Wedges lost in tradition

Paper presentation to the seminar “Unseen details”, 9 december 2014
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Ed. 2014.10.02

Sometimes a wedge is lost in tradition and cracks emerge in the modern interpretation. This investigation concerns an (eventually) unseen detail in traditional Chinese wooden architecture. The object in focus is a bamboo wedge not bigger than a thumbnail. In comparison to the vigorous Chinese wooden frameworks and its decorative brackets and cantilevers, a tiny wedge may be considered a trifle. The hypothesis in this delimited investigation is that wedges have been extensively used in different intelligent ways, not only in Chinese architecture yet in various building traditions in wood. The wedges serve many necessary corrections of small mistakes and rompish material in the complex cybernetic craft process. The many intentions behind the wedges are difficult to trace as they are hidden in the construction, or had an ephemeral function to control the wooden structure in a process of fast dehumidification and initially stressed compression and composition. The wedge is like the scaffolding in building history: essential in the process of making but concealed in the architecture.

In this text I will present observations of how the critical three or even four way mountings in the colons in connection to the roof structure. I will interpret, generalise and compare the observations with cases from historic wooden architecture in Europe. The location for the cases is Fujian region in China, Maramures in Romania, Russian Karelia and various places in Norway and Sweden. Finally I will discuss the phenomena of continuity and change in tradition, and reflect upon the use of a “Morellian method” in building archaeology i.e. an evidence-based paradigm of clues, recognizing the scientific value of significant details.


Fig. 1.


Fig. 2.


Fig. 3.


Fig. 4.


Fig. 5.


Fig. 6.


Fig. 7.


Fig. 8.


Fig. 9.


Fig. 10.


Fig. 11.

The significant framework in Chinese architecture
Chinese architecture combines elaborate woodworking arts and crafts. A significant element is the transverse load-barring framework with the colons, collar beams and rafters. This transverse framework is combined longitudinal with sills, girts, outer plates and ridges (see fig 8. and 21). The design of the transverse frames and combinations of fillings, doors and windows structure are essential means in the architectural composition, and to the various building functions and social spaces made up within this building system.

However, the most elicited feature may be the compound joinery where the colons meet the girts and beams (see fig 4.-7.). In relation to this joinery we find the decorative brackets and cantilevers, and the many carved symbolic images of Chinese culture. This compound joinery is a critical constructive part to the architecture. Considering the weight from the tiled roof with its raised curved ridges and hips, the surrounding wood to the compound joint is a weak point. How is this problem managed in Chinese building tradition?


Fig. 12.


Fig. 13.


Fig. 14.


Fig. 15.

The compound joinery and its features
A characteristic detail related to the compound joinery is a reinforcing band around the colon placed below and over the joints. There are in Fujian region two common types of bands. One is made of a bamboo chip wrapped in turns around the colon and fixed with iron nails (see fig 15). The other type is a piece of animal skin drawn around the colon and fixed with iron nails (see fig 6.). Both the bamboo chip and the skin are very tight and they have probably been put in position wet and tightened when dried. The type of band of animal skin has large decorative nails and is used in architecture of heavy timber.

The joints connecting the collar beams, outer plates and girts to the colon are regularly in a parallel offset, not to hollow the wood in the very same spot (see fig 9. and 12). Between the offsets a reinforcing band is normally placed. In cases the offset is not possible or at least in very close position.


Fig. 16.


Fig. 17.


Fig. 18.


Fig. 19.

Another way to enhance the construction in this weak point is the cantilevers supporting the joint to uphold the weight from the horizontal outer plates and beams (see fg 9.). The fitting of the cantilevers in the column is hallow, not more than a klack to bear some of the load. The cantilevers are also a decorative element with carved ornament.

The type of joinery in this location, where the colons meet the plates, girts and beams, is the mortise and tenant or some kind of blade (see fig 5 and 11.). The mortise is commonly one third of the colons dimension and measured from a centre-line. In new and in cases old timber the ink


Fig. 20.


Fig. 21.


Fig. 22.


Fig. 23.


Fig. 24.


Fig. 25

from the centre line marker is still visible. The intention of fitting is not to statically fix the joint, rather to locking the joint for traction forces. A dovetail fold or diagonal to the bottom of the mortise, using the weight of the beams to hold position, does this (see fig 10).

