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The genesis and fortification of the castle architecture of the early Middle Ages

Abstract. This study was devoted to a detailed analysis of the genesis and fortification of castle architecture of the early Middle Ages, covering the period from the 5th to the 11th century. An extensive review of historical documents, drawings, works of historians, and reports of archaeological research was conducted. The study examines the architectural, social, and economic aspects of castle architecture, paying special attention to the impact of historical events on defensive structures and the changes caused by the integration of construction methods from different cultures. The main attention was paid to the examination of the evolution of castles from simple wooden fortifications to powerful stone ones and the analysis of construction methods used in various regions. The castle architecture of the early Middle Ages borrowed many elements from ancient Roman and Byzantine fortifications, such as towers, walls, and gates. These elements adapted and developed in the face of frequent invasions and instability, which led to the creation of more powerful and functional fortifications. Castle architecture was born gradually, starting with simple fortifications, such as the Roman fortifications of Autun, Saxon burgs, the location of which is recorded in the list of Burghal Hidage, compiled in the 9th century. One of the first types of castles were Motte and Ringwork or similar in function, motte-and-baileys, first common in England and Germany, representing fortifications on artificial hills and plots of land surrounded by moats and ramparts, which played

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an important role in strengthening the power of the feudal lords in the 11th-12th centuries. Examples of such fortifications are the Peñerudes Tower in Morcina and the Castle of Canossa. Marlborough Castle in Wessex, Berkeley Castle and Castello Firmiano Castle are important monuments of fortification of castle architecture of the 5th-11th centuries, demonstrating a more developed approach to strengthening in comparison with their predecessors. The findings are important for analysing the development of castle architecture and understanding the historical processes that influenced its formation

Keywords: motte-and-bailey; fortified walls; defence; towers; Anglo-Saxon burgs

INTRODUCTION

Castle architecture, which originated in the Romanesque style, continued to exist even after this style gave way to Gothic, Baroque, and Classicism. The question of the origin of castles and their connection with general security remains relevant and causes a lot of scientific debate. Discussions usually describe the development of castle building as a reaction to the increasing threats of attacks and the need for protection. However, the first castles began to appear in the 9th and 10th centuries, and the connection between the level of security and fortification construction was not always direct. Sometimes, castles were built in relatively safe places as a symbol of the power and status of the owner. Meanwhile, some border areas remain uninhabited and unprotected.

Castles are complex fortified systems based on a strong connection between the territory and architecture. The territory defines the context of development, access and protection conditions, and the architecture adapts to the context, offering fortified structures in accordance with the orography of the area. Both factors are crucial for understanding the historical evolution and social role of castles over time. Motte-and-bailey-type structures that predate the appearance of the classical image of the castle, concerning which historians and archaeologists have different hypotheses and archaeological research data, often lead to contradictory conclusions regarding the dating and place of origin.

The architecture of the early Middle Ages covers the period from the end of the 5th century to the beginning of the 11th century. This period begins with the fall of the Western Roman Empire and continues until the beginning of the Romanesque style of architecture, which began to develop in the 11th century, but until that moment, the architecture of castles transformed from primitive fortified buildings to full-fledged architectural structures integrating elements of defence, housing, and centres of social activity. E. Cirelli (2020) and H. Little (2022) examined this issue. The pre-Romanesque style is defined as the dominant one among the castles of the early Middle Ages, often representing simple, massive structures designed for defence and housing. It is also noted that the original function of the castles was defensive. They represented not only military fortifications but also centres of social and economic activity, which is confirmed by the finds of various objects and structures.

The examination of castles and fortifications dating from the period from the 5th to the 12th century is complicated by the high level of destruction of these structures. Many of them have either not been preserved or are ruins, which creates substantial difficulties for research and understanding of their history and architectural features. Researchers A. Marciniak-Kajzer (2020), M. Brintley (2020) and R. Barber (2022) drew attention to this issue. It is emphasised that the dating of motte-and-bailey structures is often based on the analysis of ceramics, which may be inaccurate. An example is the Douai-la-Fontaine monument, which dates back to the Carolingian era, but an artificial mound appeared there only in the 11th century (Marciniak-Kajzer, 2020). Most of the archaeological material is usually discovered as a result of random excavations or non-targeted research, while targeted excavations often yield a limited number of finds (Barber, 2022). Most castles from the early Middle Ages did not survive until the development of archaeology, which could provide modern methods of research (Brintley, 2020).

The examination of fortifications and the origin of castle architecture in the early Middle Ages requires a comprehensive analysis, including regional and architectural features of this period, as well as social and economic contexts. S.D. Kirk *et al*. (2020) emphasised that it is necessary to consider the term "castle" more broadly. These monumental structures should be analysed considering the cross-cultural behavioural processes that led to their emergence in different parts of the world, without limiting their interpretation only as a feudal or Christian phenomenon.

S. Ozola (2020) highlighted that the knights from Lubeck and Bremen, to implement their policy on the conquered lands inhabited by the Balts, founded economically independent stone castles with chapels. These castles served not only as military outposts but also as centres of administrative and economic management. S.D. Kirk *et al*. (2023) noted that state castles owned by centralised authorities included defensive fortresses and palaces until the 16th century, and then investments moved to border-control castles. Non-state castles also moved from defensive fortresses to palaces but did not reach the stage of border control castles. J. Hložek *et al*. (2023) highlighted that the symbolic role of early medieval fortresses and castles located on mountain peaks was often reduced to demonstrating power over the surrounding area.

