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# St. Mary's Dominican Convent in Sigtuna Revisited

## Geophysical and archaeological investigations

By *Andreas Viberg & Anders Wikström*

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A ground-penetrating radar (GPR) survey and an archaeological excavation of the buried remains of the Medieval Dominican convent in Sigtuna (Raä 30) produced new information on the ground plan of the convent and the condition of the buried structures remaining at the site. The site has hitherto seen surprisingly little archaeological investigations, and it is now over 30 years since the previous fieldwork. In addition to the foundation walls of the convent and adjoining structures, GPR also revealed an earlier building phase and a previously unknown lavatorium connected to the southern range. These interpretations were confirmed by excavations in September 2009. A suggestion as to the function of the various buildings, based on comparison with other convents, is offered.

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St. Mary's Dominican convent (Raä 30) in Sigtuna, Uppland province, Sweden, was founded in 1237 and abandoned and demolished during the Reformation in the mid-1520s. The convent church was consecrated in 1247 and is the only Dominican church still in use in Sweden. For over a century it has attracted the attention of many researchers (e.g. Curman 1913, p. 80 ff; Floderus 1941, p. 130 ff; Holmqvist 1947, p. 7 ff; Sundquist 1954; Redelius 1975, p. 113 ff; Strömsten & Svanberg 1976, p. 3 ff; Tesch 1997, p. 21 ff). Several excavations have been carried out in the area, beginning with those by Emil Ekhoﬀ in the mid 1890s. However, the ground plan of the convent has, until now, been unknown. As the layout of a

Dominican convent could vary greatly (Blomqvist 1958, p. 168) a more complete map would be important for understanding the daily life of the Sigtuna friars.

The use of geophysical methods to map monastic and ecclesiastical remains has a long and successful history (e.g. Gaffney & Gater 2003, p. 160 ff). Successful surveys have, for example, been carried out in Sweden at the Skänninge Dominican convent in 2006 (Trinks 2005), the Krokek Franciscan convent in 2008 (Trinks et al. 2008) and the Ås Cistercian monastery in 2009 (e.g. Löwenstein 2010). Although most monasteries and convents were torn down during the Reformation, beginning with the issue of the "Västerås

recess and *ordinantia*” in 1527 (Berntson 2003, p. 93 ff), a large portion of the foundation walls still remain buried below the surface in Sigtuna.

In Sweden, geophysical study of prehistorical remains can be challenging: partly because of heterogeneous glacial till and clayey soils, but also because of the elusive nature of the most common archaeological features (mainly postholes, hearths and pits). The more substantial remains of Medieval masonry, on the other hand, often make suitable targets for geophysical investigation, using techniques such as soil resistivity or ground penetrating radar. These methods have been used in Sweden since the late 1970s (e.g. Bjelm & Larsson 1980; Wihlborg & Romberg 1980; Fridh 1982; Burenhult & Brandt 2002). For a more thorough discussion of the development of archaeological applications of geophysical prospection in Sweden, see Viberg et al. 2011. In a collaboration between the Archaeological Research Laboratory at Stockholm University and Sigtuna Museum, geophysical and archaeological surveys were performed at the convent in Sigtuna during May and September 2009. The purpose of the geophysical investigation was to map buried foundation walls in order to better understand the layout of the central part of the convent. This information was then added to data from earlier excavations in order to produce a more complete picture. A subsequent archaeological excavation in September 2009 tested the geophysical results and assessed the condition of the remaining walls.

#### *St. Dominic and the Order of Preachers*

The Order of Preachers (*Ordo Predicatorum*) was founded by the Castilian priest Dominic de Guzman, who was born in 1170 in Caleruega, Spain (Gallén 1958, p. 174; Lawrence 1994, p. 65). The new order, confirmed in 1216 by Pope Honorius III, was founded as a response to the crusades against the Albigensian heretics or Cathars in Languedoc, southern France (Gallén 1983, p. 14). St. Dominic believed that the Cathar heresy should be defeated through education and the preaching of the word of God (Blomqvist 1943, p. 108). At their first general chapter in 1220, the order decided to renounce all types of income and estates and instead earn their livelihood by

begging. Thus they were called a mendicant order. The male members were called friars instead of monks and wore a black hood with cap, rendering them the vernacular name Black Friars. The order became popular: in less than sixty years the Dominicans founded over 400 houses and convents throughout Europe (Refoulé 1954, p. 7). The Scandinavian province of Dacia, founded in 1228, eventually numbered 31 convents (Gallén 1983, p. 14). A few examples are Lund 1223, Ribe 1228, Visby 1228–30, Nidaros 1228–34, Roskilde 1231/34, Skänninge 1237 and Sigtuna 1237. In the Middle Ages, a total of eleven brother convents and two sister convents were founded in Sweden (Karlsson 1993, p. 117).

