of Castile at the expense of al-Andalus (see below). This resulted in the establishment of a series of frontier lordships, which were endowed with a principal city and a dependent territory with rural settlements. From the 16th century, the most politically and demographically significant cities were designated as capitals of several agglomerated territories. One of these became the province of Guadalajara, whose boundaries have remained essentially the same since at least 1590, but its current physiognomy dates to the administrative reforms of the 19th century (Ballesteros et al., 2001; Martínez Díez, 1981).

This region formed the borderland between Muslim and Christian societies for several centuries. Firstly, this region was under the control of Al-Andalus from the 8th to 11th century, known as *Marca Media* or the 'central border' (Manzano Moreno, 1991). The Castilian crown annexed this region between the 11th and 12th centuries and created a new frontier territory called *Extremadura Castellana*. This was sub-divided into the domains of local authorities in charge of the *Comunidades de Villa y Tierra*, referring to towns and their territories in both economic and political terms (Estepa Díez, 2006; Martínez Díez, 1983). These 'town and land' communities, which were a typical form of lordship in the borderlands of the kingdom of Castile, would eventually constitute the territorial bases for the divisions of the modern Spanish state. This initial process of territorial division following the Castilian conquest has been studied in relation to the construction of castles, the formation of towns and civic councils, estate management, the introduction of Christianity and the imposition of regulations and taxation. The countryside, on the other hand, remains poorly understood, but clearly fundamental changes took place following the Christian conquest that points to significant investment. Previous studies had characterized the Islamic phase as a dense network of small rural settlements and towers organized into the equivalent of castral districts, engaged in the intensive exploitation of various natural resources, including irrigated crops and salt works (García-Contreras Ruiz, 2016a). These were directly managed by individual rural communities.

After the Castilian conquest, various lordships and manors were established within the province and numerous rural settlements became populated by Christian migrants. At the same time, the Christian authorities invested in a new programme of building focusing on

castles, town walls and churches. The centralization of political power following the conquest had direct repercussions in the countryside; the extent of the cultivated area dramatically expanded and included the draining of wetlands (there is no evidence for this from Islamic sites), areas for pasture were delimited and the exploitation of valuable resources such as salt became an elite monopoly, removing them from the control of rural communities (García-Contreras Ruiz, 2018). These general trends following the conquest are being explored in more detail in the LoR project, particularly in relation to the impact of the shifting frontier. Moreover, the post-conquest settlement pattern remains poorly understood and requires further mapping through the integration of written sources and archaeological surveys (examples in García-Contreras Ruiz, 2018 and Ortega & Arenas Esteban, 2018). This, in turn, would enable the diachronic formation of villages, new towns, churches, monasteries and, of course, castles to be linked with trends in the exploitation of natural resources in their respective territories.

In Guadalajara province, there are approximately 200 known fortifications (AA.VV., 2003; Daza Pardo, 2007; Jiménez Esteban, 1992; Layna Serrano, 1994; Rubial Rodríguez, 1992), of which only 12 have been excavated or, at least, published. These are Alcázar de Guadalajara (Cuadrado Prieto & Crespo Cano, 2018), Guijosa (Rivera Gámez & Vela Cossio, 2005), Castilnuevo (Abril Urmente, 2012), Embid (Martínez Gómez et al., n.d.), Brihuega (Abril Urmente, Alcón García, & Vela Cossio, 2012), Jadraque (Retuerce Velasco & Prieto Vázquez, 2018), Torija (Condado Ayuso, 2011), Cifuentes (Cuadrado Prieto, 2017), Hita (Abril Urmente, García Hermida, & Vela Cossio, 2012), Zorita de los Canes (Urbina et al., 2015; Urbina & Urquijo, 2022), Palazuelos (Gámez & Torres, 2005; Vela Cossio & Villafuela Arranz, 2002), Cogolludo (Daza Pardo, 2017) and Molina de Aragón (Arenas Esteban, 2008). Two of the most important castles—Molina de Aragón and Atienza—functioned as centres of frontier authority in the Middle Ages and are the first medieval fortified sites in the province to have had geophysical surveys published.

The historical importance of these two castles is clearly defined in the written sources. Molina de Aragón was the capital of an almost independent territory during the Taifa period (11th century) but above all after the Castilian conquest when the aristocratic Lara family took control of the centre. This united political and economic power, as the town functions as the regional market and lies at the crossroads of long-distance cattle routes. Its location on the border between Castile and Aragon also gave it an important strategic role. Atienza was the principal base for Caliphal troops in the defence of the Andalusí border against Christian attacks from the north. After the Castilian conquest, it was transformed into a lordship or *Comunidad de Villa y Tierra* directly dependent on the crown, rather than on any noble family or ecclesiastical elite. Its urban council and the governors of its castle played important roles in the internal politics of Castile, and it served as the temporary seat of some monarchs and a focus of conflict during civil wars.