The studies of these researchers are really important because they help to better understand the problem of understanding the factors that stimulate the construction of castles, which can be much more complex and include social, economic, and even cultural aspects. However, despite the substantial contribution of these studies, certain gaps remain. It is necessary to consider in more detail the specific construction methods for the fortification of castles

of this period; it is also important to analyse the buildings preceding the appearance of castles; attention should be paid to the integration and exchange of castle construction methods between different cultures and regions.

The purpose of this study was to examine the origin and development of castle structures from their original forms to more complex and monumental castles and to analyse the role of castles in the social and defensive life of the early Middle Ages. This contributes to a deeper and more objective understanding of the processes of development and functioning of castle architecture during this period, which allows expanding the perception of castles not only as architectural monuments but also as important buildings reflecting the social and historical events of that time, which contributes to a deep understanding of their role in shaping social and cultural practices of the early Middle Ages. Literature analysis and photogrammetric analysis were used to conduct the study, the paper is theoretical. The historical document Burghal Hidage (n.d.), deciphered by Lawrence Nowell in 1562, was considered. An important stage of the study was the search for the most accurate and detailed plans, drawings, and 3D models for the reconstruction and analysis of early medieval castles.

THE ORIGINS OF CASTLE ARCHITECTURE: THE INFLUENCE OF ANCIENT CIVILISATIONS AND BYZANTINE CANONS OF URBAN PLANNING, GERMAN AND ANGLO-SAXON FORTIFICATIONS

The Middle Ages have long been considered a dark and barbaric period. However, between the 5th and 9th centuries, despite the decline of civilisation, knowledge, and art due to invasions and riots, after the 10th century, European society began to change due to the interaction of ancient Roman culture, Germanic customs, and Christianity, reaching its heyday in the 13th century. In the period from the 5th to the 6th centuries, Europe was fragmented: Roman centralisation gave way to political division, and barbaric invasions led to violence, destruction, instability, and epidemics. Despite this, the Germanic tribes introduced new elements to civilisation. The fortifications of the 4th-6th centuries were characterised by a reduction in urban life and the revival of defensive structures. Cities have turned into small fortified cores built from the materials of abandoned buildings to protect against violence and invasions.

The formation of a medieval castle involves the development of key elements such as city walls and towers, which together create an architectural synthesis. The castle, as an association of defensive structures, is not unique to the feudal era, it reflects both functional and symbolic aspects. After the classical era, castles became a means of control and resource extraction, symbolising an agreement between influential members of society and the population, forming a new understanding of the territory and its inhabitants (Greco, 2023).

Fortifications that preceded castles were built in the 8th-7th centuries BC on the territory of Assyria. Prototypes of castles are also present in the architecture of Ancient Rome, where the country residences of Roman emperors were strengthened, such as Diocletian's Palace in Split, modern Croatia (Barker *et al*., 2023). Ancient Roman fortifications had a substantial influence on the architecture of medieval castles. Byzantine fortification structures, such as city walls with multiple lines of defence, towers and gates, also made an important contribution to the development of castle architecture. Byzantine cities like Nicaea and Athens used high walls and reinforced gates for protection. These fortifications were adapted in Western Europe by the 9th century, preserving elements of Byzantine architecture and technology.

In the early Middle Ages, Byzantium was actively involved in conflicts with Sassanid Persia and the Arabs, which influenced its defensive strategy. Important battles, such as the Battle of Chersonesos in 625 and the sieges of Constantinople in 674-678 and 717-718, contributed to the development of Byzantine fortifications. These elements, such as towers, walls, and gates, were adapted in Europe, especially in the 12th century, to protect cities, estates, and monasteries (Kontogiannis, 2022).

The origin of European castles dates back to ancient times. The original fortifications, similar to modern castles, copied Roman military camps with tents and a palisade. Since Norman times, castles have begun to build more complex stone structures. Since the 12th century, the castle has become a fortress with stone walls and defensive towers, which allowed effectively controlling and protecting the territory (Shatkovskyi & Tupchienko, 2023). Although the formation of castle architecture began earlier, various countries developed their own versions of castles but they all adhered to common principles and included basic fortification elements.

The first builders of fortified settlements were the Germanic tribes of the Angles and Saxons in the early Middle Ages. These tribes strengthened their positions in the conquered territories by building burgs, which were fortified cities with an important defensive and administrative role. Rural burgs were smaller and included wooden structures such as halls and towers, and were not classified as castles due to their functional specificity and size. Early fortifications, such as Saxon burgs and Iron Age hillforts, served as centres of command and control, anticipating later castles that became residences of feudal lords and symbols of their power (Haslam, 2023).

Due to the list of Burghal Hidage (n.d.), compiled during the reign of Edward the Elder, son of Alfred the Great (899/901-924), the location of all Burgs was recorded (Maitland, 1897). This list mentions 33 fortified towns located in such a way that any resident of Wessex could be no more than 20 miles from the burg. This approach ensured a wide coverage of the territory by defensive structures and strengthened the position of the Saxons in the struggle for power and security in territories subject to enemy attacks (Fig. 1).

Figure 1. The location of the Burghs based on the list of Burghal Hidage in 10th century England
Source: History Chronicles (2023)

The Anglo-Saxon Burghs provided the Normans with the existing concept of fortified settlements, which were used to protect and control the territory. The Norman conquerors often built their castles in places where the burgs had previously been, using their defences or adapting them to their needs. Norman castles not only performed military functions but also served as high-status residences and estate management centres, and they also played a symbolic role in demonstrating power and dominance. In the context of Wessex, Marlborough Castle is an example of an 11th- and 12th-century castle building, demonstrating the features and functions of Norman castles in the region. Burgs had a simpler layout with earthworks and moats, while Norman castles developed from motte-and-bailey to complex stone fortresses (Creighton, 2022).

