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Stefan Bürger

NEW INSIGHTS INTO THE ALBRECHTSBURG IN MEISSEN

Observations on Constructional Innovations in the Period after 1470

The Albrechtsburg was built on the "Burgberg" (Castle Mountain) in Meißen, as a double residency and by order of the princely brothers Ernst and Albrecht.[1] The construction happened in three phases between 1471 and 1489 plus one more period of extension between 1521 and 1524. This magnificent electoral princely building is considered an extraordinary product of the late Gothic period, representing the most sophisticated way of building palaces in Europe.[2] It is the first real *palace* independent of the tradition of medieval castles,[3] or even – although this is not undebated – the first palace building in Germany,[4] marking the moment when for the first time the threshold from a castle, built primarily for defence purposes, to the prestigious residential palace was crossed,[5] an "incunabulum" of the early-modern art of building residences, or as a well-planned building representing the "post-Middle Ages remembrance culture"[6] and, due to its uniqueness when it comes to its mature artistic way of expression,[7] the exemplary building initiating an extraordinary building-cultural quality leap in Central Germany and beyond.

There is evidence for a building-cultural gain in quality connected to this building on many levels. Now, when having a closer look at the constructional innovations it must be pointed out that the building shows also other particularities which, in a way, were the preconditions for the innovation. The palace building was only part of a huge cathedral castle, the electoral palace being an attempt by the territorial power of monopolising the cathedral and of indeed making this visible. For this purpose, the cathedral was in a way integrated into the building complex as a third wing of the palace. The later construction of the bishop's palace could not negate this encroaching and monopolising, it could only reduce the effect by establishing an apparent balance of power on the Burgberg. This meant that the palace building was not just a new princely house but a serious ecclesiastical- and power-political act to readjust the sacral centre. Thus, for the outside world the castle was a lively and, when it comes to territorial power, also momentous measure. It was in principle connected to the highest construction-cultural and construction-artistic demands.

The following, however, is not a discussion of the prestigious, metaphorical and residential qualities of the building. This has been sufficiently accomplished by Stephan

Hoppe's study on the functional and spatial structure of early palace building in Central Germany and by Matthias Müller's study on the palace as an image of the prince.[8] Also, it is not about elaborating on the particular innovative qualities of the art of building and of spatial art, or on the style, on possible transfers of form, on the living comfort afforded by such features as heaters fired from backrooms, or any details such as the rounded steps which allowed for a bouncy, almost hovering way of climbing stairs. Here it was already a constructional innovation that the stair treads of the Great Staircase were not integral parts of the walls and the newel but rested on a twisting vault and were on both sides fixed to the upward construction by iron bolts sealed with lead. Also, the integrated toilets which belonged to each apartment and the water supply will not be discussed, neither will the fortification elements which allowed for defending the new building with the use of fire-arms.

What is interesting here are the static-constructive demands on the building, for example if also fire safety issues were taken into consideration for the protection of the once precious furnishing. Or, it is of interest what was necessary for the stability of the multi-storey building, to enable it to bear the considerable load. Moreover, we should also be concerned with the exclusive aesthetics of the building, and this most of all when refined constructional methods were applied to create these artificial spatial arts solutions.

To make such innovations visible, we may draw on two kinds of sources – although they are limited: 1. The fragmentarily preserved construction invoices and 2. the building itself which was changed for its later use as a porcelain manufactory and then as a historical and remembrance monument of the Wettins. Now, in several steps, individual findings shall be presented which reveal building cultural innovations of the building structure and of a hypothetical construction process. The following analytical results are based on the author's curatorial activities, together with project work by students, in the years 2011/12 in the course of creating a new concept for the permanent exhibition at the Albrechtsburg.[9] Thus, the results are not entirely new but perfectly suitable for judging the constructional significance and, in this respect, high rank of the Albrechtsburg.[10] However, the fact that now some particularities turn out to indicate innovations is a result also of the recent years, as many other buildings have been analysed for similar findings and similar questions have been asked and pursued.

First finding: The special nature of a new building

Other than common for the construction of castles in those days, the Albrechtsburg was no renovated building for which older elements were integrated into a new concept. Instead, the old Margrave castle there was demolished almost down to the bedrock, and the palace was a completely new building.[11] A new building offered more possibilities for the design, in the context of which the neighbouring cathedral was literally the "yardstick" for the new building. This is why the Albrechtsburg does not show any irregular, grown and pictu-

resque overall composition, but the building was the result of strict, definitely organised and purposeful planning. In particular, it can be observed that the height to eaves of the nave corresponds to the roofline of the Albrechtsburg, in the context of which it must be taken into consideration that the nave of the cathedral was once provided with transverse roofs above the aisles, which were concluded by gables.[12] This lively roof construction had its counterpart with the sequence of the high wall dormers of the Albrechtsburg. In particular when looking from the Elbe, the interplay of the axes and references of the new building with the eastern parts of the cathedral can be observed (Fig. 1).

But the rationality of the planning is even more clearly revealed by the ground plan of the first main floor (Fig. 2). If one turns the ground plan around the central pillar of the Great Hall as the centre of the building, it becomes obvious how the wings of the palace, of the staircase and the Kapellenturm are back-to-front referred to the northern transept of the cathedral and the analogous angle of the protruding northeast wing (Fig. 3). In terms of construction, it is absolutely unclear with which special means and surveying methods these regular measures could be determined and measured at the steep slope of the Domberg (Cathedral Mountain) in those days! It might be imagined that one base point was determined at the slope in accordance with the later central pillar, that it was marked by a post and that perhaps measuring cords were fixed to it with the help of which the future dispositions could be determined. This method could definitely be applied even on an inclined plane.

Second finding: On the system of the building phases

The palace building was constructed in several steps. It is a complex of enormously high building elements, each tower-like individual segment – which, however, does not appear tower-like in the context of the overall complex – being provided or concluded with a staircase (Fig. 4). Immediately at the northern side of the cathedral one started the new building of the southern wing, so that already after the completion of the first building phase at about 1477 not only the rooms of this southern wing could be used but also the effectual, functional and power-political combination of cathedral and palace could be exploited (Fig. 5).[13] We must assume that the clients had a particular interest in such a solution. It may be imagined that the state of construction achieved after 1500 was only an intermediate state, that originally the Albrechtsburg was supposed to be shifted westward beyond the fountain (Fig. 6) and that also the northeast wing was planned as a tower (Fig. 7).[14] In any case this stepwise solution offered advantages, for in those days the speed of the construction was determined by the vertical heights of the building elements. The higher a building grew, the more the progress was slowed down. Step by step construction allowed on the one hand for starting other, lower parts while still working on the higher elements. On the other hand, at an early stage the building was provided with several staircases and thus with several vertical ways for the on-going transport of material.