According to the Danish *De ordine Predicatorum*, which is a short history of the Dominicans, a first attempt to found a convent in Sigtuna took place in 1220 (Lovén 2001, p. 245). At that time the general council of the order in Bologna sent two clerics, Simon from Sweden and Nicolaus from Denmark, to the town with the task of founding a convent. They followed a rural dean from St. Peter's church in Sigtuna, Gaufred, who had been in Rome to obtain a pallium for the newly established archbishop Olav Basatömer in Uppsala. The archbishop, however, rejected their request which forced the two brothers to leave Sigtuna and take refuge in nearby Sko with Knut II the Tall. There they remained for three years until the first Dominican convent was built in Lund (Blomqvist 1943, p. 110; Gallén 1946, p. 20; Martling 1997, p. 12). A Dominican convent was not founded in Sigtuna until 1237 (Gallén 1943, p. 39; Maliniemi 1947, p. 88; Lovén 2001, p. 245; Redelius 2006, p. 117). According to a letter from the papal legate William of Sabina to the friars and prior in Sigtuna, dated 2 December 1247, the church of St. Mary was consecrated that year (Berthelson 1943, p. 11; SDHK).

As we have seen, the convent was demolished as a result of the Reformation during the mid 1520s (Berntson 2003, p. 68 ff). In 1529, King Gustav I ordered that all Sigtuna's congregations be merged into one and that the Dominican church of St. Mary be used as the parish church (Holmqvist 1947, p. 36). This meant that all the other churches in Sigtuna (St. Peter, St. Olav and St. Laurence) ceased to function as churches. The

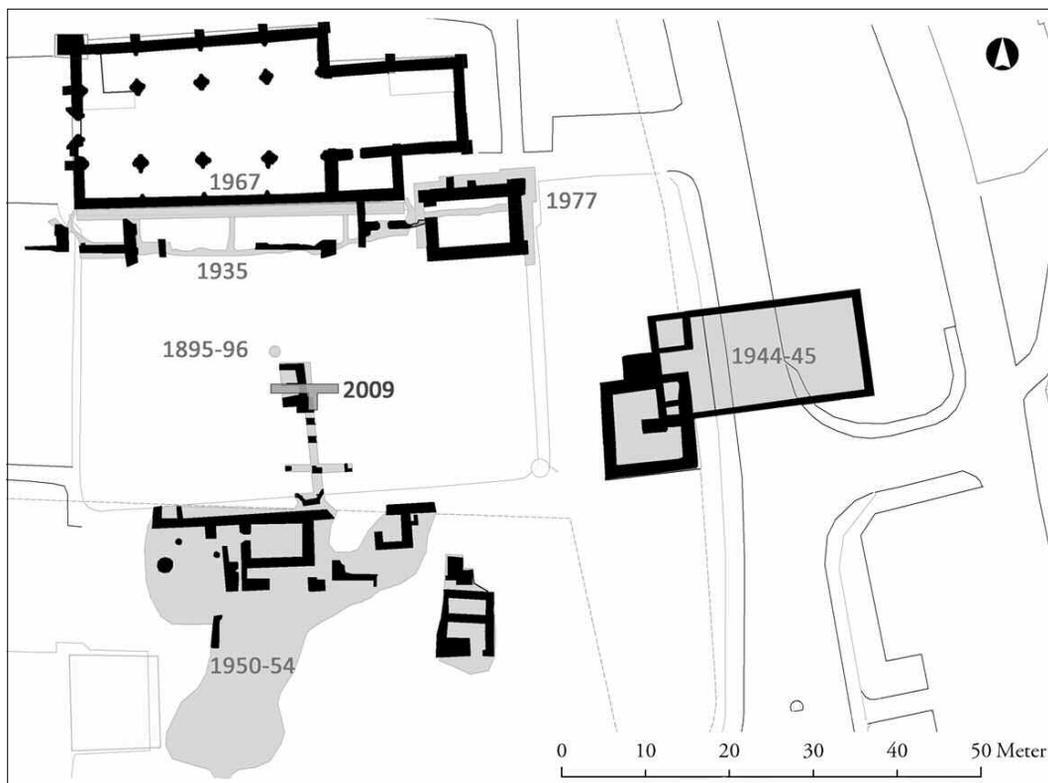


Fig. 1. Excavations in the vicinity of St. Mary's Dominican convent in Sigtuna up to and including 2009.