The development of castles was a complex and multi-stage process, starting with simple fortified houses and moving on to more complex structures in response to changes in military tactics and socio-political conditions. One of the first types of castles were mounds (motte) and circular defence (ringwork), which appeared in Western Europe, especially in Normandy, from the 10th century. These castles, common in England after the Norman conquest of 1066, were wooden or stone buildings on an artificial earthen mound, surrounded by additional defensive structures such as moats and walls. The main idea was to raise the defensive structure to an elevation to increase its protection (Cantor, 1982).

Ringwork castles were built without an embankment hill and were fortified plots of land with ditches and earthen ramparts. The first such castles appeared in Germany in the 10th century and became popular in England in the late 11th and early 12th centuries. There could be a manor house or a tower in the centre but without an elevation on the hill. Over time, they have become more complex, including stone walls and other defensive elements. Many of these early castle forms were replaced by motte-and-bailey structures, which combined an embankment hill with courtyards and fortifications and were simpler and faster to build.

The Peñerudes Tower, located in Morcina and dating from the early Middle Ages, namely the 12th century, is located at an altitude of 530 metres above sea level on a hill on the north side of the city of El Campo in the parish of Peñerudes. The tower has a quadrangular plan with a wall thickness of almost 2.5 metres and a height of about 17 metres. Inside, traces of reinforcement beams that divided the tower into three floors can be seen. Externally, the southern facade of the building is missing, but the northern wall and a substantial part of the remaining walls have been preserved (Fig. 2).

Figure 2. Photo of the Penerudes Tower
Source: Peñerudes Tower (n.d.)

The preservation of only some elements from the original form of the Matilda fortress demonstrates a number of difficulties associated with the study of the architecture of castles of the early Middle Ages. Historical castles and fortresses have often been destroyed and rebuilt over the centuries. This led to the loss of original materials and structures, which makes it difficult to accurately recreate and interpret them.

The castle of Canossa, built on top of an isolated cliff, has substantial strategic and defensive importance. The first mention of the fortified system at the top of the Canossa cliff dates back to the beginning of the 10th century. This castle played an important role in the medieval history of Europe, especially during the reign of Countess Matilda of Canossa, who used it as a political and military centre in internecine conflicts spanning the territory from Lombardy to Tuscany. The castle of Canossa was part of a complex system of fortifications typical of the Apennine territory of Reggio Emilia. Most of the original fortress, dating back to the Matilda era, has not been preserved. The remains that can be seen today mostly date from the late Middle Ages and later periods (Fig. 3). Some elements of the foundation, however, date back to Matilda's original time (Russo *et al.*, 2023a).

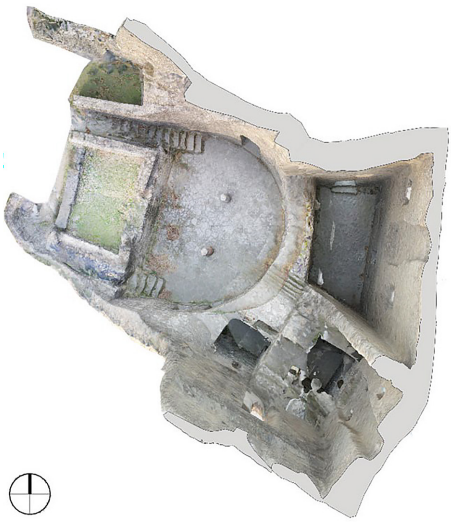

Figure 3. View of the Castle of Canossa from above
Source: M. Catellani *et al.* (2021)

The castle's location on a white sandstone hill indicates the strategic use of natural features for defence. The remains of the fortifications demonstrate how the castle controlled the surrounding area and ensured the security of the region. The raised part of the eastern tower is a defensive structure that could serve to control the surrounding area and provide visual surveillance. It clearly illustrates the transition from wooden to stone fortifications (Russo *et al.*, 2023b). In addition, the fortification element is the foundation of the gate tower, located to the south of the main building, which indicates the existence of entrance fortifications that protected the main entrance to the fortress.

THE FORMATION OF CASTLE ARCHITECTURE AND FORTIFICATIONS IN THE EARLY MIDDLE AGES: SYMBOLISM AND THE IMPACT OF SOCIAL CHANGE

The city of Autun, located in the region of Burgundy, in France, is an interesting example of a city with an ancient history, important for understanding the development of castle architecture in the early Middle Ages and the influence of the historical context on the development and fortification of architecture of the early Middle Ages. The fortifications in Autun, covering an area of 200 hectares, included a battlement with a diameter of 6 km, a thickness of 2.5 m and a height of 11 m, 52 tall semicircular towers, four main gates, and six secondary rear gates. These fortifications greatly enhanced the prestige and wealth of the city, although they did not play a key military role. In the following centuries, Autun was destroyed several times. In the 6th century, the collapse of the Western Roman Empire led to substantial changes in the political and social organisation of the former Roman provinces, accompanied by migrations of peoples, barbarian invasions, and the formation of new state structures. In 674, the city was ravaged by Vandals and Franks, in 731 it was attacked by the Moors, in 895 the city was robbed by the Scandinavians.

During the early Middle Ages, the architecture of castles began to actively develop in the direction of strengthening and defence (Andresyuk, 2024). Castles became more massive and functional with the addition of towers, walls, and other elements to sustain long sieges and attacks. In the 6th century, the construction of a castle with a cathedral and a bishop's residence took place. At that time, castles became a necessary element to protect the population and church institutions from attacks. In Autun, the castle was fortified and included a cathedral and a bishop's residence, reflecting a combination of defensive and religious functions. Roman fortifications dating back to the 1st century were located around the perimeter of the city (A), and framing it, the castle territory became the final part of this fortification system (B). The medieval fence of the 12th century (CC) complemented the fortification system, located in the southern part of the city, crossing its centre (Fig. 4).