Third finding: The quarry stone masonry

If once the rapid prestigious usability of the building was a declared quality goal of architecture – and given the concept we must assume as much – then construction speed and also construction economics considerably influenced the design of the building. For, the highest architectural demand pursued for building the palace is in sharp contrast to the almost shapeless flatness of the plastered natural stone facades. The extensive use of hewed stone, which was easier to handle, may be supposed to have been a means of guaranteeing the fastest possible progress without any need for time-consuming stone cutting, without lengthy material transport from the Elbsandsteingebirge, and without any effort to move the stones by help of cranes. Stone was quarried in huge amounts and many cartloads of it were delivered to the construction site.[15]

Fourth finding: On the speed of building

That the construction speed must have played a significant role becomes also clear from the construction bills. In contrast to other large-scale buildings, the files in Meißen reveal that the construction site was, among other things, provided with the considerable numbers of 34 stone axes, 18 "Kalkhauen (chalk hoes)", 36 wheelbarrows ("radebern") as well as 36 iron (!) shovels.[16] The number of tools and the assumption that these tools may have been used at the same time indicate a considerable number of construction workers – indeed an indication that one intended to complete the building as soon as possible.

Fifth finding: On the vertical transportation with lifting gear

The bills note also that two new so-called "Kefferseile" were bought when the height of the shell construction required it.[17] These extremely expensive crane ropes allow for the assumption that on the one hand the site was already equipped with old "Kefferseile", i.e. that cranes were already working. And another accounting entry, on the repair of two old crane jibs and the making of a new derrick ("Kefferbaum"), indicates that on the copings of the building at least three "Keffer", i.e. three cranes, driven by winches or treadwheels, were working simultaneously. Then a site office entry lists two "kaczenseyl" (another kind of rope) and furthermore two ropes for hoisting ("renneseyl") as well as two iron (stone) pincers "do man die wergstuck uffzeut (by help of which the workpieces are hoisted)".[18] This finding is somewhat striking, insofar as for the time being we do not know any large-scale construction site in the Upper Saxony region for which there is evidence of more than one crane. It might thus be imagined that the technology alone made the site in Meißen by far stand out from the rest of the country. These days, concerning the prestigious effect, the Albrechtsburg construction site might be compared to that of the Elbphilharmonie in Hamburg.

Sixth finding: On the position of the cranes

The ground plan of the palace reveals that the stair turrets were protruding. This made sense not only for the representative structure and the pathways but also when it came to construction technology. For on these turrets, which were possibly completed earlier than the other masonry, the cranes could be placed. In any case, the joint marks for the roof timbering allow for the conclusion that the construction of the latter was started from these turrets.[19]

Seventh finding: On the production of chalk

Concerning many advanced techniques we lack sufficient information. For example, the bills provide the information that the construction site was provided with four "Kelgen", that is four lime kilns, to produce the large amounts of chalk.[20] We may only assume that these kilns were operated according to the rotation principle, in order for the four operational phases (heating, burning, cooling, removal/filling) to allow for a continuous supply of material.

Eight finding: On the pre-fabrication of workpieces

For the portal walls, the windows, the arch constructions, the wall and eaves cornices, the ribworks, the steps and many other parts, workpieces of Elbe sandstone were used. To allow for their quick making and frictionless mobility, it seems that many of the pieces were prefabricated at the quarries upriver and were delivered on the barges of independent carters. We can only speculate that this practice was following a long and tested tradition along the waterway of the Elbe. In any case, on the one hand the bills distinguished between deliveries of "fuder stein (natural stones)", "stucke (probably ashlars) and small and big "vngehawenn (unhewn)" or "gehawenne werckstucke (hewn pieces)", i. e. hewn and unhewn stones of different sizes.[21] In some cases, the workpieces can be specified: for example, also "gesnytene phosten", i. e. ready hewn workpieces for portal and window casings, were delivered from Meißen to the bailiff at Tharandt for the construction of the palace there.[22]

Ninth finding: The construction of windows or walls

The windows or the wall construction. One highly appreciated particularity of the Albrechtsburg is the structure of the wall construction. It is striking how flatly the windows are integrated into the façade (Fig. 8). This is underlined even more by the very flatly made but richly membered profiles of the window casings. However, the wall is by no means as thin as it may look according to constructional habits, for up to then tracery windows were in most cases built in at about half of the wall's depth. This made the wall look membrane-

like, which it was not, for in the interior sometimes even ever stronger rock faces were integrated towards the upper floors.

These pillars had several functions: on the one hand, like pilasters they were built in the interior to bear the thrusts of the vaults, on the other hand arches were spanned between these pilasters, so that there resulted an aqueduct-like bridge construction to bear the respective ceilings and roofs. For this construction it was necessary to newly organise the constructional relationship between wall and opening, i.e. between wall, vaulted niche and concluding window. Up to then huge window openings, like in churches, had been provided with centring-like mullions and tracery, to be able to integrate a wall-bearing arch (Fig. 9). In case of shifting walls, such as due to basement subsiding, the tracery was able to prevent the arch stones from moving towards the interior and pushing the masonry further apart.

Such a structure was not used in the case of the Albrechtsburg, instead the openings of the walls were closed by robust cellular vaults to absorb the wall load. Towards the interior, each vault was concluded by strong arches. Towards the outside, then the openings could be closed by multi-section windows, so that now the much reduced tracery had to bear only the load of the window arch (Fig. 10). This enormous load relief allowed for big, wide windows, and it was particularly emphasized by way of the atectonic-looking inflexed arch as a novelty. Whether this also allowed for easily removing the mullions, so that in case of attacks artillery pieces could be placed on the full storeys is unknown but at least worth considering.

Tenth finding: Specifics of the roof construction

Late medieval roof structures have been analysed, described and assessed for quite some time, not least to clarify constructional issues.[23] Some original roof timberings of the Albrechtsburg have largely been preserved; in particular the timbering above the southern wing and the construction of the central part of the building, which was ready-made to make the attic habitable (Fig. 11 and 12).[24] The roof of the central part is a single-framed roof. What makes it special is the fact that the masonry of the third floor already makes up a large part of the roof structure. The pillar heads were made in such a way as to be able to bear the rafters and roofings. The ceiling beams of the third floor were at the same time the tie beams of the rafter structure.