Finally, the shape of the colons and beams are intentionally formed wit both aesthetic and static durability functions (see fig 13-14). Firstly, most of the sapwood of the original timber is hewed and planed away. This require large timber to start with and an extended core. The dimension of the log is wider in the middle and narrowed down in the ends as in the European antique Doric columns. In some cases the base and top of the colons are semi-square while the wide centre is round or ellipse-shaped.

Observation and interpretation of wedges
The roof covering the rainbow bridge in Minhou west of Fuzhou has a standard load bearing timber-frame construction (see fig 20-22.). Focusing on the compound joinery at the top of the colons, the material is consistent and the marrow cracks are apportioned all around the wood. In this construction we fins, around the colons in middle of its length, small bamboo wedges. The wedges are placed vertically upended, approximately one eight of the circumference and inclining upwards (se fig. 24-25.). The apportion of cracks in the vertical load barring timber by means of these small wedges make the critical two or even three way joints possible. My hypothesis is that the wedges are intentional and part of a knowledge-based working method. The wedges are strategically placed in the timber with the objective avoid the cedar to open in one or few large marrow cracks but instead in many small-dispersed cracks. The method work for the peculiar construction and the critical compound joinery by the outer plate and collar beam. This significant detail seems to be lost in Chinese building tradition. The wedges are not found in all historic constructions although we can se that the drying process has caused no trouble with single large marrow cracks. This may be explained by the logical consequence of the drying and shrinkage of the wood that the small wedges will fall out.

It is a general phenomenon that many wooden constructions has been reused and repaired through out history. Some misplaced mortises may also be a result from extensive use of prefabrication, and cases where the final location of the material did not correspond to the plan. A notable observation in relation to this is that the parts in the timber constructions that seems to have been renewed in recent time, judging by the color, rate of erosion and mechanical treatment of the wood, have a few but large marrow cracks (see fig. 23). The mortises at the compound joinery are many times opened up by these large marrow cracks. In this new wood there are no traces of bamboo wedges.

The living tradition carried by the carpenters working with traditional timber constructions and restorations are not familiar with the use of wedges placed in the timber. However by random interviews no one shares this observation or reconnects the wedges to an intentional method. Can these all these skilled craftsmen be mistaken? The architectural surveyor and researcher Yu Yu Chang were told by one master carpenter that the wedges were used to get out the humidity from the logs (see fig 16-19). It may be so. The interesting feature is that these small wedges systematically appear in other traditional building contexts in Europe. Some use of wedges are known and practiced among an elite of highly skilled craftspersons, but some of wedges seem also here to be lost in tradition.

Wedges in North and Central European timber building constructions
In European wooden building traditions, some uses of wedges are known and practiced and others seem to be lost in tradition. As I initially stated, many uses of wedges in traditional wooden building has a hidden position or ephemeral function in an initial stage of decompression. Below I will present and discuss observations of different uses of wedges, interpreted as part of an intentional building method in structural load barring timber constructions. Wedges used in fittings of doors and windows or secondary constructions are excluded, as well as for scaffolding and various mounting arrangement for storage. A common use is to lock tenants, bades or dovetail joints with a wedge to widen up the material as a locking (see fig. 26-28). The explanation of wedges as a symbolic practice is also excluded, for instance the narrated old practice to put in wedges in log timber to prevent from toothache. I do not state that symbolic material practice of this kind does not exist, but it is an easy way of reasoning when there are no other explanations at hand.

