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Reed as building material – renaissance of vernacular techniques

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Abstract

Reed and grass are widely used in many traditional building cultures all over the world. They are easy availability and good material properties have made them a popular component in roof, wall and other constructional parts of houses. In some areas whole buildings are built out of reed, and in other areas again it is used in combination with a variety of other, mostly natural, building materials. After presenting different examples of the use of this special material from Oceania, Asia, Africa and America, we will focus on the harvest, processing and use of reed in the middle-European region.

The use of reed in traditional architecture is mostly connected with the lowland regions of Europe, as in mountainous areas wood as construction material and especially wooden shingles as thatching were always given advantage over the slightly more ephemeral reed. Also the fact that in mountain areas less reed is available and in the lowlands wood is scarce led to the evolution of a very typical appearance of lowland villages with reed thatched houses.

It is important to note, that according to availability of reed and peculiarities of agricultural production, in some areas rye straw could even be more important than reed. Usually in more hilly and mountainous areas rye straw was more easily available. However, with the introduction of mechanised harvest processing the resulting rye straw was not of good quality anymore, and therefore from the beginning of the 19th century reed was the only organic thatch alternative.

Especially in the Carpathian basin and around Lake Neusiedl the use of reed has a long tradition. This tradition continues until present day, albeit on smaller dimensions and somewhat transformed compared to the „ethnographical" past, when only natural materials were used in rural architecture.

Today it is at least as expensive to cover a building with reed as with ceramic tiles. While of course ceramic is fireproof, there is a discussion going on concerning overall fire resistance qualities of reed thatch. However many people feel still attracted to the peculiar appearance of the more traditional material, and commission the use on newly built houses. In some special areas, which are under cultural heritage protection, only the use of this traditional material is allowed.

Even so, the total number of buildings with reed roofs has decreased to a small amount, which means, that there are only a few craftsmen left, who are still adept in reed thatching techniques. One aim of our research was to get an insight into the working procedure of these craftsmen.

Interestingly the modern building industry also uses a number of products manufactured out of reed – usually they are used as composites in combination with other building materials – reed mats as reinforcement under plaster layers or to enhance insulation properties.

As Lake Neusiedl is not only a local, but also a major source of reed for the middle-European region (a substantial part of the harvest is exported to the Netherlands and Germany) the traditional and present use of reed as building material in its surrounding is worth to be studied more thoroughly.

Fig. 1 House with palm leaf thatch, Samoa Islands. The building has no wall, only plaited screw pine mats, which can be lowered if it is raining, 2002.

1 Organic Thatch

The use of plant parts as materials to cover the roof of buildings is widespread in traditional architecture all around the world. Moreover, it is evident that the first buildings used by humans (apart from ice-age hunters´ skin tents) had to be covered by some kind of grass or leaves. This means the building techniques we will examine in this article are as old as the house and human habitation itself and have evolved therefore over extremely long periods of time. So there must have been many occasions and possibilities for the emergence of different techniques and certain variations in their application. However, we will find that there is only a rather limited scope, especially when dealing with thatching techniques which involve grasses. These building procedures also have not altered much during the changes which occurred in building industry during the last 100 to 200 years (and presumably did not alter too much before).

In fact we can state, that the use of plants and especially grasses as thatching is still a technique, which can be applied even to modern houses and which only evolved a few variants during its extremely long history. Moreover methods in different geographical regions seem to be similar. This suggests, that the function (protection against wind, rain and snow) of the roofing combined with the properties of the material (shape, size, weight, structure, etc.) only allows for a very limited amount of processing techniques (in contrast for example to wooden constructive connections, where a high number of varieties of wooden joints are known).

Apart from wooden shingles (which we will not consider here) there are following thatching techniques involving plant parts:

- use of branches with leaves (e.g.: palm leaves all over the tropics, special tree leaves on Fiji)
- use of leaves only (e.g.: screw pine in Oceania), Banana leaves in Ethiopia
- use of grasses:
    - different kind of reed or reed-like grasses (Phragmites, Typha, Papyrus)
    - (rye) straw
    - other grasses
    - bamboo as shingles or reinforcement on roof ridges

Apart from the widespread use of palm leaves for cheap and short-lived roof thatch all over tropical regions of the world, the highest percentage of roofing material used in traditional architecture consists of different species of grasses, mainly species thriving in water, commonly referred to as some kind of “reed”.

The use of the grass bamboo is a special exception: it is split and processed to shingles, giving a fine roof covering. However, this structure is completely differing from other grass thatching techniques.