The location of these two castles can be explained in relation to their geological context. The province of Guadalajara has both uneven topography and considerable relief (600–2500 m.a.s.l.) consisting of

plutonic, metamorphic and sedimentary rocks; areas with complex Hercynian structures with Alpine structures and non-folded Cenozoic regions, diverse climatic erosive patterns and areas covered with thick superficial deposits alternating with areas lacking those deposits where broad outcrops of underlying rock define the landscape (Calonge & Rodríguez, 2008; García-Quintana et al., 2005). The castles have been built on prominent topographic features—Molina de Aragón on a hill composing of Upper Triassic/Lower Jurassic dolomite and Atienza on an Ordovician/Silurian limestone outcrop rising from a Triassic clay depression in the valley. The opportunities and constraints provided by the topography also influenced the layout of these castles and their associated wards.

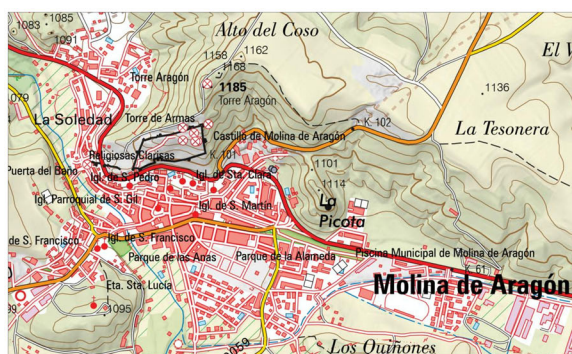
3 | MOLINA DE ARAGÓN

Molina de Aragón is the capital of a region, historically known as Señorío de Molina, located in the eastern part of the province of Guadalajara at 1065 m.a.s.l. The fortified complex of Molina de Aragón is located on a dolomite hill overlooking the valley of the river Gallo. It consists of an *alcazaba* or citadel connected to an enclosed ward containing some form of settlement called the *albacar* (an outer bailey) and a separate tower with a walled enclosure or barbican on top of the hill, the so-called Torre de Aragón. There is no data from the site itself before the 10th century. Some researchers have argued that the

early medieval settlement before the 10th century may have been located a few kilometres further north, in a place called Molina la Vieja (Old Molina), based on ceramic fragments identified on the surface through fieldwalking (Checa Herraiz, 2014, 2018).

There is more evidence for the use of the site from the 11th century when Andalusí governors are mentioned in relation to the Taifa de Molina, which has been suggested as evidence for Molina as the centre of an Islamic Taifa kingdom (Pérez Fuertes, 1990). Following the Christian conquest of the region by Alfonso I of Aragón in 1129, Molina would be incorporated into the crown of Castile but functioned as an autonomous lordship under the control of the Lara family (Estepa Díez, 2006; Fabián Fabián, 2012; García-Contreras Ruiz, 2018; Ortega & Arenas Esteban, 2018). As the frontier with Andalusí territory moved southwards, the lordship of Molina became a borderland between Castile and Aragón. This situation did not change until the middle of the 14th century, and in 1369, it came under the governance of the crown of Aragón for 6 years (hence, its name, Molina de Aragón) (Benítez Martín, 1992), after which it came under lasting Castilian control. Its castle was the seat of the governors of Molina, and although it was gradually abandoned from the 16th century, it still retained some importance especially during the wars that took place in subsequent centuries.

Excavations were carried out in the church of Santa María del Collao within the *albacar* (1995), at the ‘Prao de los Judíos’ or ‘Castil de los Judíos’, a district associated with a Jewish settlement after the



- 1 First walled enclosure (Alcazaba)
- 2 Second walled enclosure (Albacar)
- 3 Tower of Aragón
- 4 Church of Santa Catalina
- 5 Jewish quarter (Prao de los Judíos)
- 6 Third walled enclosure
- 7 Torre de los Veladores
- Previous excavations



FIGURE 3 Plan of the fortified complex in Molina de Aragón, showing the *alcazaba*, *albacar*, Torre de Aragón and Prao de los Judíos, with the locations of previous excavations (Instituto Geográfico Nacional <https://centrodedescargas.cnig.es/>). [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/arp.1899)]

Christian conquest (1998–2005), within the courtyard of the *alcazaba* (2004) and the Torre de Aragón (2005) under the direction of Jesús Arenas Esteban (Arenas Esteban, 2002, 2008, 2017; Arenas Esteban et al., 2004, 2007) (Figure 3). They demonstrated a lengthy period of occupation and modification spanning the second millennium AD, which could be sub-divided into five phases:

1. The Andalusí period, with occupation throughout the 11th century and into the first decades of the 12th century. The oldest part was built at the Torre de Aragón, consisting of a trapezoidal enclosure with a central tower, both of which were subsequently concealed by masonry from the Christian era. The original structures were built of rammed earth (*tapiál*). In the *alcazaba* and *albacar*, this is the most poorly preserved phase due, in part, to the destruction caused by later construction phases. Walls made of rammed earth were identified that retained a coat of white plaster on their outer face. At the foot of the so-called ‘Torre de los Veladores’, a section of wall built on an earthen rampart with its external face covered with lime was exposed. The earliest ceramic finds at the site came from a silo in the southeastern corner of the Prao de los Judíos, dated between the 10th and 11th centuries.
2. The Christian medieval period, beginning with the conquest of Molina in 1129. This was followed by a gradual transformation of the *alcazaba*, with the three towers on the southern side being completed towards the middle of the 13th century, and further modifications in the 14th century giving them their present appearance. Much of the courtyard was open with a rammed clay pavement located on average 1.2 m below the present-day topsoil. In addition, a series of buildings were constructed up against the walls, but their function remains unclear. At the Torre de Aragón, the Islamic earthen walls were rebuilt in stone, and a cistern was constructed as well as a large pentagonal tower whose appearance has remained unchanged into the present day.
3. A 17th-century phase associated with the quartering of Philip IV's troops in 1640, during his military campaign against the Catalan Revolt. Some of the wall fabric is attributed to this phase, especially that on the southern side of the castle, although traditionally this had been considered medieval. The medieval entrance of the Torre de Aragón was reconstructed, as well as other structures in the interior. The rebuilding of the southern end of the tower changed access to the barbican with the addition of a rectangular lobby and a sentry box.
4. Nineteenth-century occupation related to the War of Independence (1807–1814) and the quartering of Napoleonic troops at the castle, as well as Elizabethan troops during the later Carlist Wars. At the Torre de Aragón, a large room was built between 1810 and 1811. In addition, scattered throughout various points inside the barbican were the remains of other buildings intended for the accommodation of troops, as well as stables and stores, and a series of trenches on the southern, western and eastern sides of the barbican.
5. Restoration works during the 1960s led by the Fine Arts Directorate that dismantled structures from the second phase and utilized

grey cement mortar for rebuilding, in what has been described as ‘the most aggressive action that the monument has suffered throughout its history’ (Arenas Esteban, 2008, p. 26).

The *albacar*, which was the focus of the geophysical survey presented in this paper, saw only small-scale excavations in 1995 focused on the ruins of the church of Santa Catalina, also called ‘Cristo de las Murallas’. Located by the Puerta del Reloj entrance to the fortified ward, its remains had been uncovered before the excavations took place (Arenas Esteban, 2008, p. 32). The church was built in the 12th century, as suggested by its plan and architectural style, but it is first mentioned in written sources in the 13th century. It was destroyed by Napoleonic troops during the War of Independence (Abanades, 1963, p. 44). Between the 12th and 19th centuries, various phases of occupation and re-occupation were identified, with a clear phase of rebuilding in the late medieval/early modern period, which was also documented in written sources (Arenas Esteban, 2008, p. 32). Further small-scale excavations in the *albacar* took place in 2015, 2016 and 2017 as part of LoR's pilot projects, with the aim of clarifying the stratigraphy in different parts of the fortified complex and collecting paleoenvironmental samples for further analysis, which are ongoing (Banerjea et al., 2020; García-Contreras Ruiz et al., 2016).

4 | ATIENZA

There is comparatively less information about the castle in Atienza than in Molina, because of the almost complete absence of archaeological investigations at the site. It is located in the northern part of the province of Guadalajara, in the so-called Sierra Norte, at an altitude of 1170 m.a.s.l. It is surrounded by mountains and large expanses of cultivated fields. The town has been built on the side of a hill, resulting in a network of sloping streets; the castle complex is situated on top of the hill and visually dominates the town and surrounding landscape. The castle itself is located on top of a limestone promontory approximately 130 m long, 30 m wide and 12 m high, which has been shaped to make access more difficult, and its walls, two water cisterns and the donjon at the southern end have been preserved. In the north-western part, the layout of the wall and the terrace indicate the existence of an *albacar*, below which, in a south-westerly direction, stands the church of Santa María del Rey, which has a bilingual inscription in Latin and Arabic on its portal dating from the time of King Alfonso VIII (Thomas et al., 2017, p. 311). On the eastern slope, there is a large empty space that is also enclosed, with earthworks indicative of buried structural remains. The extent of the current urban area begins at the foothills of the eastern and southeastern slopes (for a detailed description, see Layna Serrano, 1994, pp. 57–82; Pavón Maldonado, 1984, pp. 62–67; Daza Pardo, 2007; Muñoz Jiménez, 2008) (Figure 4).

Populated since the Neolithic, the site became more important at the time when the frontier between Christians and Muslims was situated in the Duero, and it represented a point within this borderland on the river Duero Line. The site functioned as a base for Umayyad