In conditions of instability and frequent invasions, the construction of fortified castles has become necessary to protect the population, church, and royal mansions from barbarian attacks and other threats. Castello Firmiano, also known as Sigmundskron in German, is a substantial fortification located in the vicinity of Bolzano, the capital of South Tyrol. The castle is now part of the Messner Mountain Museum. The first mention of Castello Firmiano dates back to 945 when it appeared under the name of Formicaria. In 1473, the ruler of Tyrol, Sigismund the Rich, acquired the castle and renamed it Sigmundskron, and adapted it to firearm protection. Only fragments of the original Formicaria have been preserved, mainly in the highest sites of the area. The castle's design includes towers evenly spaced along the perimeter of the outer walls. This layout allowed the defenders to conduct a circular bombardment, which

made it more difficult for enemies to approach the castle and increased the difficulty of destroying its walls (Biran *et al.*, 2023). Since then, only a few fragments of buildings have been preserved, mainly at the highest points of the area. The towers, located evenly along the outer walls, allowed the defenders to conduct a circular bombardment, which made the approaches to the castle dangerous for opponents and complicated their task of destroying the walls (Fig. 5).

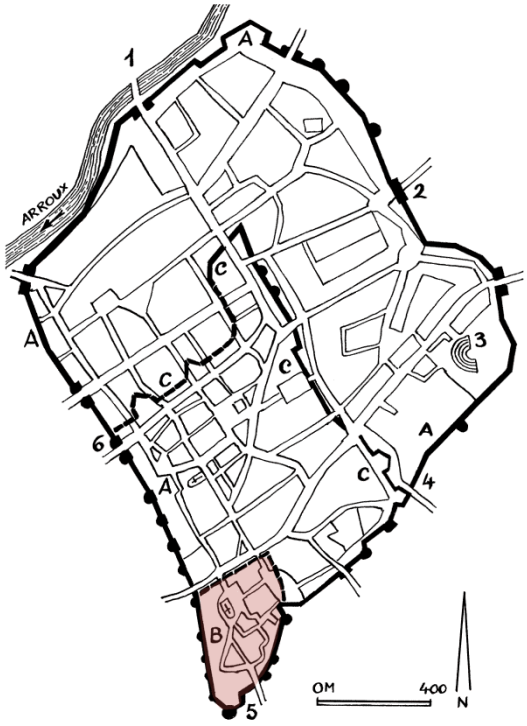

Figure 4. The location of the 6th-century castle with the Cathedral of Saint-Lazare and the episcopal residence in Autun
Source: J.-D. Lepage (2015)

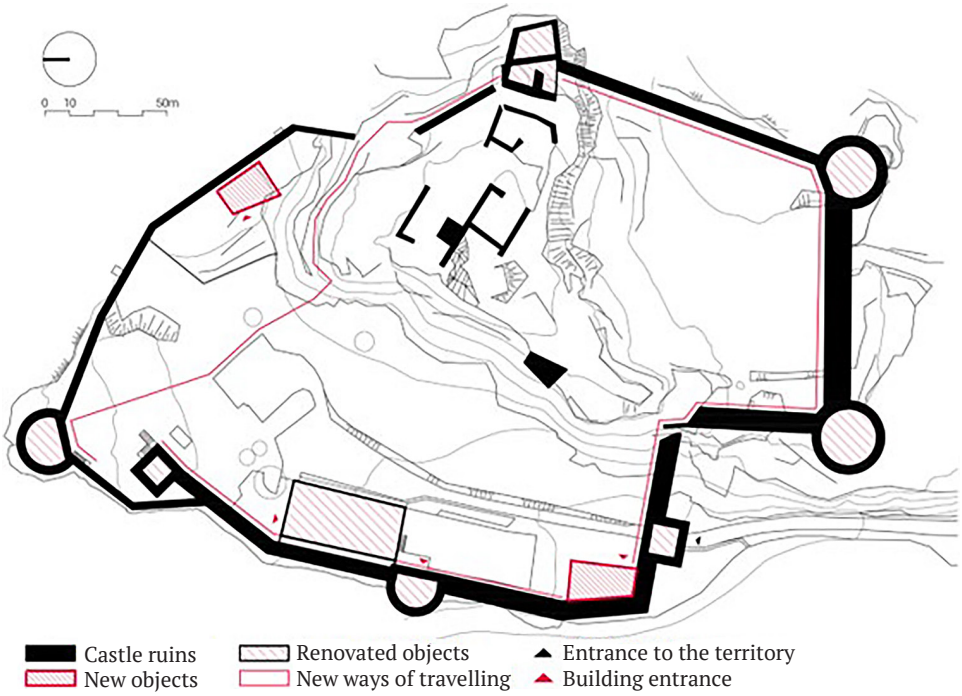

Figure 5. Firmiano Castle. Location and spatial relationships of ruins and modern buildings
Source: I. Wilczek (2021)

Berkeley Castle is an interesting example of fortification architecture from the period of the 12th century with various elements characteristic of the era of the Angevin dynasty. Berkeley was a royal domain in the time of Edward the Confessor (1042-1066). The initial castle included a motte (artificial hill) with a moat on three sides and natural defences on the south side. The stone from the pre-existing cathedral was used to build the foundation of the castle. Despite the original boundary function, Berkeley Castle became part of a larger system. Evaluating the data on the preserved structures of the 12th century, it can be assumed that the original form of Berkeley Castle was a palisaded courtyard, inside or next to which there was an artificial hill with a donjon on top (Fig. 6).