Also of special interest is the fact, that reed (especially papyrus in Egypt and Iraq) is sometimes not only used as roof covering, but also in limited ways as structural, load bearing member in (quite large) huts or in case of walls and fences.

The use of rye straw was very widespread in Europe before the appearance of threshing machines, but with commencing modernisation in agriculture and changing rye cultivars no suitable raw material was available any more. Although from time to time initiatives are started which involve the sowing and hand-threshing of old cultivars of rye the produced

Fig. 2 Palm leaf thatch for sale at a store in Senkang, South Sulawesi, 2011.

material is used for the maintenance of one or two historical buildings only. Contrary to reed thatching, which has been able to hold on to a certain (albeit limited) importance and market in modern building industry, rye thatch can be regarded today as a purely historical phenomenon.

2 Problematic structural Parts of roofs and measures to prevent the damage of roof structure

In the course of this paper we would like to give different examples, how organic thatch and especially grass and reed are used in traditional building culture all over the world. To be able to understand the peculiarities of each structure, thatching material and its application, it is important to have some background information on basic principles of roof constructions.

Every kind of thatch (with very few exceptions as we will see) is applied to a roof in a way, that those parts which are positioned higher up the roof slope cover those which are further down, shielding them from as much rainwater as possible. Usually there is also a considerable overlap between these parts. Therefore thatching activities always start from the lowest part of the roof, and are finished at the top. Sometimes, when thatch is made up of shingle-like units of grass or leaves there is also a displacement of each following layer by half a unit. This measure is also essential to produce a more rain-proof cover.

The pitch of the roof is also used to reach rain proof conditions: The pitch of houses with reed cover can be lower than the roof-pitch of buildings covered with treaded straw, where qualities of water drainage are inferior to that of reed.

The ridge part of the roof is especially prone to damage by wind and weather and is usually in every geographical region reinforced by special means. These special measures very often are executed with care and emphasis, and in very many cases the practical structure starts to be utilised for ornamental and symbolic reasons. As soon as there is a deeper meaning attached to these (now usually already very decorative) rooftops, legends and stories are linked to it, and it is integrated as an essential part in the identity of a traditional house in the mind of the people.

We can state, that out of purely functional necessities, which are often radically determined by the roofing material, the overall basic shape of a traditional house is defined (roof pitch, basic silhouette, rooftop reinforcement). These features then evolve while people are refining these parts according to their cultural ideas. The roof and its substructure in certain areas are usually very important in giving a house the qualities of a “traditional” building.

If a roof is not well kept, and unrepaired during time of course damage patterns appear which are different for specific kinds of roofs (e.g. treaded rye straw roofs and reed roofs). Not only wind and weather cause and caused damage to the building, also fire was a great issue. Fire coming from outside - the danger of burning houses setting fire to a whole village was in former times a great threat, and of course the danger from the inside while utilising open fire (in Europe this is only true for the ethnographic past when open fire was still used in the buildings). To secure the escape of smoke and to protect the roof against sparks different measures where taken:

In houses, where there is no ceiling, the smoke rises up to the roof area and usually cools down on the way sufficiently enough not to be dangerous for the wooden structure and the organic thatch. Moreover soot layers, which are adsorbed

by the substructure, heighten its fire resistance and avert vermin.

In case there is a ceiling usually some kind of rudimentary chimney is built - in very archaic cases this chimney leads only into the attic, where there is usually a plate or a structural part of the chimney to direct sparks away from the thatch to the inner void of the attic. The smoke leaves through small openings on one end of the roof or the gable wall. The most recent development was the installation of chimneys, which penetrate the thatch - in this case care had to be taken to execute the construction detail properly, as otherwise either rain would drain in the gaps between thatch and chimney, or the thatch itself would be in danger of burning as a consequence of too high chimney-temperatures.

In some cases the loss of the thatch even in the slightest possibility of fire was a calculated risk, before the house itself and the people's belongings were lost, so the pulling down of the thatched areas with hooks was preferred to attempts (mostly doomed anyway to little success) of extinction of the fire with water. However, in areas of Germany we usually find also a pool of water near the house to ease the latter activities.

To secure the possibility of escape from houses with large thatched roofs, constructive measures where sometimes taken. The "Friesengiebel" in Germany is a small roof structure shielding the entrance area from big amounts of flaming straw thatch, which inevitable where sliding down the roof as soon as the building was on fire. This ensured that no escaping person was hit by or buried below the thatch.