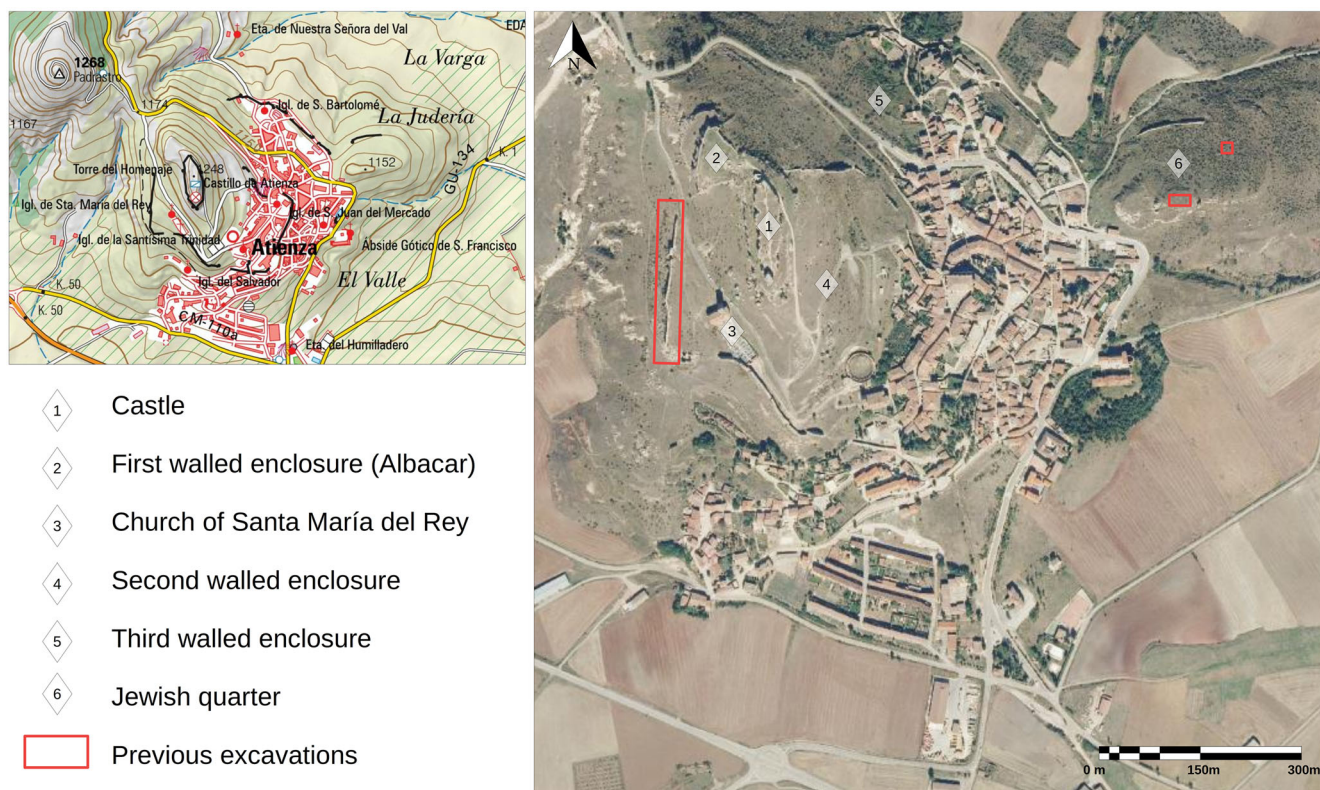


FIGURE 4 Plan of the fortified complex in Atienza, showing the *alcazaba*, *albacar*, church and associated enclosed district (Instituto Geográfico Nacional <https://centrodedescargas.cnig.es/>). [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/arp.1899)]

troops launching their attacks on the Christian kingdoms of the north, and its importance is emphasized by its description as a city or *madina*, rather than just a castle (García-Contreras Ruiz, 2016b). From the end of the Caliphate period until 1085 when it was definitively conquered by Alfonso VI, its history is a continuous exchange between Muslims and Christians. In 1140, Alfonso VII granted privileges to Atienza, endowing it with a vast territory or *Comunidad de Villa y Tierra*, which stretched to the Tagus under the dominion of the Castilian monarchs (García-Contreras Ruiz, 2018). From this point, the town of Atienza grew, especially during the late medieval period, when it had some 10 000 documented inhabitants served by 15 parish churches, including Nuestra Señora del Val, Santa María del Rey, San Gil and the Santísima Trinidad (Layna Serrano, 2004). The importance of Atienza began to fade in the 15th century, largely after the destruction it suffered in the so-called Infantes de Aragón war. In 1446, it was occupied by the Navarrese army and besieged by the Castilian king Juan II and Don Álvaro de Luna who, unable to capture the castle, abandoned the siege and set fire to the town. As a result, the district of Santa María del Rey was destroyed. Most of its Romanesque churches suffered significant damage and were rebuilt in the 15th and 16th centuries (Layna Serrano, 2004).

Atienza has not seen any archaeological excavations, except in relation to the restoration of the outer walls of the town (Muñoz Jiménez, 2008) and unpublished trenches made in the so-called 'Jewish quarter', which are still visible today. However, there have

been surface surveys that resulted in the collection of large numbers of ceramic fragments (Valiente Malla & Cuadrado Prieto, 1988, pp. 635–638), with dates spanning from the 7th to 15th centuries (García-Contreras Ruiz, 2020; Retuerce Velasco, 1998).

Regarding its construction, which can be dated to the 12th century, most of the castle has regular masonry courses with ashlar reinforcing the corners and openings. In the northwest corner, the remains of a tower with masonry in a 'herringbone' arrangement are similar to others in the vicinity identified as Andalusí constructions (Daza Pardo, 2007). It has been proposed as the oldest phase of the castle and the only clear architectural evidence from the Andalusí period, although one of the cisterns may also date from this period (Valiente Malla & Cuadrado Prieto, 1988, pp. 633–635). However, it is not clear exactly where the Andalusí settlement was located. Within the bounds of the fortified complex, in the absence of any published stratigraphic archaeological excavations, which were not carried out even during the restoration of part of the castle wall (Muñoz Jiménez, 2008), only the results of fieldwalking surveys are available, which of course must be treated with caution.