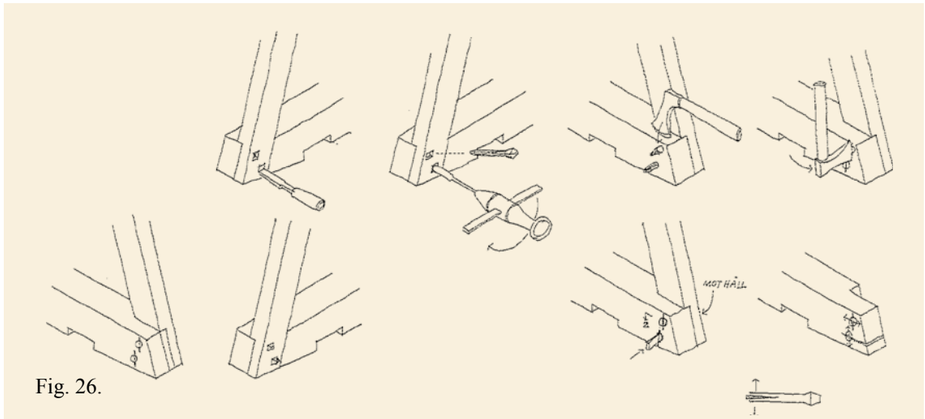

Fig. 26.


Fig. 27.


Fig. 28.

A possible classification of wedges, as intentional building method in structural load barring timber constructions, on basis on observations, is:

- to apportion the marrow cracks in the timber,
- to open and dry out the timber,
- to fill marrow cracks to obtain a flat surface eg. for wall painting
- to control the composition and compression during the process of drying.
- to set the plumb line of a log timber wall by adjusting wedges in the dowels, and finally
- to direct the marrow crack into one large crack with an intended position.

Many different types of wedges have been observed and interpreted in Swedish medieval corner timber constructions. The on-going full-scale reconstruction of the lost14th century wooden church in Södra Råda (fig 33) proceeded by investigations of the ten remaining medieval corner timbered churches as well as in some tithe-barns (fig. 29). Small thumbnail wedges made of pine tree are found sporadically in the interior timber walls (see fig. 30-31.). The wedges are placed apparently random in the longitudinal marrow cracks. However, the cracks are usually still large, so an eventual systematic *use of wedges to apportion the cracks* might not have worked sufficiently. A possible intention could be *to open up and dry out the timber from moister*. The medieval church timber architecture uses square hewed logs, and it has been observed that the top of the logs sometimes is concave shaped, probably unintentional and mistaken but nevertheless creating water pockets. Wedges could be a way to lead the moister out.


Fig. 29.


Fig. 30.


Fig. 31.


Fig. 32.


Fig. 33.


Fig. 34.

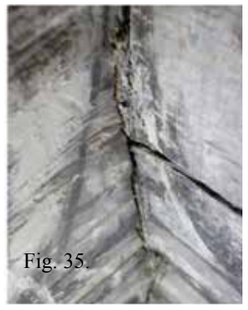
Fig. 35.


Fig. 36.

A kind of wedge that has been observed in recent surveys (Melin et.al 2013) is fitted all along the horizontal marrow cracks (See fig 32, 37). This wedge is about one cubit long and an inch wide. The type is seen only in wooden churches with interior religious paintings on the timber wall. In some cases the interior wall has also been shaved by axe after its construction. Probably this post-construction shaving and wedging has to do with *the preparation of a good foundation for the master-painter*.

A third type of wedge has been observed in the church of Granhult, the oldest wooden building in Sweden from 1217 AD (fig 34). In the upper part of the tall log timber walls we find hundreds of wedges put in between the horizontal logs (fig 37-39). The wedges have been placed and compressed *or* driven in the splice afterwards. (The wedge is directed with an angle slightly turned upwards. The most damage on the wood is made in the lower log.) A preliminary hypothesis is that the scribing of logs in the upper part was not as elaborate as in the lower parts, where the parishioners were. It is notable that the best timber quality and largest size was selected to the lower parts. The assumption put forward here is that the under-cut and scribing was roughly made or even without scribing on the logs in this upper part of the wall. Nevertheless, the weight from the roof construction compressed the logs just enough, as the V-shaped undercut leaves a compressible seam at each side. *To avoid tilting of the wall during compression, wedges were put in the gaps.*

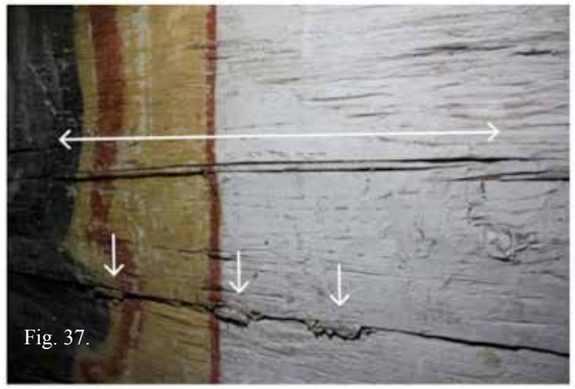
Fig. 37.