3 The tropical parts of Asia and Oceania - a broad variety in Materials

The tropical regions offer maybe the broadest selection of organic materials to be used as roof thatch. The mainland of Southeast-Asia, the continental islands of Indonesia, the Philippines and the region of Oceania with their smaller but nevertheless fertile islands are an environment abundant with wood and different types of grass. Usually the basic structure of houses consists of wooden frames; sometimes even bamboo is used as load-bearing construction material. In many cases rafters and other important roof parts are also made of round bamboo sticks. Sometimes an airily woven mat of split and flattened bamboo is applied below the roofing material, in other cases split bamboo is used as shingles. Grass, reed, leaves of special trees, palm fibre and palm leaves are found in abundance and used as thatch.

3.1 Palm leaves and fibres, Screw pine leaves

Different kinds of palms are a very important source of drink, food, rope, household utensils (bowls, etc) and building material in the tropics. In some areas whole economies are based on certain kinds of palm trees (the coconut palm in Oceania, the lontar-palm in Eastern Indonesia, the sago-palm in Borneo). It can be said, that they provide an essential part of the necessities needed for livelihood, and that without these plants the settlement of certain regions would have been much more difficult or even impossible. It is only natural, that also the leaves are used in house construction, usually as a short-lived alternative if reed or other grasses are not available.

While grass thatches last for quite a long time even under tropical conditions (20-30 years), palm leaf thatch is usually more short-lived (3-10 years) and used for more temporary constructions (small huts, etc). However, as palms are grown in nearly every garden and settlement there is plenty of material available nearby – it is easy to gather and abundant.

To preserve palm thatch, in Indonesia nipa (Nypa fructicans) or rumbia (Metroxylon sagu) palm fronds are soaked in water until turning sour, afterwards dried and cured over smoke before applying them in construction (Dawson & Gillow, 1994).

Palm leaves are split along their ribs and used as shingles, or the leaf is bent to form a shingle or two split-half leaves are plaited together.

Ijuk is a black fibre from the trunk of the sugar-palm (Arenga dinnata), similarly processed like grass thatch and long lasting. It is used especially on the island of Bali, where houses and even temple roofs are covered by it, and it is said to be the best available material for this purpose. Alang-alang is regarded as second best material, which is a kind of grass. Ijuk is also used on the famous houses of the Minangkabau in Sumatra, with their upwards-curved gables. Latter thatch is said to last 100 years.

3.2 Tree leaves

The covering of houses with material taken from trees is most unusual, as when twigs are broken off from the plant, the leaves fall off after some time. This is the case with almost every tree species (palm trees have been discussed in the former section, as their leaves differ completely from those of usual trees). Interestingly the only tree specie known to us, who retains its leaves after branches are broken off and can be therefore used in traditional building culture, is Atuna

Fig. 3 Fijian house with characteristic roof shape and thatched walls, Navala, Viti Levu, Fiji Islands, 2002.

racemosa, called “makita” by its local Fijian name. It can be found from Malaysia to the Caroline Islands, Fiji, Tonga and in Samoa (called there “ifiifi”). However we only know its use as building material in Fiji (we did not encounter other references to this tree related to house building neither in ethnographic special literature nor during field trips). In Samoa the seeds of this tree are used in scenting coconut oil (a practice also existent on Fiji). It grows 5 to 20 m high, with leaves 10 - 35 cm long and 2,5 – 13 cm broad (Zámolyi, 2004).

3.3 Grasses

In Fiji it is common to use reed (“sina”) or different species of grass (“gasau” - Miscanthus floridulus, “manibusi”) as a thatching material. The houses are built of wooden posts dug into the earth, on top of this wall frame a hipped roof is constructed. On the rafters a layer of woven bamboo is installed. These mats are composed of split and hammered bamboo, which is interwoven at intervals of 10 cm. The first layer of reed or grass is put on this mat starting from the eaves and is secured by a stick (“nakawi”), which is cut from guave-wood. The nakawi-stick is sewn to the substructure with a kind of liana (“vau”). Two men are executing the process - one stands on the inside, the other is sewing from the outside. Sometimes also walls of a house are thatched. In the mountain regions this extra thatch, if present, is usually executed as a thick layer against the relatively cold conditions during nighttime. In coastal regions walls are thatched in much thinner layers (Zámolyi, 2004).

The ridge part of the building is treated in a special way: Sticks are stuck through the thatch below the ridge horizontally and an extra amount of roofing material is placed in the area above. The whole construct is then artfully bound down with watigiri-lianas, incorporating also the trunks of tree-ferns (“balabala” - Cyathea lunulata) on each side of the ridge. These trunks protrude from the ends of the roof to some extent, giving the roof a special, easily recognisable shape. These fern trunks strengthen the uppermost ridge. It can be said, that the most typical feature of a Fiji house is this special treatment of the ridge - it has become the “hallmark” of the architecture of these islands. Roofs thatched with reed are said to last 10 years without repair, roofs made of grasses last considerably shorter.