Layna Serrano and Basilio Pavón suggested that the current church of Santa María del Rey may have been converted from a mosque (Layna Serrano, 2004, pp. 50–51; Pavón Maldonado, 1984, p. 64). This church is located on the western slope, today otherwise empty and not built on. It is precisely in the western part of the wall that the only Andalusí architectural vestige has been recognized and to the

northwest is Cerro Padrastro, where the largest quantity of ceramics has been documented through fieldwalking surveys. In this respect, the Andalusí settlement must have been located between the two hills, that of the castle and the Cerro Padrastro, relocating to the eastern slope after the Castilian conquest, when the different parts of the wall were constructed. The original fortification must have been situated on Cerro Padrastro, and from the 10th century, the rocky platform on which the castle is located today began to be developed and remained fortified until the modern period. It is quite likely that the Andalusí population was clustered around the fortification, which would explain the lower density of Andalusí settlements in the surroundings of Atienza, in contrast to other parts of the province of Guadalajara (García-Contreras Ruiz, 2016a, 2016b). After the Castilian conquest, the site continued to be occupied and was heavily transformed, although no study has considered this in detail. It is probable that the Tower of Homage dates from this period, although more than one phase is suggested by its structure, and it is likely that a keep was added. The written sources for the castle in Atienza refer to various buildings that served its inhabitants, but aside from the two cisterns, the keep and the walls that surround the complex, we know nothing about these internal constructions or subdivisions of space within the castle. It is entirely possible that some of areas functioned solely to house mustering troops or to protect the population and their goods, so for much of the time they would have remained empty.

5 | GEOPHYSICAL METHODOLOGY

Two separate geophysical surveys were conducted within the fortifications of Atienza and Molina de Aragón between 4 and 9 July 2016. The surveys detected many features and structures relating to the occupation of the castles. Because of the challenging steep and undulating terrain, vegetation cover and the time limitations for coverage, a magnetic survey was chosen as the most practical method for data coverage and quality. Both sites were surveyed using a Bartington



FIGURE 5 The slope of the *albacar* of Molina de Aragón (photo by Rob Fry). [Colour figure can be viewed at wileyonlinelibrary.com]

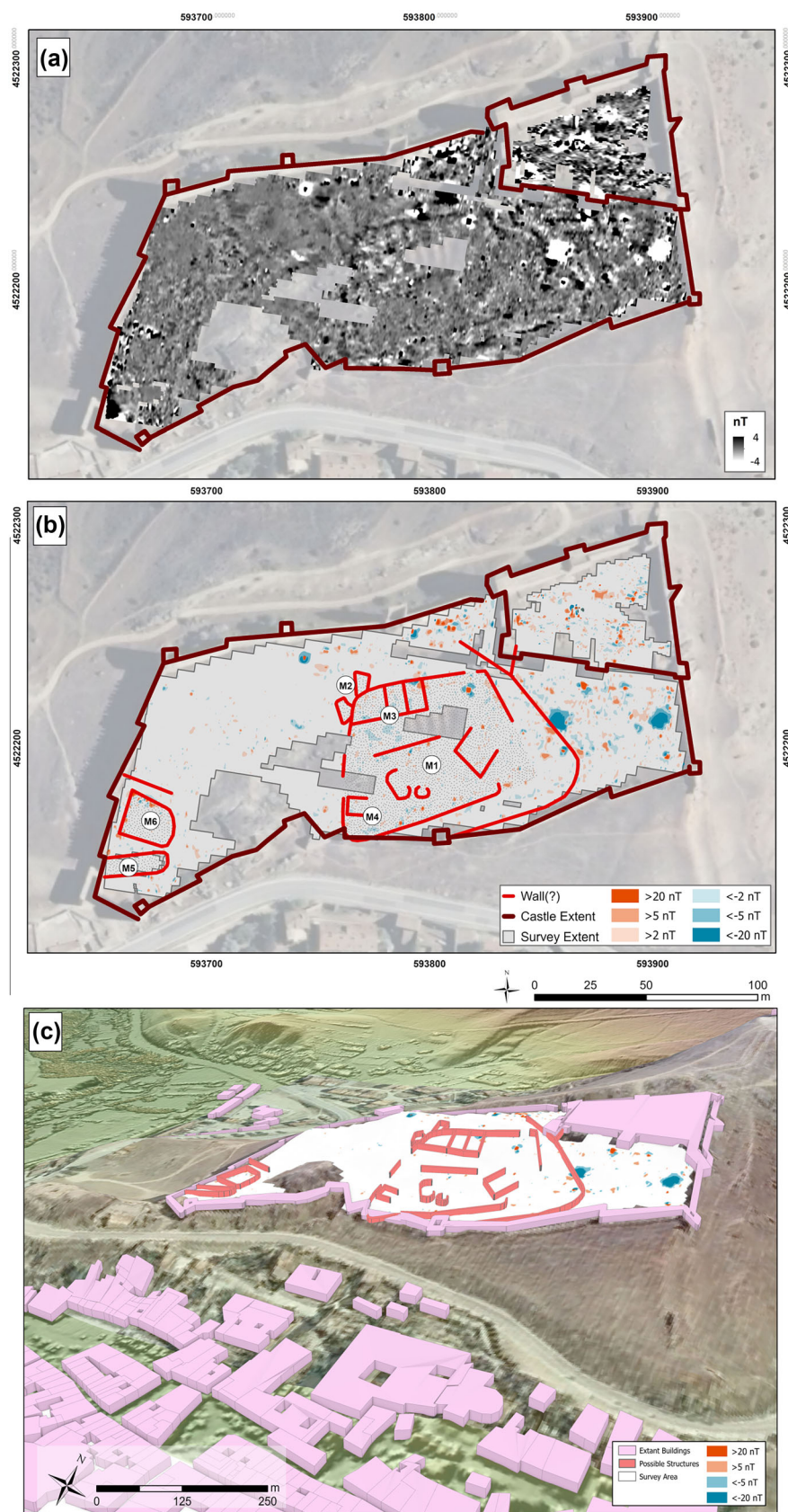
601-2 fluxgate gradiometer, at a resolution of 0.5 m (traverse intervals) * 0.25 m (sample interval). A cart system was considered for the surveys; however, because of the nature of the survey areas, being constrained in size and on challenging terrain, a walked survey was deemed the most appropriate methodology (Figure 5). The survey was conducted using 20-m grids, positioned using a Leica Total Station (TC407). The surveys were successful in delimiting particular areas of activity and structural remains at both sites; however, some features of archaeological interest, particularly structures such as walls or buildings, built from the parent geology have been difficult to identify and may still be undetected as a result of the low magnetic contrast at both sites. Anomalies within the magnetic surveys that are indicative of ferrous material, modern debris or geological origin have not been discussed within this publication as they are not considered relevant to the archaeological analysis of the sites. These are discussed briefly in the associated survey report, completed shortly after both surveys (Fry et al., 2016).