Fig. 38.

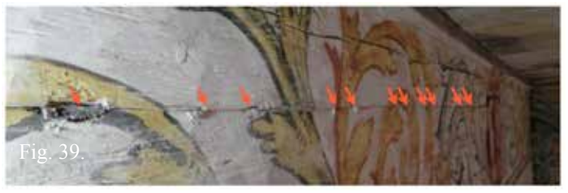
Fig. 39.

Another common and known use of wedges to avoid tilting and keeping the plumb line of a log timber wall is *to adjust the dowels by means of wedges*. In log timber tradition both the corner joints and the wooden dowels fix the horizontal logs. Before the hard steel drills came in serial production in 19th century, a type of spoon drill was used to make these dowel holes. The drilling was exhausting work and the depth of the hole was minimized. Today the drill-hole is made from the top and all through first the log and into the one below. Traditionally the location of the dowel was marked with a small nail and the hole was drilled in two separate procedures: one

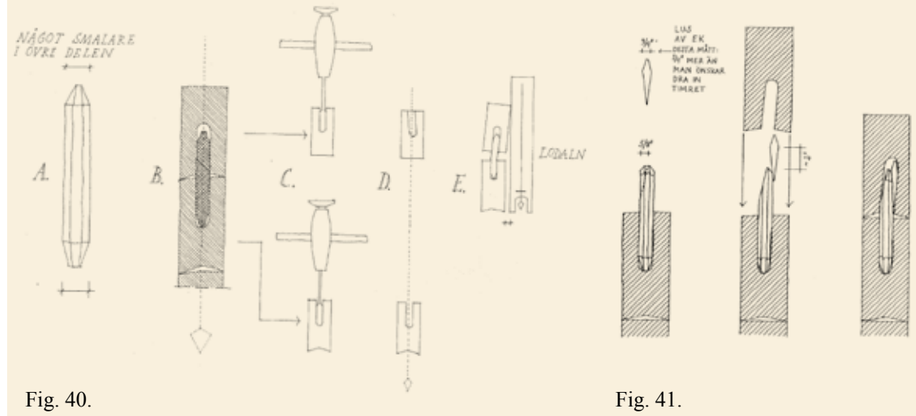

Fig. 40.

Fig. 41.

part in the upper log and one in the log below (fig 40). By this method, the hole was not always in plumb line, and then, when the dowel is put in position, the logs will tilt. Even if the holes are just right in plumb line, the scribing may be inaccurate and causing a wall tilt. In these cases, it is possible *to adjust and align the plumb line by putting wedges and turning the dowel in a sought direction* (fig 41).

An interesting feature seen in cases in round timber building from Russian Karelia and Archangelsk is that *the dowel is not round but shaped as a flat double-directed wedge* (see fig. 42). In this case the builder does not need a drill, which may serve the one with few production means. The wedge functions as a tenant of a mortise cut by axe. The mortise is more of a pre-cut, and the joinery give direction for the marrow crack in the very plumb line centre of the timber wall. To intentionally direct the marrow crack downwards in the centre of the log is have also been practiced in Norwegian round timber tradition yet only with groove cuts and not by wedge shaped dowels. The method will prevent large cracks in the outer surface that may moister the building.

Fig. 42.

Fig. 43.

Fig. 44.

Fig. 45.

Fig. 46.

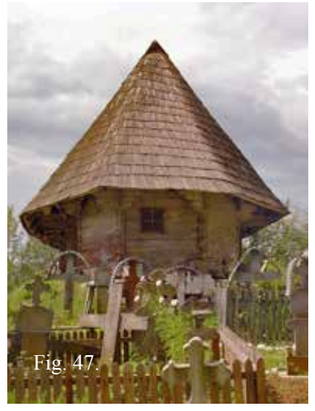

Fig. 47.

Fig. 48.