Analyses often also document the jointing marks and structure specifics, for example to be able to depict the sequence of the trusses. What is particularly analysed are the constructions as such, sometimes also the corresponding assembly process and designs resulting from the crafts processes. Only seldom, however, it is analysed how the trusses were erected and what consequences this might have for the building design.[25]

We know, for example, that the roof of the southern wing is provided with a truss and that some truss posts were later supported by beams. These truss posts were supposed to bear the load of the widely spanned collar beam structures, to prevent them from giving

way and destabilising the structure. This way it was possible to cover wide spans with unsupported roofs. However, it may also be that the truss once served the purpose of making the montage of that kind of roof possible at all. The lower level of the roof structure above the third floor was constructed as a horizontal truss. This level is concluded by horizontal beams, beams which later supported the collar beams. It is possible that at first the truss posts were erected with the help of their diagonal braces, to be provided with a temporary support for erecting the main elements, like in case of a tracery structure. The long rafters could be placed on these pillars and braces with their collar beams. Only after the heads of the braces and truss posts had been connected at the crest, the truss post was able to also take traction forces. With the roof load being increased as a result of placing the glazed roof tiles, this became necessary to prevent the braces from giving way towards the inside. The braces and collar beams successively took the loads and transferred them to the strong truss posts. As pilasters, stone roof structure, wooden roof structure and probably also the technique of erecting the roof were immediately intertwined and dependent on each other, we may safely assume that already when making the ground plan the master workman in charge, Arnold von Westfalen, knew exactly how to finally construct and erect the roof structure.

Eleventh finding: On the concept of lighting

At first, at a formal, aesthetic level, we must be aware of the fact that there was an extensive use of gorged designs (Fig. 13 and 14). What is their advantage? Round pillars and designs were considered particularly precious and demanding, as they were more difficult to construct. However, they had the disadvantage that, through the simple distribution of light and dark on their surfaces, they might make a somewhat ungainly impression. Just simple, polygonal designs, on the other hand, made sure that pillar shafts produced several shades of grey; however, cubic polygonal shafts looked rather like being parts of the walls, due to their geometric straightness. The solution were grooved polygons, for they at first broke up and dissected the main bodies, and the grooves provided for a variety of shades of grey on the surfaces. This way, light and shadow areas were richly interwoven. In case of the heptagonal bases of the engaged columns this effect was increased by the staggering and twisting of the shafts.[26] The pillar bases look dematerialised and relieved. This contributes considerably to hiding the fact that these gracile pillars of the first floor bear the loads of the other floors as well as the roof structure.

The light design also concerned the façade, making it look delicate, as light and shadow areas were purposefully employed for the design of the surfaces. In the interior, the surfaces of the massive pilasters were grooved, so that the light was refracted into the depths of the Great Hall (Fig. 15). However, these effects were also supported by the structural design. For example, the wide surfaces of the fan vaults refracted the light into the darker parts of the Hall (Fig. 16). And contrary to other, common descriptions, this is no two-span hall but a room centring around one central pillar. Accordingly, different from the two-

span room of the Georgenkapelle in Görlitz, there was no attempt to standardise, by making the central parts higher, those parts of the room which, for reasons of construction and due to their low height, could not do without an additional row of pillars (Fig. 17). Quite on the contrary: the outer rims of the vault were lifted, so the heights of the lunettes were lifted towards the wide windows, or the starting heights of the central pillar were purposefully reduced (Fig. 18 and 19). This resulted in voluminous fan vaults with faceted surfaces that, like the funnel mirrors of the dome of the Reichstag building in Berlin, refracted light into the wide room. To still create a standardised design of the room, the ribwork and the base structure countered this strategy. Sideways, the ribs crossed each other at the bearings above and were led upwards from the engaged columns far below. This way it seemed as if the vault, like the central pillar, was starting far below. Accordingly, the crossed beginners are a hollowed-out column core, by which way the delicateness of the structure is further enhanced and can be used as a decorative strategy even without any structural constraint.

Twelfth finding: The construction of cellular vaults

Significant and conspicuous is the many ways of using the, in those days, new cellular vaults.[27] Even if there is evidence that at the Albrechtsburg they did not appear for the first time, nevertheless it must be stated that they were systematically used there. It is debatable if the invention of this specific kind of vault resulted from modern demands, reasons of stability, economic points of view, new possibilities of architectural hierarchies, or from technological possibilities of building construction and accelerating the completion of buildings. The focus here shall not be on these questions and possible answers to them but only on the structural aspects and the design advantages depending on it.

The jointed cellular vaults had the advantage of refracting the light in a variety of ways like a crystal.[28] According to the inverse square law, light loses its intensity with every metre farther into a room. However, as in the front parts of the room the cells deflect the light, thus making it exploitable for lighting the room, rooms with cellular vaults look clearly brighter.

The above mentioned exhibition project resulted in further research projects in the context of which, headed by David Wendland, the specific design technique and construction technology of the cellular vault was researched. Recently, parts of the empirical experimental arrangement were integrated into the exhibition at the Albrechtsburg.[29] The most significant insights are: that the centerings were less needed for just bearing the temporary payload of the vault as long as it was under construction but rather were also part of a process-accompanying plan and were of significance for shaping and controlling the design. Due to their wider cross-section as a result of their extensive design, the folded cap associations are extremely stable, as due to their folded cap structure and their cross-section per se they are hardly a burden for the masonry.[30]

Thirteenth finding: The use of iron

Not only some visible elements indicate the structural role of wrought iron. The bills also give an idea of how significant forging technology was for the Albrechtsburg (a number of payments "zu scherffen und zu stelenn dem schmiede").[31] The staircase shows edged iron rods not serving as tension rods but as rods for dissipating the weight-bearing forces (Fig. 20). The vault ribs press on the newel, and the iron rods prevent the small pillars from being pressed towards the inside.

It is not clear in which way the portal structure at the base of the Great Staircase is secured by iron anchors (Fig. 21). On the arch crown of the portal, which is similar to the portals of the Landshut St. Martinskirche (St. Martin's Church), there is a buttress which is necessary for taking the weight of the vaulted staircase.

Fourteenth finding: Concerning the role of construction plans

notwithstanding all the rationality and refinement of the building, we may assume that for some parts of the Albrechtsburg plans were needed, most of all to be able to predetermine some important elevation measures.[32] For example, it was necessary to predetermine, by way of sighting out vaults and setting out arches, the ground plan geometries of some artificial vaults and to investigate the different starting heights of the appropriate ribs. Construction plans for the Albrechtsburg have not been preserved. From the bills we only know that table boards were bought which were supposed to be used for Master Arnold's work ("zw sein handel"; "di meister Arnolde zu seim handel diin").[33]

Fifteenth finding: The stones and signs of the vault of the Wappensaal

Finally one more finding shall be pointed to, which does not belong to the construction phase under direction of Arnold von Westfalen. Until 1524 Jakob Heilmann topped the Wappensaal with a loop rib vault (Fig. 22). When the palace was renovated, at the upper side of the vault some ashlars were uncovered which showed scribe marks and letters or numbers (Fig. 23). It was assumed that these signs might have served as marks for the planning or construction process, as planning marks, as transport marks or something similar.[34] The meaning of these signs and lines has meanwhile been clarified.