6 | GEOPHYSICAL SURVEY: MOLINA DE ARAGÓN

The surveyed area at the castle of Molina de Aragón focused on the steep hillside containing the enclosed outer ward or *albacar*, which slopes southwards towards the modern town. Within this area, 1.7 ha of land was suitable for survey; areas not suitable included parts that had been fenced off for safety reasons or which were not possible to walk over, such as the location of three extant bomb craters dating from the Spanish Civil wars. An area of 0.2 ha was also surveyed within the inner ward of the *alcazaba*; however, this was largely affected by magnetic noise from external sources such as electricity cables, mounds of sorted brick, metal fences and a recently constructed scaffold viewing platform. The extant structural remains within the surveyed area confirmed a mixture of buildings constructed from local stone and fired bricks. Despite the weak magnetic contrast, the survey was able to successfully identify anomalies of potential archaeological interest, especially on the steepest slope of the outer ward (Figure 6). This is of interest because most of the castles in the region, not only in the province of Guadalajara but throughout the centre of the Iberian Peninsula, tend to have completely empty-walled enclosures today. Their function at the time of their construction remains largely unknown, but they may have accommodated residential and storage structures and/or served as a place of refuge for local communities and livestock.

One of the most prominent features in the magnetic dataset is the existence of an enclosed area, trapezoidal-like in shape, delimited by enhanced linear anomalies in the middle of the outer ward. The enhanced linear character of the anomalies that define this area could indicate the existence of a boundary ditch, possibly with an associated wall or bank built around. This feature encloses an area of approximately 0.5 ha and appears to dominate the available area of the *albacar* [M1]. The southern and eastern flanks of the enclosure roughly align with the ruins of an extant low wall. Unfortunately, the interior

FIGURE 6 Fluxgate gradiometer survey of Molina de Aragón showing the different survey areas. (a) Processed magnetic data at $+4\text{nT}$ (black) to -4nT (white), (b) magnetic interpretation and (c) data positioned onto three-dimensional landscape showing possible structures identified within the data as extruded features. Aerial photography and LiDAR: National Geographic Information Center of Spain (CNIG)-CC-BY 4.0. Extant buildings layer: (C)OpenStreetMap, OpenStreetMap Licence, using: EDINA Global Digimap Service. [Colour figure can be viewed at wileyonlinelibrary.com]