Dominican friars in Sigtuna had however most likely already left their convent and church at the time (Berntson 2003, p. 115).

#### *Previous Excavations*

The most extensive excavations at the Sigtuna convent to date were carried out in the central cloister area by Emil Ekhoﬀ in 1895–96 (fig. 1; Tesch 1997, p. 23 ff). The only records preserved from this fieldwork are a few plans and maps, and the position of the buried foundation walls was uncertain prior to the geophysical survey of 2009.

In 1935 excavations were carried out at the convent by Eva Bergman (1935), who discovered and documented walls in the northernmost part of the convent. Excavations south of the main convent buildings were directed by Birgit Gejvall in 1950–52 and by Anne-Beate Jonsson in 1953–54 (Gejvall 1952a; Jonsson 1954). A range of small building foundations was discovered and inter-

preted as outbuildings connected to the southern part of the convent. According to one of the excavators, it seemed as if the south-eastern parts of the main buildings had been completely demolished (Jonsson 1954, p. 27). In 1953, a trench was dug from the southern side of the convent northwards, through the main buildings next to the southern wall of the convent church. Among other things, a portal and remains of walls closer to the centre of the convent buildings were discovered. During restoration work in the church in 1967–71, Else Nordahl (1979) documented, among other things, foundation walls when reinforcements and drainage work were carried out south of the church.

The most recent archaeological excavations were done in 1977 by Margareta Hasselmo in the chapter house, recording some previously excavated walls still standing above ground level before they were covered again. For a more compre-

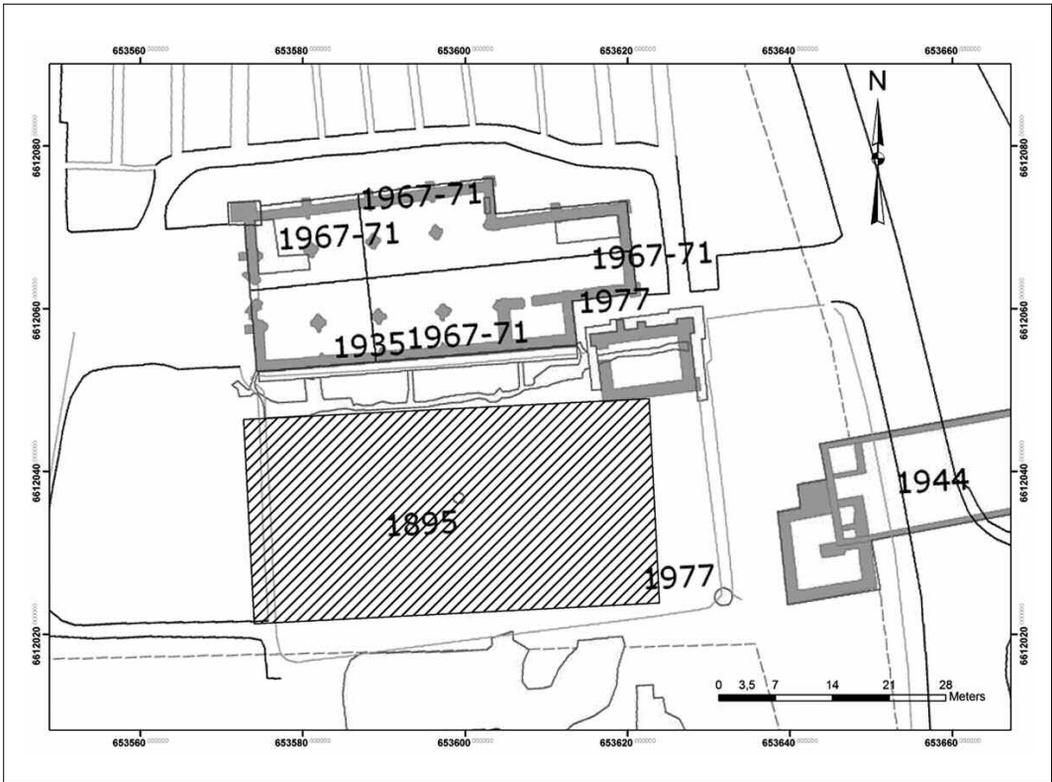


Fig. 2. GPR investigation area south of St. Mary's church (hatched rectangle). Coordinates in SWEREF 99 TM.

hensive list of the small excavations at the Sigtuna convent see Tesch 1997, p. 34 f.

#### *Geophysical Survey in 2009*

A ground-penetrating radar (GPR) is an electromagnetic instrument that emits radio pulses into the ground. A receiver measures the time it takes for the pulse to return to the surface after reflecting off buried objects or soil boundaries. The radar reflections are strongest when the reflecting structure and the surrounding soils have very different electromagnetic attributes (Conyers & Goodman 1997, p. 27).