Often we assume that a vault or ribbing is built from below, starting with the bases, to conclude it with the keystone. However, this has the disadvantage that possible misalignments add up in the upward direction until the centre of the bay and that irregularities manifest themselves where the network structure of the vault was supposed to be densest and most beautiful. Contrary to this assumption, now we know that the stones of the crosspoints, the end points of every rib, were first placed on the stands of the centering. This was exactly the way of proceeding for the construction of the new loop rib vault of the Schlosskapelle in Dresden.[35] However, at first it was of considerable difficulty to adjust the

workpieces to each other on the wooden pillars with the help of customary measurement methodes and devices to control the shape. Thus, probably once the workpieces were provided with iron pegs, to fix the workpieces on the logs, to so position them in two directions while at the same time keeping them turnable and tiltable (Fig. 24 and 25). The flat surfaces of the crosspoint stones allowed for, firstly, adjusting the stones horizontally by help of mason's levels and, secondly, for providing orientation through the scribe marks, to then be provided with a simple means of adjusting the stones to each other. This was exactly the way of proceeding for the newly constructed vaults of the Schlosskapelle in Dresden, only that instead of iron pegs one used a soft mortar bed to keep the workpieces movable during the construction process. Then the rib elements were placed between the crosspoint stones. The rib elements were fixed to each other by help of pegs and filled with mortar instead of sealing them with led.[36] Different from the late medieval technology, one used round bolts of stainless steel instead of edged wrought iron plugs. Finally the capstones were laid without support, the actual vault was closed, thus completing the capstones as the third load-bearing structure after the centering and the ribwork.

Conclusion

The new construction of the palace vault tells us the following. Although buildings provide us with structural findings and the written sources give hints at construction methods as well as connected innovations, the ways in which structures functioned, the framework conditions and most of all the effects of progressive building techniques, crafts and communicative processes on the design of a building can only be worked out by using empirical methods. In the specific case of late medieval vault construction, by the way, this was only possible with the help of digital tools, and only to a limited degree. Finally it shall be pointed out that thus the construction of a building consists of several aspects: 1. the intended building as a theoretical construct; 2. the conditions set by the plan; 3. the crafts processes for erecting the building construction; 4. the static characteristics of construction during work and after completion; and 5. today's architectural-historical and construction-archaeological point of view and the ways in which we theoretically comprehend the construction, today's reverse-engineering technology for tracing these construction techniques. Furthermore, such planning and construction processes were conditioned by a wickerwork of relationships. In the end, this means that, although – and this must be emphasized – the construction was based on a very simple plan and the ways were easily controllable and kept, like it was the case with the subsequent new vaulting of the Schlosskapelle, still empirical aspects and crafts procedures exerted their influence step by step. Then these gradually influential aspects, which could not be planned, resulted in each case in very complex individual designs and on the whole in an artistic spatial design. They make the vault appear to be a seemingly complicated spatial form, for the rationality of the construction performance cannot easily be comprehended just by pure observation, simple re-measuring or appropriate remodelling.

Anmerkungen / Notes

1 Redaktionsschluss für diesen Beitrag war Ende 2016. Jüngere Forschungen und Untersuchungsergebnisse konnten in diesem Beitrag nicht mehr berücksichtigt werden. – Grundlegend zur Albrechtsburg mit weiterführender Literatur Mrusek, Hans-Joachim (Hg.): Die Albrechtsburg zu Meißen, Leipzig 1972; ferner Czeczot, Ursula: Die Meißner Albrechtsburg, Leipzig 1975; Fuhrmann, Dietmar / Schöner, Jörg: Albrechtsburg Meissen, Halle 1996; Donath, Matthias / Thieme, André: Albrechtsburg Meissen, Leipzig 2011; Bürger, Stefan: MeisterWerk Albrechtsburg. Von fürstlichen Ideen, faszinierenden Formen und flinken Händen, hrsg. von den Staatlichen Schlössern, Burgen und Gärten Sachsen, Dresden 2012.

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9 Zur Projektarbeit, den Projektbeteiligten und ihren Ergebnissen: Bürger, MeisterWerk, S. 94–95.

10 Diesbezüglich sei die Sektion zur *Architektur und Baugeschichte zur Albrechtsburg* im Rahmen der Dauerausstellung *Albrechtsburg Meissen* (3. OG) empfohlen. Die Ausgestaltung der Inhalte erfolgte unter Leitung der Staatlichen Schlösser, Burgen und Gärten Sachsen durch das Gestalterbüro Gerhards & Glücker und mit Beteiligung der Zwingerbauhütte (SIB), den Deutschen Werkstätten Hellerau, der Medieninformatik der HTW Dresden und dem EichbergFilm Dresden. Die Inhalte wurden unter Leitung des Autors am Institut für Kunst- und Musikwissenschaft der Technischen Universität Dresden erarbeitet und 2009 von der Gesellschaft der Freunde und Förderer der TU Dresden mit einem Lehrpreis/Sonderpreis ausgezeichnet.

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16 Ebd., S. 96.