In the coastal regions of Fiji sometimes sugarcane leaves (“duruka”) have been used as thatching material. The leaves are utilised separately from the stem, folded and stuck together on a short length of bamboo or reed. In this way they form “shingles” which are applied mostly to ridge regions. On roof regions not exposed to wind and weather sago-palm leaves were used in the same way, stuck together on reed as shingles of 1,5 m length (“bati-ni-sogo”). In ethnographic literature the lifetime of such a house (if smoked properly) is given with 20 years. We believe this might include also repairs, as usually according to our fieldwork data repairs on houses with palm thatch sometimes have to be already started after a few (2-3) years. It may also be, that the comparably short lasting time given for reed thatch in the highland areas of Fiji by informants (Navala village, Viti Levu) is on one hand due to the fact, that in the living houses no open fires are used anymore, on the other hand 10 years refer rather to the first occasion of a larger repairs on the roof, the house structure (and parts of the original roofing, if maintained and repaired properly) last considerably longer. Of course humidity of the geographic region can vary within the tropics also considerably and alter these estimates (for example some Indonesian Islands like Timor do have much drier climates than Oceanian Islands).

In most parts of Indonesia the climate is also humid, comparable to that of Oceania, with the exception of Lombok, Flores, Timor and a few other Islands clustered around or in between these mentioned ones. Sumatra, Java, Borneo

Fig. 4 The decaying roof shows its substructure – rafters and a bamboo mat, to which the reed or grass is affixed. Navala Village, Viti Levu, Fiji Islands, 2002.

Fig. 5 Re-thatching of a rooftop on Fiji. The ridge is secured with lianas. Navala Village, Viti Levu, Fiji Islands, 2006. (Photo: Schuller, J.)

and Sulawesi have no real dry season, whereas the islands around Timor and Flores do possess a few months with very small amounts of precipitation. Interestingly though this climate difference doesn't seem to affect roofing and the use of materials. In Indonesia, contrasting to Oceania, where reed is frequently used, the preference seems to be towards grasses, namely the alang-alang (Imperata cylindrica), which is used more often than any other material. Alternatives are the already mentioned palm leafs of different palm species, usually called "atap" (atap is also an Indonesian word referring to the roof as a whole) or the more expensive, rare (and therefore seldom used) but longer lasting sugar palm fibre, the ijuk.

The lifetime of houses lasts from over 100 years in Borneo, where large long-houses built with ironwood piles and ironwood shingles have an extreme long durability, to small houses built of bamboo and palm leaves with a durability of only a few years. Own fieldwork data places houses in east Indonesia (Adonara Island) with 20 - 30 years lifetime somewhere in the middle, with alang-alang roofs to be changed in 10 - 15 years and palm leaf roofs lasting approximately 3 years. Although the substructure of these houses made of bamboo and comparably small palmwood posts may not have a very high material quality, they might quite well be a representative example for the average lifetime and durability of smaller to middle size village houses in Indonesia. Exceptions are maybe large Clan-houses built of massive wooden trunks and possessing thick layers of thatch. However, also in these cases usually the wooden substructure is lasting quite a long time, the thatch has to be renewed more often.

Throughout Indonesia in most cases the ridge zone is also treated specially: At the least an extra layer of thatch or nowadays even small pieces of corrugated iron are applied to the area in question and often secured by wood pieces joined at the ridge. These wooden parts are lying on the upper part of the roof, holding it down by their own weight. Sometimes they are also projecting over the ridge (e.g. Mentawai), in this case the upper ends can be decorated (similar practices

Fig. 6 House on Adonara Island, Indonesia (Lowobunga Village). The roof is thatched with alang-alang grass, its upper part made stronger by ijuk fibres, which are held down by bamboo stripes. On top of the ridge a bamboo cane is placed, 2005.