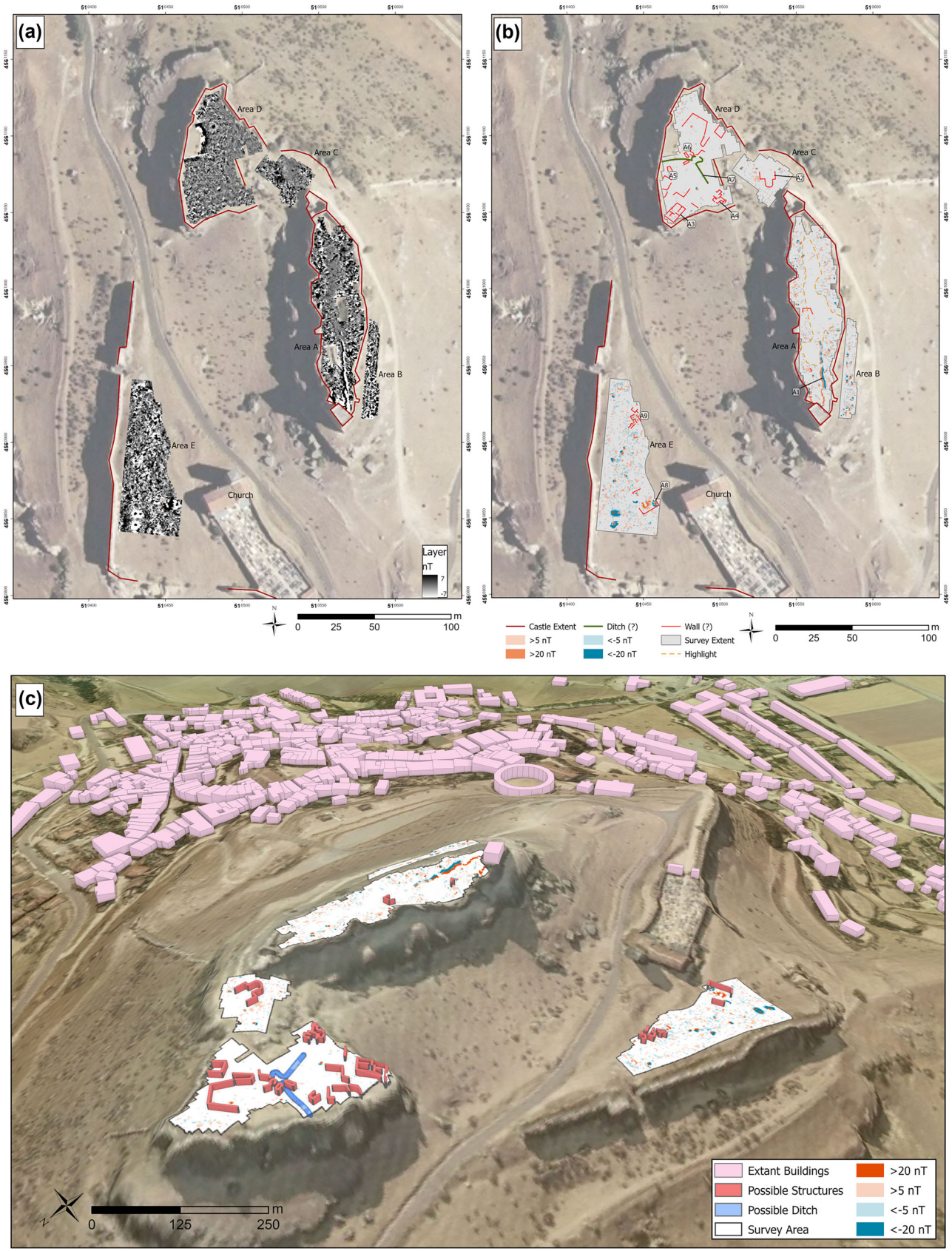


FIGURE 7 Legend on next page.

FIGURE 7 Fluxgate gradiometer survey of Atienza showing the different survey areas. (a) Processed magnetic data at +7nT (black) to -7nT (white), (b) magnetic interpretation and (c) data positioned onto three-dimensional landscape showing possible structures identified within the data as extruded features. Aerial photography and LiDAR: National Geographic Information Center of Spain (CNIG)-CC-BY 4.0. Extant buildings layer: (C)OpenStreetMap, OpenStreetMap Licence, using: EDINA Global Digimap Service. [Colour figure can be viewed at wileyonlinelibrary.com]

of this space has been considerably disturbed. Within the interior of this space, weak, reduced magnetic anomalies on several different orientations represent smaller structures [M3, M4]. Two further structures were identified, seemingly attached to the outer perimeter of the north-west corner of the wall, measuring approximately 17 m × 10 m [M2]. Within the south-west extent of the outer ward, the ruins of a church were surveyed [M5]. To the north of the church, further structures are thought likely to exist, one in particular, characterized in the data by a well-defined perimeter containing noticeably reduced and more homogenous magnetic field [M6].

7 | GEOPHYSICAL SURVEY: ATIENZA

The magnetic survey at Atienza was conducted over five separate areas (Areas A-E; Figure 7). The first four areas were located on and around the immediate terraces of the fortified castle, and a fifth was located to the north-west of the church. The anomalies of potential archaeological interest across this area are very weakly enhanced or reduced compared with the magnetic background, indicating again that the masonry building material was probably local stone or possibly timber-framed dwellings. The data from the terraces to the north of the survey appear to have yielded the best potential traces of archaeological remains. Possibly because of the local metamorphic/plutonic geology at Atienza, the data contained a higher proportion of strongly magnetic dipolar anomalies, which may be an indication of rubble collapse or levelled areas preventing further in situ archaeology from being identified within the magnetic dataset. This was especially evident within Area A, within the fortified castle, and Area E, next to the church.

The survey area within the most fortified part of the castle itself (Area A) appears to delimit a magnetically quiet central area with noisier flanks further east and west (highlighted by a dashed line on the dataset). This may indicate that the middle of the castle was left as open space, or it may be representative of a clearing of the area more recently to accommodate for modern access to the site (a pathway runs through the central area of the castle, positioned in the same location as the linear dipolar anomaly by the donjon, suggestive of modern clearance) [A1]. The noisier flanks of this fortified area suggest that there is a large amount of collapse and building rubble here, and this is likely to be masking any potential anomalies of archaeological interest below. Because of this increased magnetic disturbance here, the survey failed to detect any further definitive anomalies of archaeological interest, although some areas of enhanced magnetic field would warrant further investigation. Area B contained a small strip of terracing on the side of the mountain; however, the area was again quite noisy, and the magnetic survey here identified no structures of archaeological interest.