17 Ebd., S. 93.
18 Ebd., S. 95.
19 Zu den Dachwerken vgl. Anm. 13.
20 CDSR II, 4, Meißen, S. 91.
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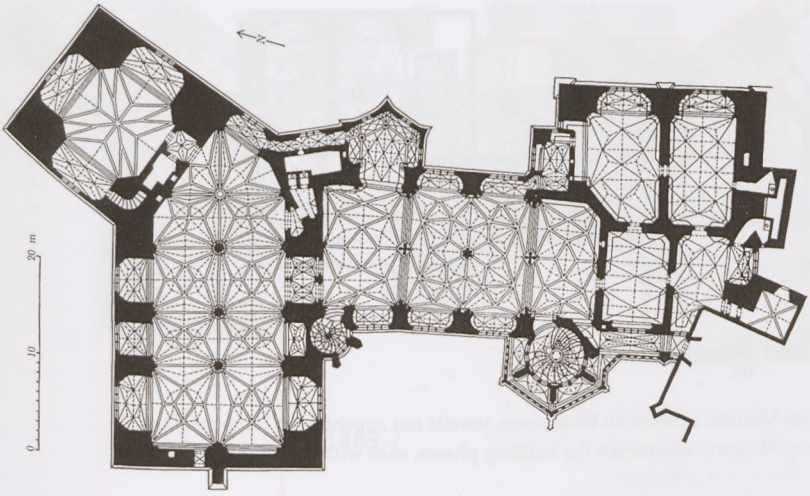
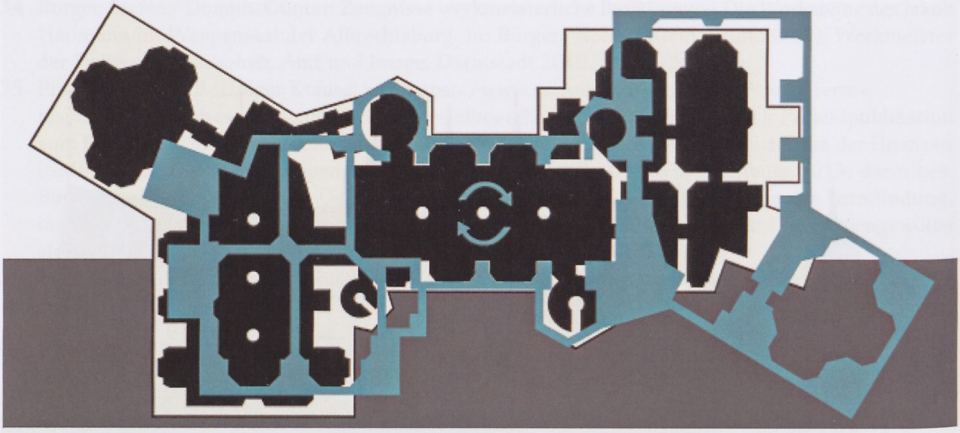
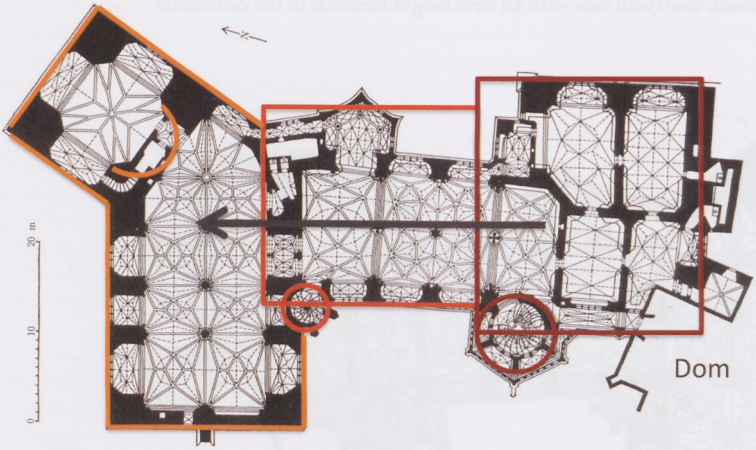
1 Albrechtsburg Meißen, Hofseite mit gleicher Traufhöhe zum Dom
Albrechtsburg Meissen, courtyard side with an eave height identical to the cathedral's



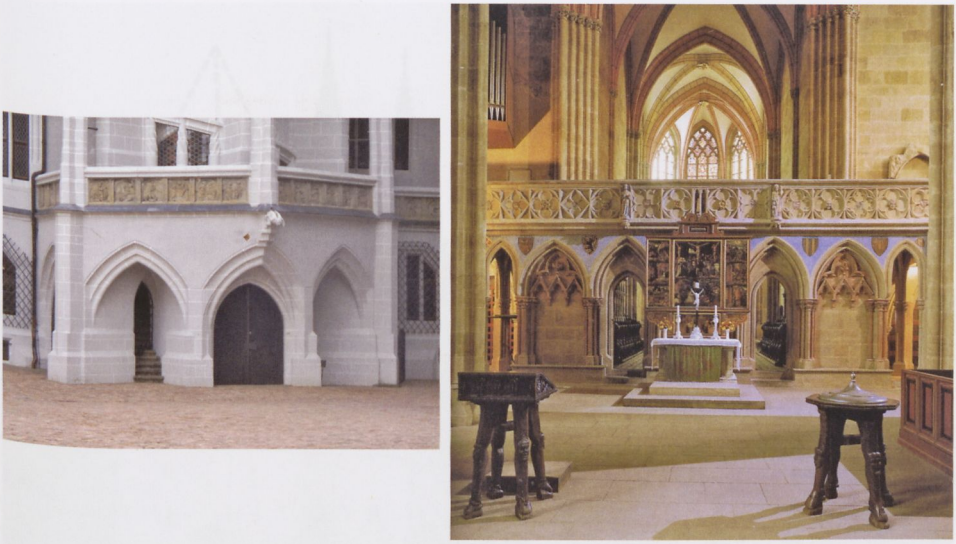
2 Albrechtsburg Meißen, Grundriss des 1. OG
Albrechtsburg Meissen, ground plan of the first floor



3 Albrechtsburg Meißen, Grundriss des 1. OG, gedreht um 180°
Albrechtsburg Meissen, ground plan of the first floor, rotated by 180 degrees

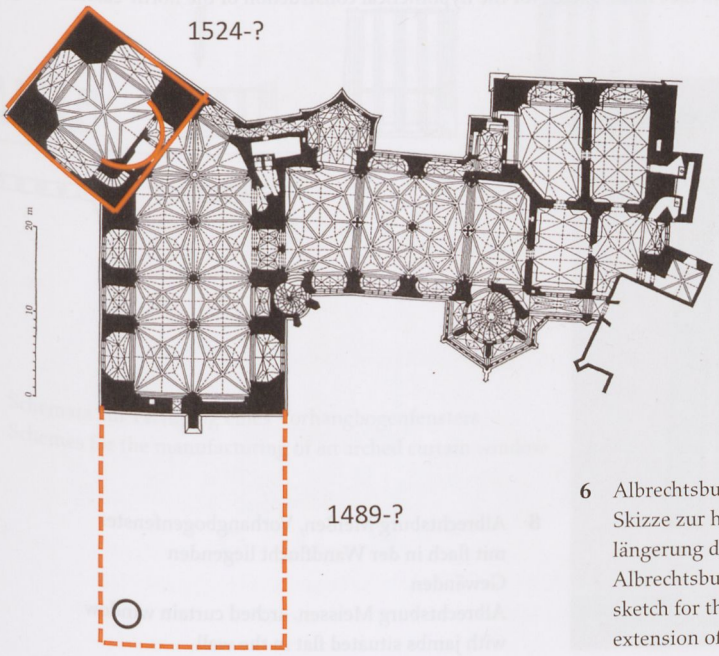


4 Albrechtsburg Meißen, Schema zu Bauphasen, jeweils mit zugehöriger Treppenanlage
Albrechtsburg Meissen, scheme for the building phases, each with the affiliated stairway



5 a+b Albrechtsburg Meißen, Loggien der Hoffassade (links); Dom Meißen, Lettner (rechts)
Albrechtsburg Meissen, loggias of the courtyard façade (left); Meissen Cathedral, rood screen (right)