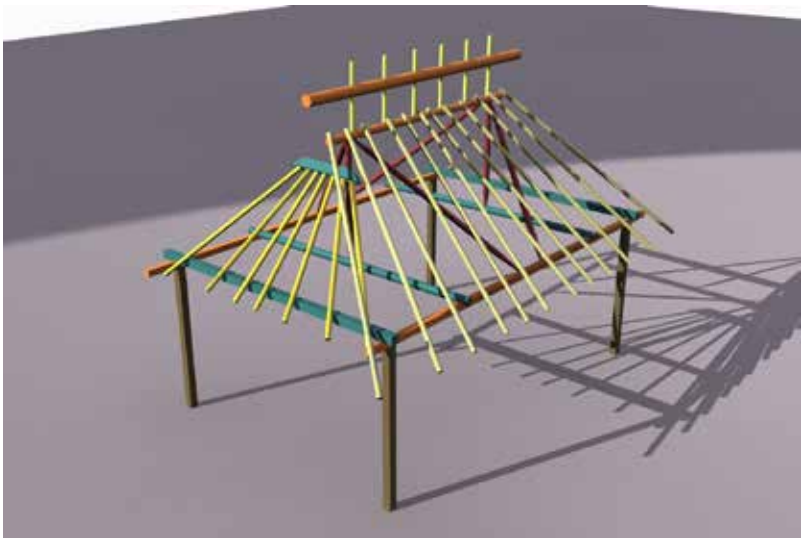


Fig. 7: Schematic roof structure of a house on Adonara Island, Indonesia.

are known also in Europe). In Timor and the Islands of Adonara, Solor and Lembata for the same purpose the ribs of large palm leaves are used.

On Adonara also another treatment of the ridge is known: here extra thatch is applied, and into the ridge purlin vertical stakes are inserted, and on the top of these stakes horizontally a strong bamboo cane is placed. To secure it in place, short vertical pieces of bamboo are attached to the ends of the stakes protruding from the bamboo cane. The ridge is sometimes also strengthened with ijuk and decorated with nagas (dragon figures) or the tombak and parang (lance and bushknife) carved out of wood and painted. Also horizontal pieces of wood are stuck through the top layers of the thatch (very much alike the procedure in Fiji). The profile of the upper part of the roof is broadening up again (seen from the side of the house), giving a marked contrast to the tapering roof below. Interestingly this again seems to be regarded as an essential feature of this local architectural form, as houses possessing corrugated iron roof are given the same roof shape, although this special kind of ridge reinforcement would not be needed in the case of the modern roofing material. Moreover, in some cases the peculiar form is even more emphasized than in the original, altering the proportions of the roof completely. Experimentation with roof forms is a typical feature of traditional architecture in Indonesia, and also on other islands roofs are a main factor in identification of a local house building tradition. This is also expressed in the fact that in many areas the wall is hardly to be noticed compared to the giant bulk of the roof. In the Timor highlands the houses of the Bunaq seem to consist of large conical roofs only - despite the fact that they do possess a wall zone and even have raised floors, nothing of these features can be seen from the outside.

The application of thatch material is similar to other areas of the world, layers of grass are held down by bamboo or

Fig. 8: The roof ridge is heightened and different structural elements are giv-en a decorative appearance. Koli Vil-lage, Adonara Island, Indonesia, 2005.

Fig. 9: Although the new roofing material zinc does not need a strenghthened roof ridge like the traditional thatched roof, the form is not only rebuilt in the modern material, but also made more prominent by enlarging the proportions somewhat. Bungala-wan Village, Adonara Island, Indonesia, 2005.

Fig. 10: The roof ridge is not only given extra layers of thatch, but this extra thatch is some-times secured by either pieces of wood, or as in this case by interlocking palm leaf ribs. House of the Tetum tribe, south of Atambua, Central Timor, Indonesia, 2005.

Fig. 11: The roof determines the house shape, walls and stilts are completely hidden under it. Bunaq tribe, east of Atambua, Central Timor, Indonesia, 2005.

sticks and tied to laths, or even the rafters. In the case of small houses of the Atoni on Timor, alang-alang grass thatch is directly bound to the round, basket-like substructure made out of rather small sticks. The Balinese in comparison wind the alang-alang onto a rib of a coconut-palm-leaf and secure it then with a lashing. The whole rib is then attached on the roof, in much the same way, than the shingles of sago-palm leaves in Fiji. These elements are always bound to their substructure, never attached with nails or screws, what maybe a modern European carpenter would suggest. For one reason iron nails (although easily available) are still too expensive in many areas to be used on large scale, on the other hand in Southeast Asia there is no real tradition of employing wooden nails in house building, which can be said seems to be a purely European tradition (albeit already originating from the iron age). The availability of a wide range of organic binding materials facilitated the use of bindings and lashings, and especially in areas (e.g. Oceania) where iron tools are a comparably recent introduction; they are also the more economical joining technique of structural parts within a house.