A last example of intentional uses of wedges is based on observations in Romania, both the Wallachia in the south and Maramures in the north. These types of wedges are especially notable in the magnificent church buildings (see fig. 43), but also documented in modern log timber production. Wedges are continually put along each horizontal log in the process of timbering, while the corner joint is made all tight (see fig. 44-45). The intention according to local craftspersons is to create pressure on the chain of corner joints. Why? No really good answer was given or comprehended. The tradition was the main reference. A possible interpretation could be that the weight from the heavy and steep traditional roofs is led through an outer plate in parallel offset to the timber wall (see fig. 47-48). All the weight of the roof conducts via the plate down to the corner joints. As the corners are heavily compressed, *the wedges in the wall logs may ease the negative affect by oblique or lateral forces in the building system during compression*.


Fig. 49.


Fig. 50.


Fig. 51..


Fig. 52.


Fig. 53.

Wedges lost in tradition

A craft is not just a special way of doing things. Each craft is complex interwoven with the history and the values of the society where the craft is practiced. To each craft belongs a tradition. The concept of tradition involves representations, expressions or traditional knowledge and skills that are transmitted from generation to generation. Tradition is something living in a practice. Every tradition balances between continuity and change, facing contemporary possibilities and demands from modern society. The question is when and why a craft tradition is broken?

In Romania the tradition has been fragmented and the use of wedges have become dysfunctional. At least in modern log timber building. A problem in the modern interpretation of the Romanian wedges is that the roof in modern log houses is a light construction. The truss is light as the common tin roof. There is no outer plate in parallel offset to the wall, hence forces from above is apportioned all along the horizontal logs. In modern production of traditional log houses, the timber structure is one craft and other craft professions complete the house with doors, windows, floor and roof. The knowledge of the traditional use of wedges is fragmented, resulting in a dysfunctional log house where the wedges create gaps in the walls (see fig. 46). The wedges are living in practice, but nevertheless lost in tradition.

Several of the uses of wedges found in historic wooden buildings in Sweden are not part of the living craft tradition. The traces tell us that the builders in history had intentions using this seemingly insignificant element of construction. The interpretation in this small investigation is that wedges are unseen but significant details in the structural wooden craft. It serves the many necessities for corrections in the complex cybernetic craft process.

An interesting turn in Chinese wood building tradition has made the function of the wedges more or less obsolete. In the last ten to fifteen years the traditional cedar has been replaced by rainforest woods like mahogany or else like (see fig fig. 49-50, 52). These types of hard woods are massive and do not open in marrow cracks in the same way as cedar or pine wood. The forgotten knowledge of wedges to apportion cracks and preserve the consistency of material in the compound joinery in the load barring framework has, in this new tradition with hardwood timber, has become irrelevant.

Reflections on the methodology

These observations are made within a scholar tradition of building archaeology, using close up survey, readings and excavations of the horizontal historical layers. The interpretations emerge in dialect with survey and measuring and are represented in measured drawings. The methodology may give empirical platforms for comparison and triangulation with other source material, that from one or many theoretical perspectives may elicit the human, cultural and societal relations by means of materiality (Almevik 2012).

The practice of the methodology draw back to early art history and the “Morellian method”. The Italian art historian Giovanni Morelli developed a method in late 19th century to attribute works of art from a paradigm of clues. The contemporary method of attribution in museums was focusing on the artist’s general characteristics and the most striking stiles and figures. Morelli recognised instead the copy from the original by seeing the negligible details with little influence of the general characteristics of an art-school, as the shape of fingers and lobes of the ears. A contemporary historian hat has elicited and developed the scientific paradigm of clued is Carlo Ginzburg (Ginzburg 1984). He investigates the Giovanni Morelli, Sherlock Holmes and Sigismund Freud as practitioners of an epistemology based on clues.

The methodology is not strictly inductive or deductively driven by hypothesis but rather abductive. The abductive method or retroduction of clues is based in semiotic pragmatism, making the best possible inference in account of an observation. The abductive building archaeology brings a dialectic process, interlinking theory and observations, by testing and contesting possible causes or complex relations in dialogue with observable effects. A key is the recognition of negligible details, contesting the obvious fact that someone has done something in this materiality by intention. It ma be a tiny wedge not bigger than a thumbnail. To quote Aby Warburg: “God is in the detail”.

References