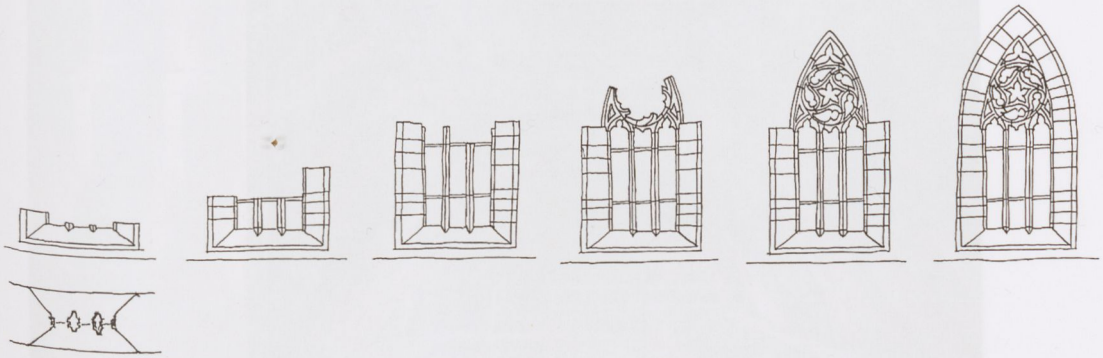
Großer Eckturm und Westbau?



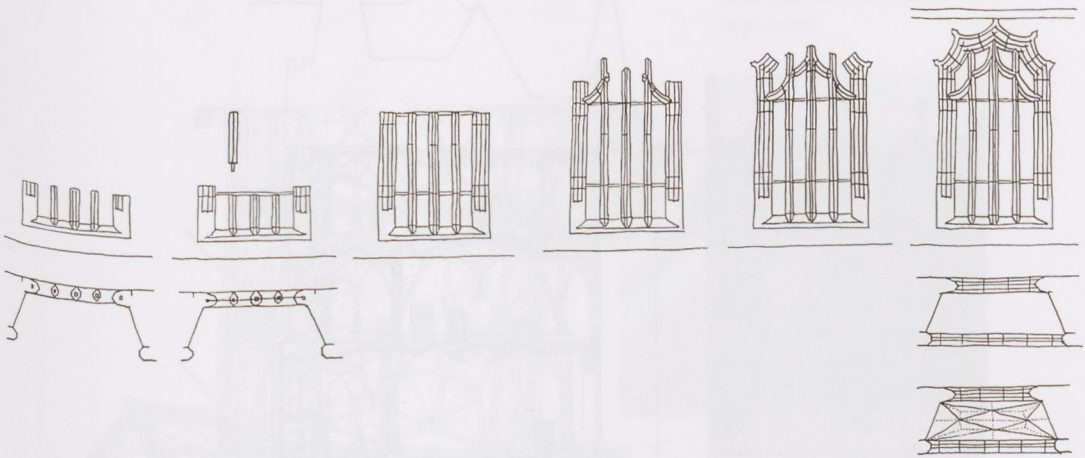
6 Albrechtsburg Meißen, Grundriss, Skizze zur hypothetischen Westverlängerung des Nordflügels
Albrechtsburg Meissen, ground plan, sketch for the hypothetical westward extension of the northern wing

7 Albrechtsburg Meißen, Elbfront, Skizze zum hypothetischen Aufbau des Nordostflügel als Turm
Albrechtsburg Meissen, Elbe front, sketch for the hypothetical construction of the north-eastern wing as a tower

8 Albrechtsburg Meißen, Vorhangbogenfenster mit flach in der Wandflucht liegenden Gewänden
Albrechtsburg Meissen, arched curtain window with jambs situated flat in the wall

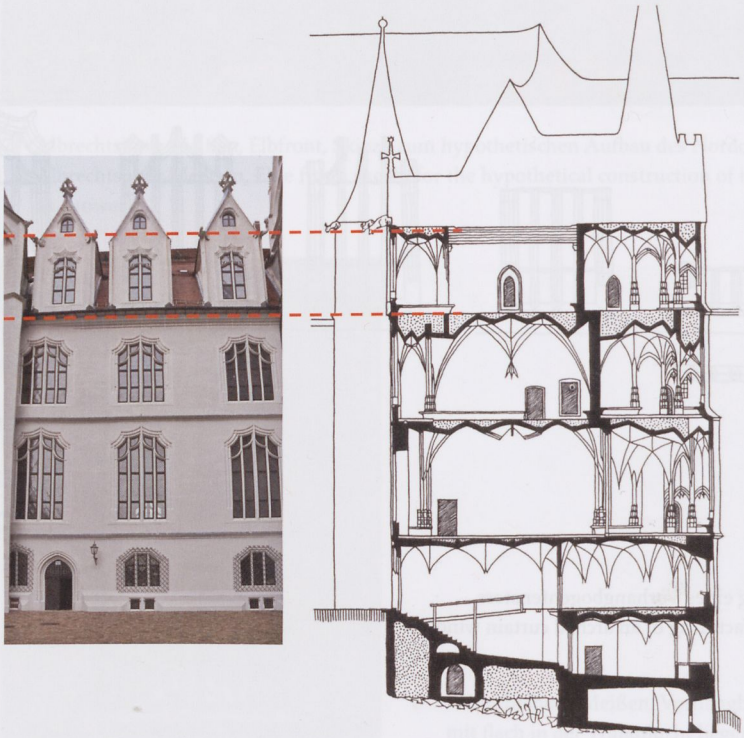


9 Schemata zur Fertigung eines Maßwerkfensters
Schemes for the manufacturing of a tracery window



10 Schemata zur Fertigung eines Vorhangbogenfensters
Schemes for the manufacturing of an arched curtain window

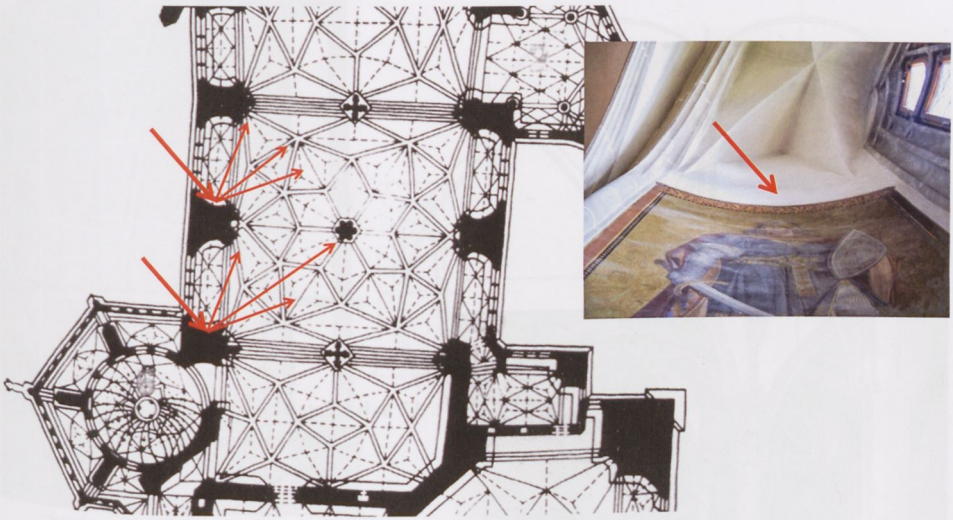
11 Albrechtsburg Meißen, Dachwerk des Mittelbaus
Albrechtsburg Meissen, roofing of the middle building