Although Java and Bali are regions within Indonesia of intensive rice production, the use of rice straw as thatch is very seldom mentioned. Further inquiries would be needed to ascertain, whether this is due to a lack of appropriate field research or whether in reality rice straw is seldom used. Of course, as alang-alang grass has very good thatch qualities, and grows excessively everywhere (often being already regarded as nuisance and a pest plant) this could explain why rice straw is not used (Rice straw has adequate qualities as a thatching material, as it is also used outside of Indonesia, e.g. in certain parts of Iran as an important thatching material.). This situation would then be quite the reverse than the situation which existed in Europe a hundred years ago: In Europe rye straw, a bye-product of agricultural production was often preferred to reed, the thatch material which could be obtained from nature. In Indonesia it seems that a natural grass is preferred to the agricultural product.

4 Egypt and Mesopotamia

The use of reed in Mesopotamia and Egypt differs completely from tropical countries: Whereas in South-East Asia and Oceania the material is used with a few exceptions as thatch, the availability of the larger papyrus-reed in Egypt and the lack of wood condition its much wider use. Not only the whole outer skin of early Egyptian huts is made of reed mats, but also fences and walls (albeit not necessarily load bearing ones) are made from reed (Lehner, 2005). The formal appearance of these fences, to which later on in their evolution a coating of mud is applied will eventually also be reflected in certain formal aspects of prominent Egyptian stone temples. In Mesopotamia the reed is even used as a structural part of quite large huts. Their layout is similar to the early Egyptian buildings, but instead of a wood latticework substructure reed canes bound together in sheafs are used to form arches and pillars giving stability to the building. This technique was not only used in ancient Mesopotamia (as pictograms in archaeological record clearly show) but has survived in southern Iraq until recent times as a form of vernacular architecture (Lehner, 1990).

The Egyptians adapted the abstracted picture of their early house as the sign meaning “temple”. As for sure the first temples did not differ much from the huts common people lived in, and thus from general built forms. In the traditional architecture of other countries, e.g. Indonesia and Fiji same tendencies can be noted. At first religious buildings do not differ from common living houses. As a second step special attributes are applied to them. They are placed on higher elevated platforms, are better decorated or given larger dimensions than usual building. However, while the quality of

Fig. 12: Reed used for mud-plastered fences, Egypt. (Photo: Lehner, E.(1990))

Fig. 13: Reed hut. Here reed functions not only as roofing material, but forms also the load-bearing structure (after LEHNER (1990)).

built structure is higher than of other houses, the form tends to be more conservative. So while the form of living houses is changing, temples usually more truly preserve aspects of their original shape and form. However, architecture moved on, but preserved the archaic from as the written “idea” of the ancient religious building.

The hieroglyph of the upper Egyptian kingdom’s temple shows in fact a domed reed hut and the hieroglyph of the lower Egyptian kingdom’s sanctuary a barrel vaulted rectangular house covered with reed mats (Badawy, 1954). It is interesting to note, that the Afar, a nomad tribe living in Ethiopia’s Danakil desert and claiming descent from the people of ancient Egypt also live in half-domed huts possessing a frame made of wooden sticks (not unlike the substructure of ancient Egyptian huts, albeit much smaller). These huts are also covered with mats. These mats are made not of reed, but of the leaves of a special palm.

Of course similarities may result from pure coincidence and the relation to Egypt may be a story only, but it proves the fact that this kind of construction was and is known in a larger area of Africa. Considering the data from Mesopotamia we can state, a kind of building type with sticks as substructure and palm or reed mats as covering was quite frequent in the arid, desertous zone of Africa and in all those spots where reed was available in large quantities (near streams, lakes or marshes) it tended to replace wood as load-bearing structure and people ended up with huts (often of considerable size) consisting of reed only.

Fig. 14: Pictograms and hieroglyphs depicting an archaic Egyptian shrine (after BADAWY (1954)).