The surveyor pulls the radar antenna along a predetermined line on the ground surface and the result is a vertical section image containing stratigraphical information about the soil below the line. This stratigraphical image is also called a radar profile or radargram. If the prospector profiles many closely-spaced parallel lines, the

data can be merged into a three-dimensional "data cube". This cube (which is box-shaped but rarely exactly cubic) can then be subdivided into horizontal images called depth slices, which are images of the subsurface at different depths (Goodman & Nishimura 1993; Goodman et al. 1995). To further increase the interpretability of the data, an animation showing the different depth slices one after another can be generated. The depth of objects or layers can be transformed from time (in nanoseconds) to depth (in meters) if the velocity of the radar pulse through the soil can be estimated. These estimations are, for practical reasons, often done using a computerized process called hyperbola-fitting, where a computer-generated hyperbola is remodeled to fit the arc in the GPR data (Conyers 2004, p. 115 f). This is, however, only an estimate, since the soil attributes can differ widely over the surveyed area. A solution that increases the reliability of

these calculations is to fit several hyperbolas from different parts of the area and calculate a mean value. The profiling depth depends on the frequency of the antenna as well as the soil's electrical and magnetic attributes. Generally speaking, a lower frequency antenna will produce a lower resolution picture but a greater penetration depth, while a high frequency antenna will generate a high resolution image to a shallower depth (Conyers & Goodman 1997, p. 40 ff).

The main difference between GPR and other geophysical methods is the GPR's ability to produce high resolution pictures. The instrument can collect dense data and, depending on how closely the radar transects are spaced, different resolutions can be achieved. During research investigations, it is important to survey a site as thoroughly as possible. This means that the distance between the radar transects must be 0.5 m or less to produce a sufficient resolution (Neubauer et al. 2002, p. 155; Leckebusch 2003, p. 216.). The survey at Sigtuna was executed using a 500 MHz antenna and a X3M system from Malå Geoscience. The distance between the radar transects was 0.25 m and the in-line sampling distance 3 cm. Data management, filtering, and hyperbola fitting were done with the data management program REFLEXW 2D/3D. The size of the surveyed area was 50 x 25 m, restricted by the surrounding terrain (fig. 2).

#### *Interpretation of the Geophysical Results*

The GPR results depict the foundation walls of the main ranges of the Dominican convent clearly (fig. 3). The western range of the priory and the cloister walk (Sw. *korsgången*) surrounding the cloister garth are the most prominent features (see fig. 4 for interpretation). The results show that the cloister walk was just over 3.2 m wide at its southern end, and 2.5 m wide in the western and eastern sections. The western and eastern ranges measured 9.6 m in width; their length, as measured from the church's southern wall, were 27.8 m (east) and 29.6 m (west). The eastern range was probably more severely affected by the dismantling of the priory buildings in the late 1520s. Perhaps it has a greater content of brick debris which makes identification of any underlying walls with GPR more difficult. This area

may also have been affected by the excavations in 1895, although as previously mentioned, the full extent of this archaeological investigation is uncertain. The poor preservation of the southeastern part of the main buildings has already been mentioned (Jonsson 1954, p. 27). It is, however, still possible to identify some of the foundation walls in this part of the convent. A possible *lavatorium* is also visible, c. 70–80 cm below ground surface, extending from the southern part of the cloister walk and into the cloister garth. A circular feature found at a depth of 35–47 cm may be a well or a stone-lined flowerbed, placed in the center of the cloister garth.

Several other possible foundation walls are also visible in the pictures. These can be interpreted as room dividers or have other structural functions. It is notable that some of the deeper walls seem to have a slightly different angle from the rest. This may indicate that they belong to an earlier phase of the convent or to older separate buildings associated with the earliest use of the convent (fig. 4, light grey colour). Some very weak anomalies visible in the GPR animation produced from the depth slices indicate that the eastern part of the western range and the western part of the eastern range may contain room dividers possibly for individual small rooms or monk cells, as can be seen in for example the Dominican convents in Aarhus and Ribe, Denmark (Lorenzen 1920 T. I.; Krongaard Kristensen 2000, p. 58). These features unfortunately only produce subtle reflections which prevents a more detailed interpretation, and they are therefore only depicted schematically in fig. 4.

Other strong echoes are also visible in the uppermost time slices, and are probably caused by more recent activity at the site. The area has, for one thing, been used for burials from the 1520s until the 1950s. The cloister garth was also used as a kind of recreational area for the townfolk during the 17th century (Aschanaeus 1612), and some of the GPR anomalies may be connected to this later use. Worth noting is that some of the convent's brick walls were still standing at the time (Aschanaeus 1612). Unfortunately, as existing historical maps do not give any detailed picture of the area, the impact of this later use is difficult to judge.