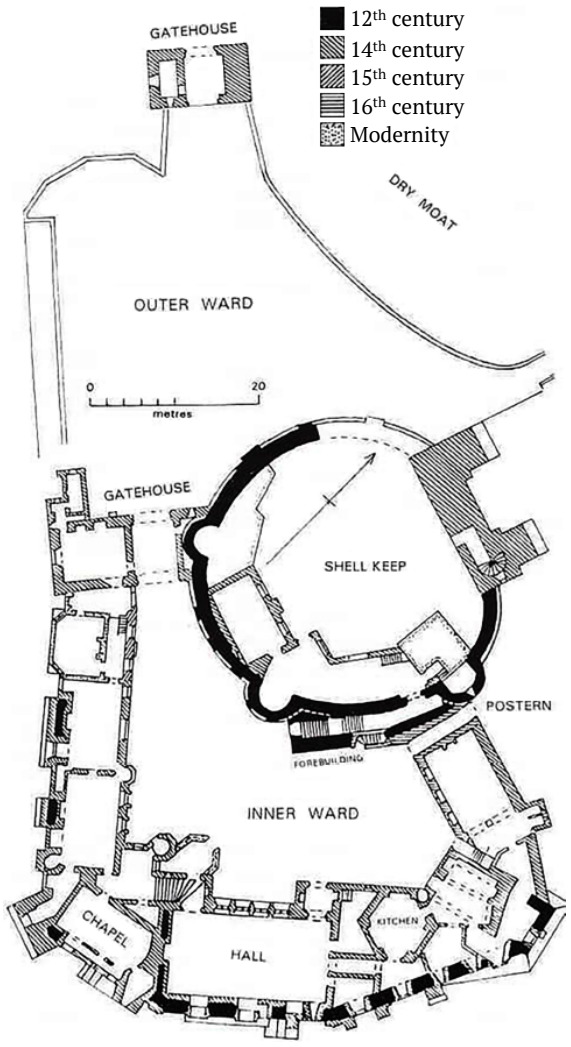

Figure 6. A plan of Berkeley Castle showing the various stages of its development
Source: S.J. Prior *et al*. (2023)

The motte castle was erected by William Fitz Osbern, 1st Earl of Hereford, in 1067. For the next three generations, it belonged to the knight Roger de Torcy and his descendants, who adopted the surname de Berkeley. At the beginning of the 12th century, they began the reconstruction of the castle, replacing wooden fortifications with stone ones. This process was lengthy and required substantial resources. However, in 1152, due to the refusal to support the Plantagenet dynasty during the feudal troubles, the last of the Roger de Berkeley lost the castle. The king handed over the castle to Robert Fitzharding, who continued to strengthen and rebuild it. In Berkeley Castle, the towers are also placed evenly along the perimeter of the outer walls. This allows for the creation of reliable protection and effective use of the castle's internal space. The uniform placement of the towers increased resistance to siege and allowed the defenders to conduct a round-robin fire. In small castles, towers often served as the main fortress, but as castle construction developed, they began to be connected to the walls, which made the fences more durable and improved visibility for defenders.

During the early Middle Ages, substantial changes took place in the socio-economic, political, and cultural spheres in Central Asia. These transformations were reflected in the architectural and fortifications of the region, demonstrating the evolution of construction technologies and defensive strategies. During this period, the territory of modern Kyrgyzstan was influenced by various cultures and peoples, which substantially influenced the development of fortifications. One of the key aspects of fortification was adaptation to geographical conditions. Fortresses and fortified settlements were often located on high ground, hills, and mountain slopes, which provided natural protection and a good view of the surrounding area (Dzhedzhula, 2023). This choice of location allowed effectively defending against numerous enemies, including nomadic tribes and conquerors. Fortifications of the early Middle Ages included high fortress walls, often reinforced with towers and loopholes. The entrance to the fortress was protected by massive gates and additional fortifications such as moats and barbicans. The layout of the fortifications could vary from simple rectangular or square to complex, adapted to the terrain. Over time, fortification technologies were constantly improved, under the influence of various cultures and peoples passing through the territory of Kyrgyzstan. An example of this is the Ak Beshim settlement, where archaeological excavations have shown several construction periods reflecting the development of fortification architecture (Biran *et al*., 2023). The fortified citadel is located in the centre of the settlement, protected by a fortress wall with preserved remnants of watchtowers. The citadel functioned as the core of the city and the main defensive structure (Silachyov & Akymbek, 2023).

The main element of protection was the powerful fortress walls, often reinforced with towers and loopholes. Inside fortified cities, there were often citadels and central fortified units that served as the last line of defence. Fortress walls were often decorated with bastions and battlements to improve defensive capabilities. The entrances to the fortresses were protected by massive gates and additional fortifications such as barbicans (Eshquvvatova, 2024). Castles served as strategic positions that marked

the boundaries of the territory, but as residences they became a support for the representation of power. Therefore, they needed to turn to a symbolic repertoire expressed through architecture. The construction of castles depended on private initiative and was directly related to feudalism, fortified buildings illustrated the decline of political and military power and reflected a social order based on the desire for power. In this context, a private "castle", designed for everyday life and inhabited by both civilians and soldiers, was substantially different from a "fort", which was built exclusively for military purposes. The influence of ideological concepts dating back to the classical era and newly opened for experimentation was traced in construction technologies. Thus, it is important to note that in Europe, most of the monumental and defensive architecture, controlled by powerful elites, served as a symbolic form of legitimisation and affirmation of hierarchy. Masonry, initially practical, gradually gained symbolic importance in the development of castle forms.