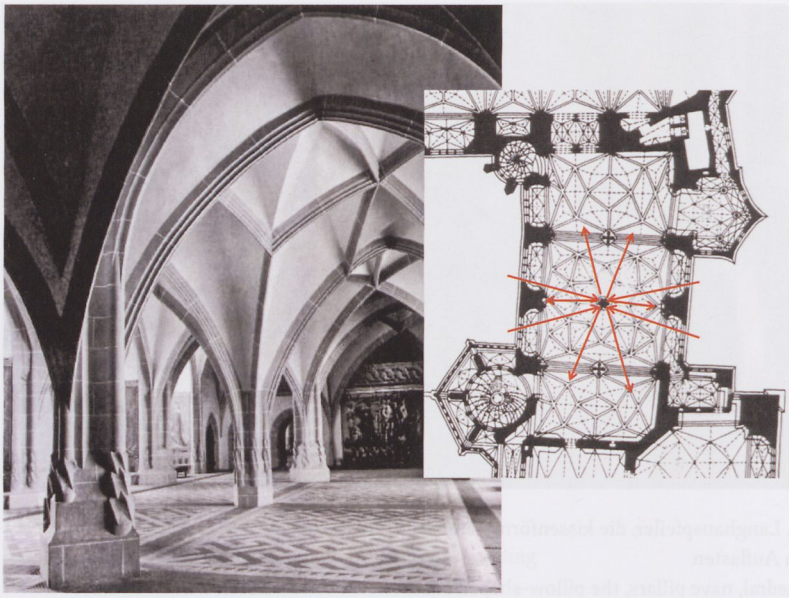
12 a+b Albrechtsburg Meißen, Mittelbau, Querschnitt (links); Hoffassade (rechts)
Albrechtsburg Meissen, middle building, cross-section (left); courtyard façade (right)

13 Dom Meißen, Langhauspfeiler, die kissenförmigen Basen vermitteln ein Auflasten
Meissen Cathedral, nave pillars, the pillow-shaped bases convey a burden

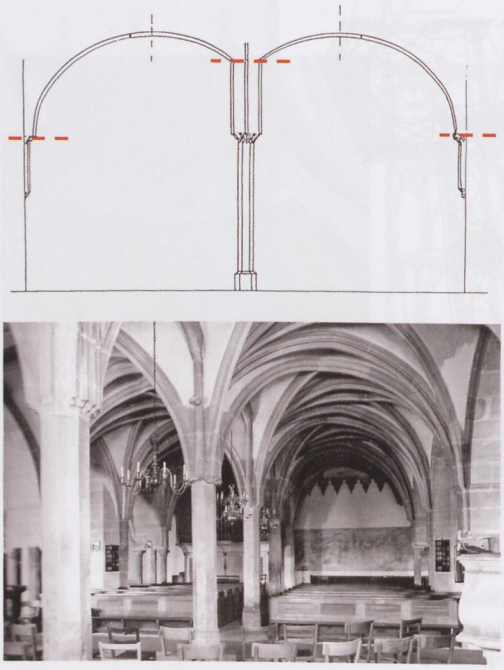
14 Albrechtsburg Meißen, Pfeiler im Großen Saal, die Basen wirken entlastet
Albrechtsburg Meissen, pillars in the grand hall, the bases give an unburdened impression



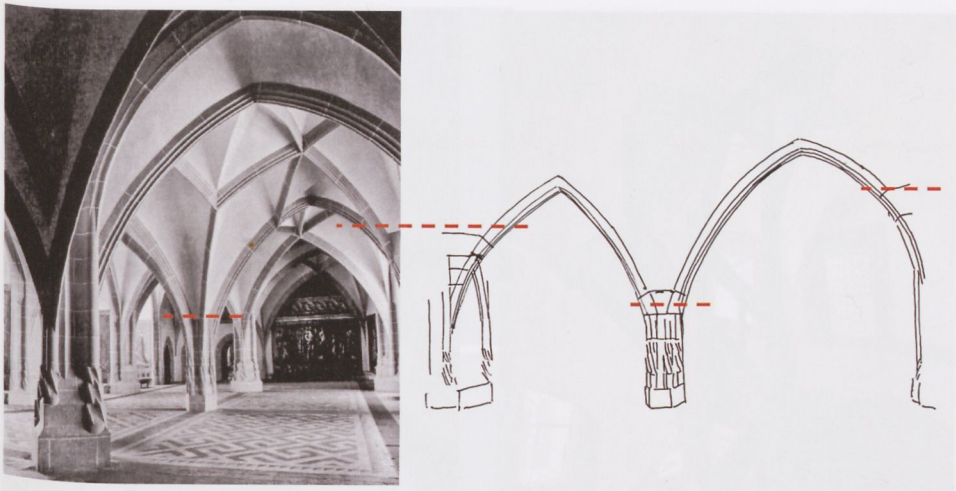
15 a+b Albrechtsburg Meißen, Grundrissausschnitt Großer Saal mit gekehlten Nischen (links); Nische mit Kehlung zur Streuung des Lichts (rechts)
Albrechtsburg Meissen, ground plan section of the grand hall with grooved niches (left); niche with grooving for the dispersal of light (right)