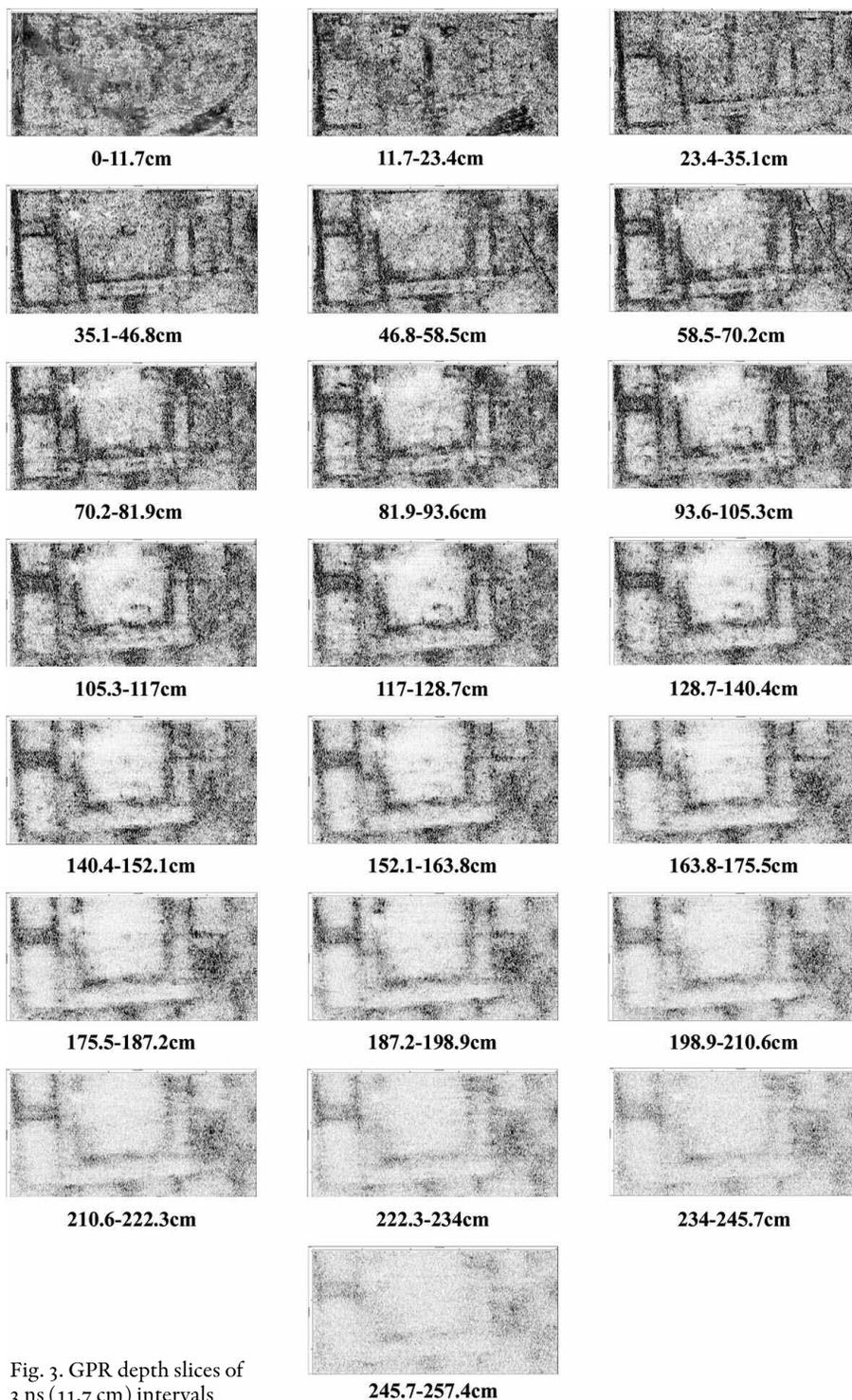


Fig. 3. GPR depth slices of 3 ns (11.7 cm) intervals over the survey area.