THE EVOLUTION OF FORTIFICATION ARCHITECTURE OF CASTLES: ADAPTATION OF TECHNIQUES AND MATERIALS

The evolution of European castles demonstrates the transition from simple wooden fortifications to powerful stone ones. Initially, the castles were enclosed by a wooden palisade, which provided minimal protection and was easily destroyed during attacks. However, the military actions showed the inefficiency of such structures, which led to the replacement of wood with more durable materials – stone and brick. The very first castles were enclosed with wooden fences, which provided basic protection. They were vulnerable to fire and easily destroyed by siege weapons. The transition to the use of stone has substantially increased the protective capabilities of castles. The stone walls were resistant to fire and more durable, which made it more difficult to destroy them. This allowed to prepare for the defence in advance.

C. Coulson (1979) discusses the architectural features of castles, which demonstrate thoughtful steps to reduce hazards. The internal factors that determine the layout of castles are often underestimated. Ideal military castle plans include polygonal shapes to minimise the vulnerability of corner towers. Examples of such plans include Bolingbroke Castles, Boulogne-sur-Mer, Fer-en-Tardenois, Castel del Monte, and Hlemutsi. The castles of Castello Firmiano and Berkeley demonstrate the strategically uniform placement of towers along the perimeter of the outer walls, which contributed to effective protection. This arrangement ensured the protection of all sections of the walls and allowed the defenders to easily control the approaches to the castle. The polygonal shape allowed creating an effective firing system, reducing dead zones, and improving visibility.

S. Sur & U. Serin (2023) also explored medieval construction methods, using the example of the Genoese fortifications in Galata (mid-15th century), they highlighted the adaptation of local construction techniques and materials, the use of various types of stone and brick, improving the quality of building materials, the development of mortar technologies to improve the binding of stones. The Eastern influence, borrowed by the Crusaders and presented to the Byzantine masons by the Genoese, is also emphasised. In turn, P. Purton & C. Krauskopf (2021) noted how the transformation of the castle fortification was accompanied by thickening and strengthening of the outer walls, especially during the appearance of powder artillery in the second half of the 15th century, bastions with fortified corners capable of withstanding direct blows from artillery guns were also added.

Building materials in the early Middle Ages were limited by available local resources, and wood and soil were mainly used. In the late Middle Ages, castles turned into complex and powerful stone fortresses. This period is characterised by substantial development of construction technologies and the use of more durable materials. Castles have become not only defensive structures but also symbols of power and status (Demessie, 2024). The example of the Genoese fortifications of Galata shows how local construction techniques and materials have adapted. The walls were built of rubble and rough-hewn stone with pieces of brick in the mortar seams, which was a characteristic feature of late Byzantine architecture. The Genoese, despite the limitations, built quickly, using all available materials.

A. Özmen (2022) examines the history of the reconstructions of the Castello Firmiano castle. In the 15th century, the castle came into the possession of the ruler Sigismund, who turned it into a powerful defensive fortress using advanced technologies of the time. Most of the preserved parts of the castle belong to this period. Over time, the castle acquired political and symbolic importance, becoming the site of calls for autonomy during the 1957 protests. Over the centuries, the Castello Firmiano Castle has undergone many alterations and reconstructions while maintaining its defensive function. By the 20th century, although it had lost its original purpose, its historical importance remained an important symbol. Initially, the defensive architecture was distinguished by its harsh appearance and was not influenced by Gothic, but with the beginning of the Renaissance, castles lost their utilitarian goals, and Gothic and Renaissance elements began to penetrate into their architecture. During the Baroque period, castles corresponded to the aesthetic and functional trends of the era.

D. Lanera (2024) conducts a detailed examination of Castel del Monte, starting with its historical context and unique architectural form and ending with a mathematical analysis of its geometric structure. He emphasises the importance of the castle as an object of research and historical legacy, especially in the context of its unique octagonal layout. P. Kocańda *et al*. (2020) also emphasise that later fortifications, especially in the form of sconces and redoubts, began to have a more regular shape. This indicates the use of old fortifications for new purposes or their modification for military needs. Early defensive structures

often had an uneven shape. An example is the fortification at Brzezow in Poland, where regularity of form was rare for the early Middle Ages. Early defensive structures, as a rule, had an uneven shape, which was often explained by the need to adapt to the terrain and the limitations of construction technologies of that time. In such fortifications, natural features of the landscape were often used to strengthen the defence, which led to an asymmetric and complex structure of fortifications.

The evolution of fortification architecture from uneven forms to more regular and symmetrical ones was due to the development of siege weapons and tactics, which required more thoughtful and effective defensive structures (Tsyrfa *et al.*, 2024). Improved construction technologies and planning methods have allowed architects to create more complex and geometrically precise fortifications. Finally, the accumulated experience and knowledge in the field of fortification architecture allowed builders to better understand and apply the principles of symmetry and regularity to improve the defensive properties of fortifications. Beaumaris Castle, built at the end of the 13th century, has incorporated a number of innovations and improvements compared to early medieval architecture. These innovations made it one of the most perfect examples of medieval fortification architecture. F.W. Lloyd (2021) notes that Beaumaris Castle, founded in 1295, is known for its concentric design and almost perfect symmetry. His gatehouse is almost identical in size and shape to the gatehouses in Harlech.

Unlike early medieval castles with a dungeon in the centre, Beaumaris has a concentric structure with two rings of walls. Instead, the emphasis is on powerful exterior and interior walls. This created a multi-layered defence, where the inner walls could continue to defend even when the outer ones were captured. The concentric structure of the castle allowed for a better organisation of the defence. In the event of a breach of the outer wall, the defenders could retreat to the inner wall and continue their effective defence. The moat around the castle was connected to the sea, which allowed large ships to approach almost directly to the castle and unload at the gate. This provided supplies and convenient logistics in the event of a siege. The layout of the castle was carefully thought out and symmetrical, which improved both its protective properties and functionality for the garrison. These innovations made Beaumaris Castle an example of the advanced fortification architecture of its time, substantially surpassing early Medieval castles in terms of efficiency and thoughtfulness of defensive solutions.