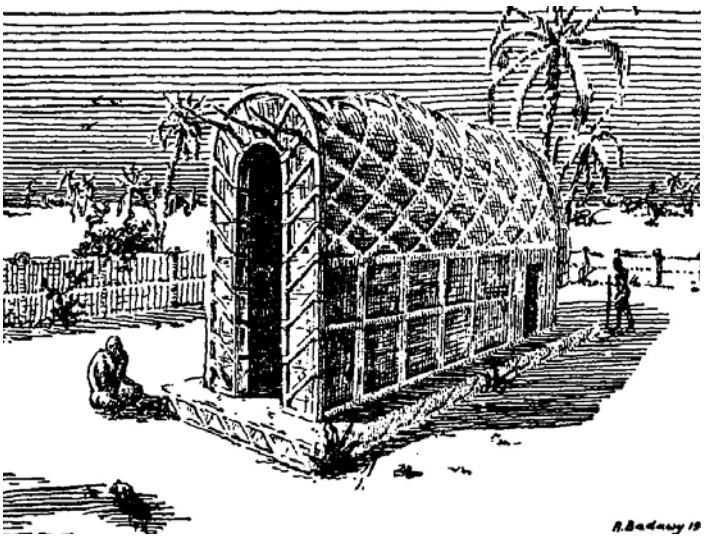
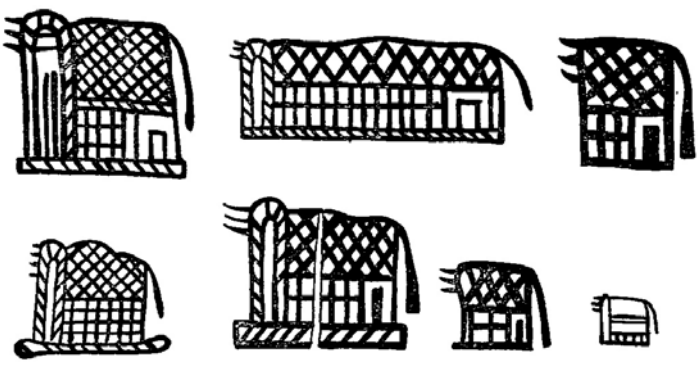


Fig. 15: Reconstruction of the archaic Egyptian shrine utilising reed in extensive way. (after BADAWY (1954)).



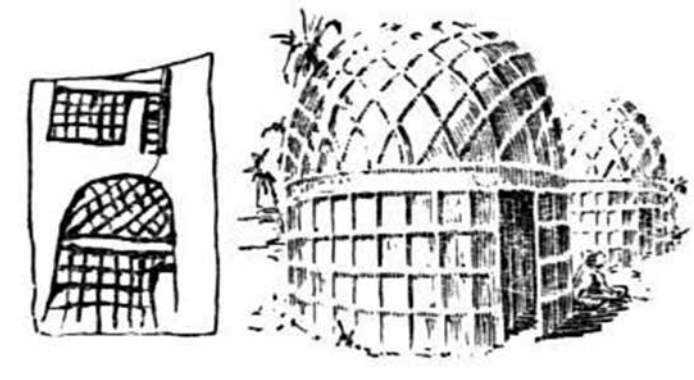


Fig. 16: Archaic Egyptian wattle building and its restored perspective. We can as-sume, that the roofing consisted of reed or palm-leaf mats. (after BADAWY (1954))

Fig. 17: Substructure of a Somali hut in Ethiopia without roofing material. The Somali huts are very simi-lar to the constructions of the Afar mentioned in the text. Note the similarities to the reconstruction drawing of ar-chaic Egyptian shrines. (Photo: University of Addis Ababa, Donat, D., 2010).

Fig. 18: Somali hut thatched with reed or grass mats. (Photo: University of Addis Ababa, Donat, D., 2010)

Fig. 19: Houses thatched with reed mats, Lake Titicaca, South America, 2004. (Photo: Lehner, E)

5 South America - Lake Titicaca

Lake Titicaca in the Andes Mountain range is the largest lake in South America and also to be found on a relatively high location (3811 m). Artificial islands made out of reed are floating on the water surface. These islands were constructed for a defensive purpose. Everything built on these Islands has to be of course a lightweight construction, so the houses consist of a wooden frame (made up of small wooden beams and posts) and a covering of reed mats. It is interesting to note, that both walls and roof are made with reed mats and the roof is never thatched in a conventional way. However as everywhere in developing countries, corrugated iron roofs have started to be used to some extent.

Fig. 20: A reconstruction of a German house from the 3rd century AD, open-air muse-um Elsarn, Lower Austria.

6 Historical European Traditions - Reed

The first known large dwelling houses in Europe were erected by Neolithic agriculturalists of the Linear Pottery Culture (5500 - 4500 BC). This archaeological cultural complex spanned wide areas of Europe. The houses built at this time where around 30 m long and approximately 8 m wide, possessing a frame of massive wooden posts sunk into the earth. The walls consisted of wooden boards split by stone tools. We can assume that as thatch material reed was used. However not much remains but post holes in the ground on the archaeological sites, so apart from clues gathered on “floor level” direct evidence of details of roof construction is missing.