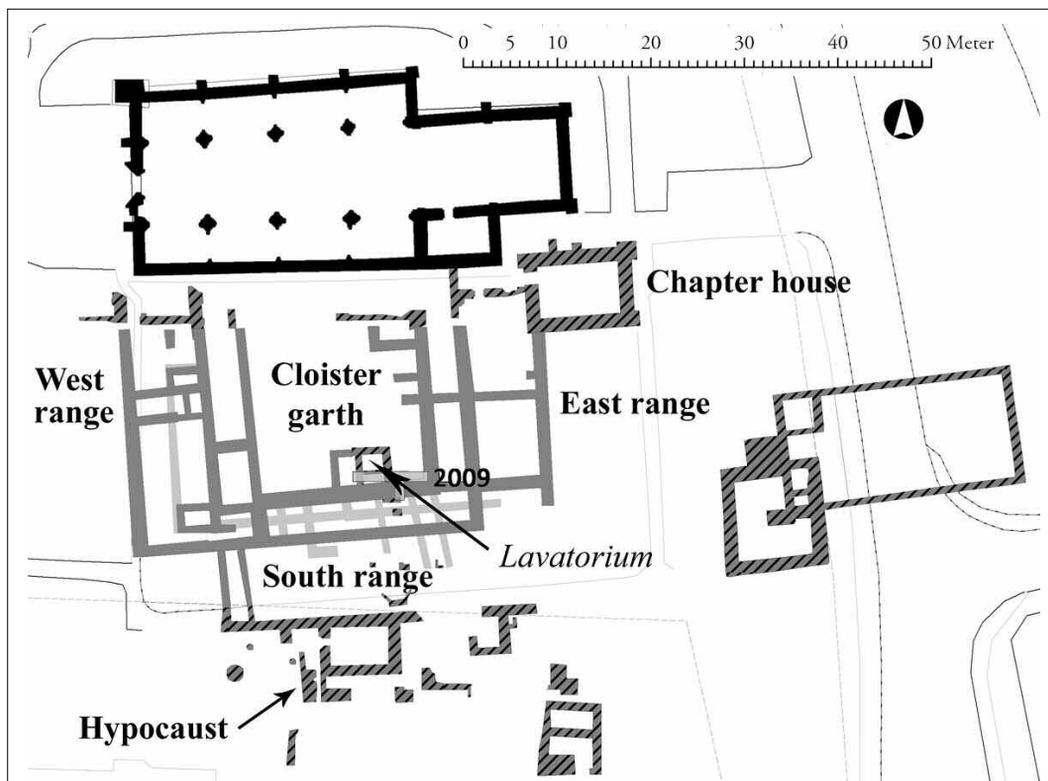


Fig. 4. Archaeological interpretation of the GPR data. Black = Church of St. Mary. Hatched = excavated convent features. Dark grey = main convent structures seen in the GPR data. Light grey = weaker anomalies which have slightly different alignments or are located deeper in the ground.

Some of the recent activities at the site, however, are clearly observable in the GPR data. Along the southern side of the church is a series of lamp posts. The cable connecting them is visible in the GPR data at c. 40 cm below the surface. An additional power cable running south-west from the church is visible in time slice five and six at c. 50-60 cm below the ground's surface. The power cable is also visible in two photographs from the excavations of 1935, when the cable for a lightning rod was buried on the south side of St. Mary's church (Bergman 1935, p. 7, fig 11 & 13).

Interpretations of the various convent buildings and walls discovered with GPR are shown in fig. 4. The southernmost anomalies in the radar data seem to show where the eastern and western ranges connected with the southern range. The southern range itself seems to have been south of

the investigated area. By comparing these results with the plans from the 1950s, the full extent of the southern range can be estimated.

#### *Excavations in 2009*

Excavations were carried out during five days in September 2009 and covered 10 m<sup>2</sup>. The trench was 8 m long in the east-west direction, with a 1 m wide and 2 m long side branch extending to the south (fig. 5). The main goals of the fieldwork were to test the GPR results, investigate the extent and condition of the walls and their foundations, investigate the presence of any cultural layers and the thickness of the demolition layers, and investigate the extent of Ekhoﬀ's excavations in the 1890s.

The trench revealed four or five masonry walls (A-E). In addition to these, part of a stone-