Since the beginning of the High Middle Ages, castle architecture began to acquire decorative elements, and attention to the appearance of castles increased. The integration of the beauty of the exterior with the defensive function of the castle has become more explicit. For example, Castel del Monte demonstrates how the architect preserved the defensive characteristics of the castle while experimenting with the shape of the plan to give it a unique appearance and interior layout.

ARCHITECTURAL AND CONSTRUCTION FEATURES OF LATE MEDIEVAL CASTLES, THE INFLUENCE OF EARLY FORTIFICATION CONCEPTS

The choice of the site for the construction of the medieval castle played a key role in its defensive strategy and symbolic significance. One of the important factors was the successful natural location. Castles were often built by the water, on natural hills, rocks, or in the middle of lakes. This arrangement provided not only a magnificent view of the surroundings but also a substantial complication for enemies seeking to approach the walls of the fortress. The first fortresses of the motte-and-bailey type were built on artificial hills, which gave a substantial advantage in defence. This practice has become widespread throughout Europe. Castles built in the middle of lakes or near the banks of rivers had natural protection from attacks. Water not only made it difficult for enemies to access but also provided an additional source of resources for the inhabitants of the castle.

D. Janíková (2016) highlights that the Normans, despite their reputation as innovators in the field of military architecture, did not actually bring radically new ideas to fortification construction. Many features of motte-and-bailey type castles already existed in earlier structures such as Celtic hills, Roman forts, and Anglo-Saxon burghs. The Anglo-Saxon Burghs provided the Normans with the concept of fortified settlements, which they adapted to their needs, building castles in the places of the former burgs and developing them from motte-and-bailey to complex stone fortresses. An example of such castles is the Castello Firmiano, a fortification with many reinforcements, where the uniform placement of towers along the perimeter of the outer walls provided the defenders with the opportunity to conduct a circular bombardment. The fortresses located on the tops of the cliffs were practically impregnable. They had return routes leading to the gatehouse, which allowed the defenders to effectively fire at the enemies, preventing them from approaching the walls. Castles with spacious panoramic views allowed controlling large territories and noticing the approach of enemies in advance.

M. Sýkora (2021), exploring the development of castle architecture in Northwestern Bohemia (13th-17th centuries), highlighted that the first castles in the 13th century were characterised by the presence of a bergfried (battle tower) and a palace or donjon. In turn, K. Pachnerová Brabcová *et al.* (2023), using radiocarbon dating of the northern tower of the Rismburk Castle, clarified the construction time of the northern tower to the period 1287-1300. Regular castle locations were limited to royal cities. Royal residences were concentrated in the lowlands, near rivers and royal cities, while noble castles were built in mountainous areas. The author identifies the 17th century as the end of the era of castles.

The donjon or central tower in early Medieval castles, which served as both a residence and the last stronghold of defence, continued to play an important role in late Medieval castles, often becoming more massive and fortified.

During almost the entire 14th century, the emphasis was on the military component in castles. However, in the last quarter of the century, there has been a decrease in the use of defensive components and improvements in residential and representative units. These elements of fortification show how the early principles of castle construction continued to evolve and improve, responding to the challenges of the time and technological changes. The basic canons laid down in the early period became the foundation for the further development of castle architecture in the Middle Ages.

B. Elortza (2020) analysed the development of castle architecture in Scandinavia (12th-13th centuries) and highlighted the construction of earthworks and fortifications to protect siege camps and to block access to castles. Castles with strong stone walls and flanking towers, such as Vordingborg, Hammershus, and Nykoping, could not be easily stormed. Trebuchets and other heavy siege engines became widely used by the end of the 13th century. The idea of a multi-layered defence, where the castle is surrounded by several defensive elements (for example, walls, moats and towers), was borrowed and developed in later stone castles. In the early Middle Ages, these could have been simple earthen ramparts and wooden walls, but by the 13th century, they were replaced by stone walls with flanking towers. Towers and gates, which were used in early medieval castles for surveillance and protection, remained important elements in later castles. In the 13th century, the towers became more complex and durable, and the gates received additional protective devices. In the early medieval castles, internal residential and economic zones were developed, which were preserved in later stone castles. In the 13th century, they became more structured and adapted for a long stay. Due to the virtual reconstruction of the medieval castle of San Salvador De Todea, built in the 12th-15th century, researchers P. Valle Abad *et al*. (2022) highlighted that the northern gate was the main gate of the castle. They were large in size and integrated into the shaft; the southern gate represented a second access or an entrance. They were smaller in size compared to the north gate and probably served as a secondary entrance.

The internal distribution of the castle was complex and included two different complexes separated by a shaft. Access between them was via a staircase carved into a rocky ledge leading to the upper platform of the hill. The inner gate gave access to a narrow pentagonal covered space adjacent to the tower and two sections of the rampart wall. This design allowed access to the upper platform and surrounded the basement of the tower. The upper part of the shaft was probably passable, although the exact access to it remains unknown. As in early medieval castles, the walls of Salvador de Todea were massive and high, which provided protection from siege weapons and made it difficult to overcome them. Multiple gates, including the main northern and secondary southern gates and internal passages, which were also typical for castles of the early Middle Ages, provided various ways of access and protection.