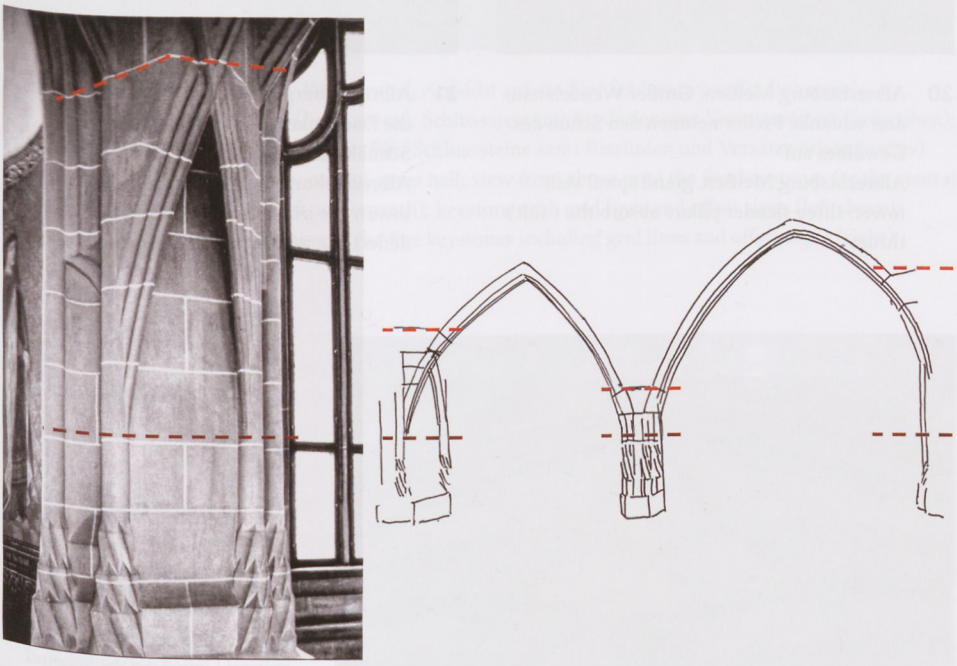
16 a+b Albrechtsburg Meißen, Großer Saal mit Gewölbetrichtern (links); Schema zur Lichtstreuung im Großen Saal (rechts)
Albrechtsburg Meißen, grand hall with ceiling funnels (left); scheme for the dispersal of light in the grand hall (right)



17 a+b Peterskirche Görlitz; oben: Schema zur Raumvereinheitlichung der Georgenkapelle (oben); mittlere Schiffe der Georgenkapelle (unten)
St. Peter's Church Görlitz; above: scheme for the spatial unification of the St. George's Chapel (above); middle naves of the St. George's Chapel (below)



18 a+b Albrechtsburg Meißen, Großer Saal mit Gewölbeanfängern (links); Schema zum Höhenversatz der Kämpferpunkte (rechts)
Albrechtsburg, Meißen, grand hall with vault springers (left); scheme for the height offset of the impost points (right)

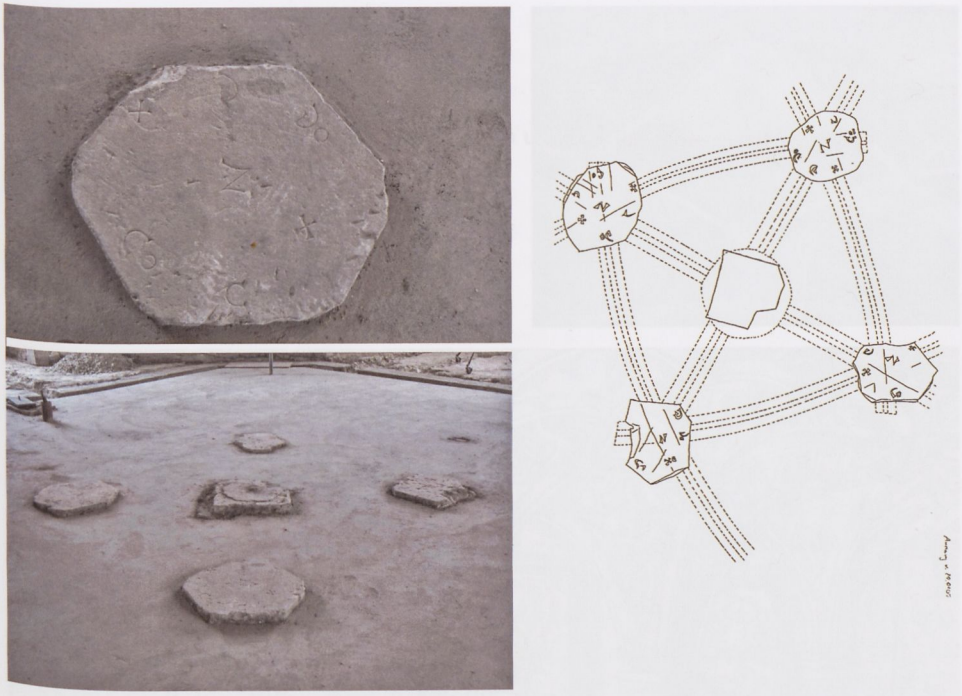


19 a+b Albrechtsburg Meißen, Gewölbeanfänger im Großen Saal (links); Schema zu den optischen und konstruktiven Ansatzpunkten der Anfänger (rechts)
Albrechtsburg Meissen, vault springers in the grand hall (left); scheme for the optical and constructive starting points of the springing stones (right)

20 Albrechtsburg Meißen, Großer Wendelstein; drei schlanke Pfeiler nehmen den Schub des Gewölbes auf
Albrechtsburg Meißen, grand spiral stair tower; three slender pillars absorb the vault's thrust

21 Albrechtsburg Meißen, Großer Wendelstein; die Eisenanker/Druckanker leiten die Schubkräfte des Gewölbes ab
Albrechtsburg Meißen, grand spiral stair tower; the iron anchors / pressure anchors deflect the vault's thrusting forces

22 Albrechtsburg Meißen, Wappensaal; Schlingrippengewölbe mit vier Kreuzungspunkten im Scheitel
Albrechtsburg Meissen, coat-of-arms hall; twined rib vault with four crossing points in the vertex



23 a+b Albrechtsburg Meißen, Wappensaal; Aufsicht auf die fünf Schlusssteine für die zentrale Schlusssteinformation (links unten); Schlussstein mit Risslinien und Versatzzeichen (links oben); Schema zur Positionierung der fünf Schlusssteine samt Risslinien und Versatzzeichen (rechts)
Albrechtsburg Meissen, coat-of-arms hall; view from above onto the five keystones for the central keystone formation (left, underneath); keystone with grid lines and offset signs (left above); scheme for the positioning of the five keystones including grid lines and offset signs (right)

24 Schlosskapelle Dresden, Zustand während der Wiederherstellung des Schlingrippengewölbes mit Stammhölzern als Lehrgerüst
Residency Chapel Dresden, condition during the reconstructing of the twined rib vault with timber logs as centering

25 a–d Gewölbe mit Eisendübeln u. a. zur Applikation von Sternen; Emporengewölbe der Chemnitzer Schlosskirche (oben links); oben Mitte: Schlussstein der Pirnaer Marienkirche (oben mitten); Schlussstein der Hallenser Marktkirche (oben rechts); Ausschnitt aus einem Stich zur Innenansicht der ehemaligen Dresdner Schlosskapelle (unten)
Vault with iron dowels, among other things for the application of stars; gallery vault of the residency church of Chemnitz (above left); above center: keystone of the Pirna St. Marie's Church (above center); keystone of the market church of Halle (above right); section from an etching for the interior view of the former Residency Chapel Dresden (below)