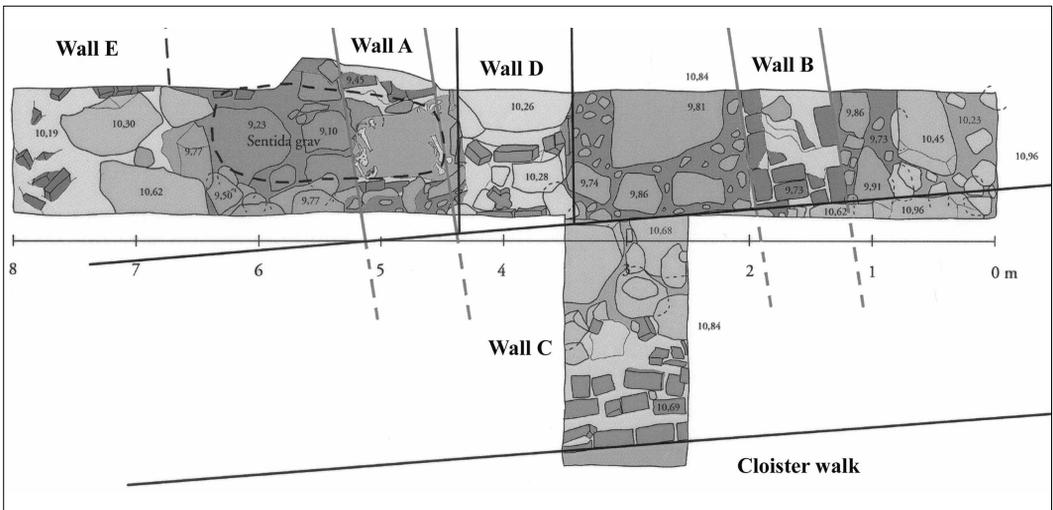


Fig. 5. Plan of the 2009 trial trench with uncovered masonry.

paved walk around the cloister garth, demolition layers from the convent, and a collection of human bones from several modern burials were documented.

The oldest remains consisted of two brick walls, A & B (fig. 5). It is uncertain what part of the convent these walls belonged to. They may, because of their difference in alignment from the other walls, as well as the fact that they continued beneath wall C, represent an earlier building phase or possibly an early separate convent building. Although all the buildings of the main convent were intended to be built at once, they were probably not finished until the 15th century or even later (Blomqvist 1958, p. 174). Such was the case at many monasteries and convents from Denmark and northern Germany as well (Krongaard Kristensen 2000, p. 53), and it also corresponds well with observations during the excavations in the early 1950s (Gejvall 1952b, p. 34). The bonding of the brickwork in the masonry is unclear, but the bricks in the west wall possibly indicate monk bond. The stone-paved walk was constructed partly of cobblestones and partly of flat stones, approximately 1 m across. The date of the cobbled walking surface is uncertain but it was probably coeval with wall C.

Wall C was clearly visible in the geophysical

data. It formed the northern wall of the southern cloister range. This wall, aligned east–west, was 1.8 m thick and very sturdy, suggesting that it had a roof-bearing function. It is therefore possible that the cloister walk was embedded into the main buildings of the convent and formed the outer wall of a two-story building. Such was the case at other monasteries and convents in the province (Blomqvist 1958, p. 147; Krongaard Kristensen 2000, p. 50). The inner part of the southern wall (C) was built in two or three rows, which formed the inner wall of the cloister walk. This part was not fully uncovered during excavation, and so the depth of a possible floor level and the number of courses of brick that remains are uncertain.

Wall D, with a width of 0.95 m, was also visible in the GPR data. The wall was placed directly against one of the granite blocks in wall C. Wall D is therefore younger than both the courtyard and wall C. The most likely interpretation is that what remains is the inner core of a wall, most likely part of a *lavatorium*. In the western part of the trench were parts of another possible masonry structure, called wall E. Interpreting this structure was difficult, but judging from the GPR data, this may be part of the western wall of the *lavatorium*, or possibly an interior wall. The location of

this possible *lavatorium* would be similar to that of the Cistercian monastery at Alvastra (Nilsson 1998, p. 122; Regner 2005, p. 85).

One purpose of the excavation in 2009 was to estimate the extent of Ekhoﬀ's excavations in order to assess the potential for recovering datable material in future research excavations at the convent. This proved to be diﬃcult, but it appears that the demolition layer from the dismantling of the convent no later than 1529 remains only in a fragmentary state. This would indicate that the area has been subjected to extensive and deep excavations. Note that the ground plan presented by Ekhoﬀ in 1895 does not contain any information on the *lavatorium* walls. This suggests that the deep excavations were done in the 1950s rather than by Ekhoﬀ in 1895. If so, then areas that were not effected by excavation in the 1950s may contain datable archaeological material in secure contexts.

However, as the 2009 trench was small and no datable artifacts from secure contexts were found, the presented chronology and development of the main convent buildings must be considered preliminary. For a more complete discussion of the results of 2009, see Wikström & Viberg 2010.