On a small flat plateau immediately to the north of the main entrance to the castle (Area C), a weakly enhanced anomaly appears to mark out the position of a possible structure, orientated north-south, with a potential apsidal end on its south side. The potential structure is 10 m wide, with an unknown northern extent [A2]. It is possible that this structure is part of a gatehouse or may indicate a series of smaller buildings flanking the main entranceway at the northern gate. The magnetic field within this structure is notably quieter than outside, indicating that the interior of the building has been kept free of rubble collapse. Dropping down to a larger fortified plateau to the north-west of the castle (Area D), a series of weakly enhanced linear anomalies may indicate the presence of further structures, which have been highlighted in the interpretation [A3], [A4], [A5] and [A6]. Within this area, a larger enhanced magnetic linear anomaly may also indicate the former presence of a ditch or wall structure that may have enclosed some of these buildings [A7]. This anomaly appears to have a break at its apex, which may indicate an entranceway or similar.

Within the area to the north-west of the church (Area E), the data are noisier still—possibly indicating that structural debris or levelling deposits have impacted on the ability to identify clear anomalies of archaeological interest. Some weakly enhanced anomalies within the data do exist that may indicate the presence of former structures; however, it is with low certainty that these are interpreted. The anomalies identified at [A8] and [A9] appear to be on a similar alignment to the extant church.

8 | DISCUSSION

The geophysical surveys of the castles of Molina de Aragón and Atienza have shed new light on the use of their wards or *albacares*. In the case of Molina, the identification of a ditch-like enclosure within the outer ward may represent a boundary, potentially marked by structures. The dimensions and internal subdivisions are suggestive of a plan of an Andalusí fortification that would most likely date to the Taifa period, that is, the 11th century. There is no evidence of any material culture or constructions within the fortified complex that can be dated to earlier than the tenth century. The changes that took place in all the subsequent occupation phases do not appear to have substantially changed the appearance of the 12th-century castle. The location of these anomalies in the centre of the *albacar*, an area that has previously not been excavated, points to the likelihood of a different enclosed plan than suggested by the current layout of the castle. This is reinforced by the evidence from other castles in the province, for example, Zorita de los Canes or Embid, where the transformation of the fortifications in the 12th century following the Christian conquests retained the essential plans and forms of the 11th-century

structures, with no evidence of earlier phases (de Ayala Martínez, 1993; Martínez Gómez et al., n.d.; Perla, 2011; Urbina & Urquijo, 2022). The settlements associated with the previous emirate and caliphal periods are usually located in different sites. The same sequence of construction can be seen in the so-called Tower of Aragón, which is located on top of the hill above the fortified complex at Molina. The archaeological excavations carried out in the centre of the *albacar* in 2020 and 2021 revealed the presence of a domestic structure dating from the 12th century that was used as a rubbish dump in the 13th century, after which the sloping surface was heavily eroded. Here, there were no traces of the internal subdivisions from the Andalusi period, although detailed analyses of the finds and stratigraphy are still ongoing. It is possible that a larger excavation area would need to be opened to capture these features.

The castle of Atienza, in comparison, has a different biography, because here, there is both documentary and archaeological evidence for the earlier emirate and caliphal phases. The survey was especially revealing in the northernmost areas where possible structural remains appear to have been identified, including a series of buildings, ditches that may have also served as internal divisions and a possible apsidal hall or religious building. As in the case of Molina, archaeological excavations at Atienza have been limited to date, with only two short excavation campaigns in 2021 and 2022, the results of which are still being analysed. Although the anomalies highlighted in the geophysical survey in the castle's upper ward or *albacar* have not corresponded to finds of rock-cut silos, in the lower part of the castle, next to the church of Santa María del Rey, it has been possible to link features interpreted from the geophysical survey with the existence of buried walls that have been dated to the early Andalusi period.

9 | CONCLUSION

The geophysical surveys of the castles of Atienza and Molina de Aragón have suggested the presence of previously unknown, varied subterranean structures within their enclosed wards, indicating that these were previously built up to varying degrees and may have had a suburban character. They also suggest that large areas may have remained open throughout the occupation of these sites. Elements of this have been verified at Atienza, whereas in Molina, they have yet to be positively identified through excavation. Although these surveys used magnetometry, it is clear, especially at Atienza, where vegetation coverage and terrain are more favorable, that additional surveys with GPR targeting the subtle magnetic anomalies that potentially relate to structural remains would be beneficial. Nonetheless, these surveys will continue to inform future excavations that will enable the diachronic development of these complexes to be clarified, particularly following their repurposing after the Christian conquests.

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CONFLICT OF INTEREST STATEMENT

No conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTES

¹ <http://www.castillosdeespa%C3%B1a.es>

² <https://research.reading.ac.uk/re-conquest/> García-Contreras Ruiz et al. 2020

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