The examination of the presented papers and their comparison with the results of the study allowed identifying key aspects of the evolution of fortification architecture of the early Middle Ages. This discussion highlights that the trend of fortification of castle architecture persisted until the end of the 16th century. The Anglo-Saxon Burghs had a substantial influence on the formation of castles in Normandy and England, evolving from motte-and-bailey type structures to sturdy stone structures. Notably, the first mention of the fortified system at the top of the Canossa cliff dates back to the beginning of the 10th century. A comparison of early Medieval and late Medieval castles demonstrates the evolution from simple wooden defensive structures to complex and powerful stone fortresses, reflecting changes in military tactics, construction technology, and political conditions. Castles have become not only defensive structures but also symbols of power and status. Their architecture and location reflected political and social importance. This allows for a more accurate understanding of the evolution of castle architecture and fortification methods, which is especially important for understanding how historical events and social changes influenced the development of castles and fortifications.

CONCLUSIONS

Since the 10th century, the interaction of ancient Roman culture, Germanic customs and Christianity has led to substantial changes in medieval society, reaching its peak in the 13th century. They began to form on the basis of ancient Roman, Anglo-Saxon burgs and Byzantine fortifications, including city walls and towers, adapting to the conditions of Europe. In the early stages, castles were often built of wood. Wooden walls, towers, and palisades were cheap and quick to build but less resistant to fire and heavy attacks. Castles of the early Middle Ages were, as a rule, simple and functional buildings. The main purpose of such castles was to provide security and protection from attacks.

Log walls reinforced with earthen ramparts were often used, which added an additional level of protection. Berkeley Castle demonstrates typical elements of the early Middle Ages, such as the motte-and-bailey structure, the use of moats and natural barriers. The motte was an embankment hill with a tower on top, and the Bailey was an adjacent fenced yard. Moats made access to the walls more difficult and slowed down the advance of the attackers, and towers integrated into the walls strengthened the entire fortress.

The strategic location and design features of the Peñerudes Tower provide important information about the feudal system and defensive structures of that time. The Castle of Canossa is an example of the fortification features of early castles of the early Middle Ages. In its original form, it included the typical elements of defence that characterised the numerous fortified structures of the time. The Castello Firmiano Castle, also known as Sigmundskron, is a large fortification with many reinforcements located in the vicinity of the city. Berkeley Castle, built in the 12th century and gradually reconstructed from wooden to stone

fortifications, is an example of the fortification architecture of the Angevin dynasty, demonstrating the uniform placement of towers along the perimeter of the walls to strengthen defensive capabilities. The construction of a castle with a cathedral in the city of Autun in the 6th century reflects the complex changes in the political, military, cultural, and social life of early medieval Europe, updating the fortification solutions of that time.

The influence of various cultures and peoples on the territory of modern Kyrgyzstan in the early Middle Ages led to the development of fortifications adapted to geographical conditions, including high fortress walls, towers, loopholes, massive gates and moats, as can be seen from the example of the Ak-Beshim settlement and the Chumysh fortress. The analysis allowed assessing how these castles illustrate the transition from primitive wooden defensive structures to more complex and powerful stone castles. The basic canons of fortification of medieval castles were laid down in the early period. The influence of the historical and social context demonstrates how castles continued to develop as symbols of power in the following centuries, up until the 16th century.

Most previous studies have focused on castles of the High and late Middle Ages, not enough examining the fortification and the influence on the development of the architecture of early castles. It also caused difficulties that most of the castles of the early period did not survive until the 21st century, and the number of archaeological examinations of early medieval defensive architecture is extremely small. Further research should be directed to less examined regions and their contribution to the development of castle architecture, such as Central Asia and Eastern Europe.

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Генеза та фортифікація замкової архітектури раннього Середньовіччя

Анотація. Це дослідження присвячене детальному аналізу генезису і фортифікації замкової архітектури раннього середньовіччя, що охоплює період з V по XI століття. Здійснено великий огляд історичних документів, креслень, праць істориків і звітів археологічних досліджень. Дослідження розглядає архітектурні, соціальні та економічні аспекти замкової архітектури, приділяючи особливу увагу впливу історичних подій на оборонні споруди та змінам, спричиненим інтеграцією будівельних методів із різних культур. Основну увагу приділено вивченню еволюції замків від простих дерев'яних укріплень до потужних кам'яних фортифікацій, а також аналізу будівельних методів, застосованих у різних регіонах. Замкова архітектура раннього середньовіччя запозичила багато елементів із давньоримських і візантійських укріплень, як-от вежі, стіни і ворота. Ці елементи адаптувалися і розвивалися в умовах частих вторгнень і нестабільності, що призвело до створення потужніших і функціональніших фортифікаційних споруд. Замкова архітектура зароджувалася поступово, починаючи з простих укріплень, таких як Римські укріплення Отена, Саксонські бурги, розташування яких зафіксоване в списку Burghal Hidage, складеному в IX столітті. Одними з перших типів замків були Motte та Ringwork або схожі за функцією мотт і бейлі, спершу поширені в Англії та Німеччині, що являли собою укріплення на штучних пагорбах і ділянках землі, оточених ровами й валами, які відігравали важливу роль в укріпленні влади феодалів у XI-XII століттях. Прикладом таких укріплень стали вежа Пеньєрудес у Морсині та замок Каносса. Замок Мальборо у Вессексі, замок Берклі та замок Кастелло Фірміано є важливими пам'ятками фортифікації замкової архітектури V-XI століть, демонструючи більш розвинутий підхід до укріплення, порівняно зі своїми попередниками. Отримані висновки є важливими для аналізу розвитку замкової архітектури та розуміння історичних процесів, що вплинули на її формування

Ключові слова: мотт і бейлі; укріплені стіни; оборона; вежі; англосаксонські бурги