### *The Convent's Main Buildings*

Through comparisons with other Dominican convents in the province, a pattern emerges in how the brethren used the various buildings at their convents. The entrance was usually in the western range, as seen at Aarhus and Ribe (Lorenzen 1920, p. 99). In addition to containing the entrance, this range was home to the novices (Lorenzen 1920, p. 104; Blomqvist 1958, p. 173). The brethren's dormitory was often placed in the range closest to the church's chancel, and above the chapter house (Lorenzen 1920, p. 101). In the case of the Sigtuna convent, that would be the eastern range where the already-excavated chapter house was situated next to the church (fig. 4). It is also likely that the study and the library were situated in the eastern range as this may well have been the quietest part of the convent.

The southern range or the northern range, depending on to which side of the church the main convent buildings was placed, commonly housed the refectory with adjoining kitchen rooms (Lo-

renzen, 1920, p. 102; Blomqvist, 1958, p. 173). The refectory and buildings dedicated to cooking and serving food were traditionally situated as far from the church as possible in order to avoid smells reaching the church (Lorenzen 1920, p. 102). Whether the refectory and kitchens in Sigtuna were in the southern range is uncertain, but finds from the 1950s excavations strongly suggest that they were. In 1950 a small building foundation was revealed containing a concentration of animal bones within a layer of ash, pottery and glass (Gejvall 1950, p. 5). The building seems to have been connected to the southern range (Gejvall 1950, p. 4). A hypocaust was then discovered next to this building in 1952 (Gejvall 1952a, p. 2; 1952b, p. 32 f). These finds strongly indicate that the southern range and the adjacent small buildings were used for cooking and dining as well as for heating at least some of the rooms in this part of the convent. Hypocausts were usually situated near the kitchens or refectories of the monasteries and convents. Such was for example the case in St. Olav's Dominican convent in Skänninge, Östergötland (Johansson 2010, p. 17 ff & refs). The Alvastra Cistercian monastery in Västergötland and the Vadstena Bridgettine monastery in Östergötland are other examples of monastic compounds where hypocausts were found in a similar context, heating a winter refectory on the upper floor of the southern range (Andersson 1961, p. 110; Regner 2005, p. 93 ff). A similar (non-monastic) structure was found during excavations in the Urmakaren block in central Sigtuna in 1990–91 (Ros 2001, p. 93 f; 2009, p. 143 ff). That hypocaust was dated with thermoluminescence to AD 1360±40 (Ros 2001, p. 93).

In addition to these main buildings, a few smaller stand-alone buildings were identified south of the main convent in the 1950s (Tesch 1997, p. 27). Their function is unknown, but one may have been an infirmary, if the infirmary was not in one of the main ranges.

### *Conclusions*

For the first time since the dismantling of the convent, a reliable image of the main buildings of St. Mary's Dominican convent in Sigtuna has been produced. The results of the archaeological excavation are consistent with those of the GPR

prospection, indicating a high validity for the geophysical results. Multiple building phases are visible in the GPR data, although the earliest one, as presented in fig. 5, was not easy to recognize and interpret because of its depth under ground. The high content of brick debris from the demolition of the convent and earlier excavations made it difficult to detect deep features.

The various building phases indicate that the convent was rebuilt several times, resulting in the ground plan that is visible today. The map produced by Emil Ekhoﬀ in 1895 does not reveal the possible lavatorium, and so it is encouraging to see that the GPR survey was able to fill that gap. This also suggests that it would be possible to find datable archaeological material by excavating areas not affected by the archaeological investigations of the 1950s.

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## Summary

The Sigtuna Dominican Convent was founded in 1237 and demolished in the 1520s. In 2009 Sigtuna Museum and the Archaeological Research Laboratory at Stockholm University collaborated on geophysical and archaeological investigations of its ruins. The aim of a Ground Penetrating Radar investigation was to elucidate the convent's ground plan. This was important as Dominican convents vary greatly in their layout. Also, few well documented excavations had taken place at the site. The geophysics were thus intended to integrate the archaeological interventions into a comprehensive plan. They produced such a plan of the main buildings, and furthermore added a possible *lavatorium* in the inner garth, extending from the southern range.

To test the geophysical results and investigate the extent of the interventions done during Emil Ekhoff's excavations in 1895, a small trial trench

was excavated in October 2009. It showed several structural phases indicating that the convent's main buildings have been extended episodically over several centuries. One early phase whose walls do not share the orientation of later convent buildings was visible both in the geophysics and in the archaeology. It may represent a pre-convent structure or an early phase of the convent itself. Apparently Ekhoff did not dig very deeply, despite some suggestions on his field drawings. The possible lavatorium, for instance, is a highly manifest structure but does not feature on Ekhoff's plans. This opens the possibility that untouched Medieval stratigraphy may still remain over certain parts of the site. This must be tested by spade and trowel. The excavation data correlate well with the geophysics which is encouraging for similar work in the future.