In a German settlement from the 2nd - 3rd century AD reconstructed at the Museum of Elsarn in Lower Austria the main building possesses a reed roof, smaller buildings are built with rye-straw roofs. According to the archaeologists opinion at this time the use of rye-straw as thatch was already quite common. (Lobisser, 2002)

Houses with reed thatch from the middle ages have been reconstructed at the open-air museum at Museumsdorf Düppel, near Berlin, Germany. These houses have stepped thatch, the surface is not smooth, as it is usually today. Putting one sheat of reed beside the other and fastening it down with hazelnut-sticks to the battens applied the thatch. The hazelnut-sticks sticks were fixed in turn by thinner twisted hazelnut or willow twigs (Schrader, 1998).

Apart from use as thatch proper on house roofs there are many examples of more archaic utilisation of reed. During and after the Turkish wars an extensive grazing economy developed on the Hungarian plains. The cattle was kept all year round in the open and guarded by herdsmen moving with it from grazing ground to grazing ground. At this time, from the 16th to 19th century also there were no regulation measures, cutting river bends and also no drainage of swamps. Large marshy areas with reed growing nearly everywhere were quite common, and as trees and forests were rare on the plains, naturally reed was utilized for shelter buildings.

These shelters were usually for temporal use (as the cattle had to be moved frequently) and were erected with little expenditure in energy and effort. Usually a reed hut for the herdsmen was built, with a U-shaped reed fence (“vasaló”) planted into the earth near the hut. The hut was used rather only during wintertime, having a central fireplace. The Inner surface was lined with mud and dung to reduce the possibility of fire. The U-shaped fence near the hut demarcated an area were meals were cooked and everyday life could take place. The main purpose was the protection against wind. In the case of the cattle also the protection against strong wind was essential, but also shade and protection against the sun. For this purpose a construction of reed fences was built in form of a star (“szárnyék”). From a central point three to four “wings” radiated in different directions. These directions were chosen in accordance to the main wind directions. So depending on the weather and the prevailing winds the cattle had always a protected area. In winter a closed, circular coral was build, also out of reed (Balassa, 1980).

If we examine German traditions in the 18th - 19th century (today this region being one of the largest importers of reed of the Lake Neusiedl area) - rye straw and reed have been historically both viable alternatives. The techniques are quite similar - they can be applied to the same substructure and the material used depends on which one can be afforded or which is available. Horizontal sticks or laths hold down the thatch and these are tied to the battens made of split pine stems or laths. Sewing the thatch to the laths is a technique encountered more and more often from the 17th century on, as coconut ropes were available through the intensifying sea trade. These ropes are especially well suited for binding roof thatch, as they are strong and flexible. Alternatives were ropes made out of straw, reedmace (typha) oat-grass or purple moor-grass.

Fig. 21: Shepherd guarding its flock. Protection against adverse weather is ensured by a windshield ("szárnyék"), the wings of the archaic reed structure are directed to shield against the main wind directions. (Hortobágy, after BALASSA (1980))

Fig. 22: The herdsmens´ shelters: reed hut with the top section plaited with rope. A stick stuck through the hut´s top is used to affix the cauldron, as fire is usually burning in-side to cook meals. (Túrkeve –Ecsegpuszta, historical aquarell painting of Koszkol Jenö, after BALASSA (1980)).

Fig. 23: "Vasaló" ("flat-iron"). U-shaped, roofless archaic construc-tion as a shelter against wind for herdsmen. It was also used as a cooking place and for storage of equip-ment and utensils (after BÁRTH (1982)).

Typical for the German areas are often big roofs (as stables, living quarters, grain storage and work area are often combined in one large house - e.g. the Hallenhaus type) (Schrader, 1998). As there are such large amounts of thatch on the roofs special need arises to cope with situations involving fire: A pond near the house is often established for water supply during fire extinction and the "Friesengiebel", which is a small extra roof over the entrance area secures a protected escape route from flaming parts falling from the roof construction (Seidel, 2007).

Different measures are taken to protect the ridge against wind and weather: The Plaggenfirst is an extra layer of extremely dense heath turf which is cut out in tiles and placed on top of the roof. As one of these tiles weighs around 35 kg it was extremely hard work to place them on the rooftop. The German phrase "Plackerei" which is used often in present day's informal language (and denotes some kind of extremely difficult or tiring work) refers exactly to this building process (Seidel, 2007). However, usually nobody knows the original meaning of the word any more. Another way to protect the upper region of the roof is to apply an extra amount of thatch and secure it with two wooden members joined at the ridge. These wooden parts are called "angelische Reiter" as they sit like they would ride on top of the roof, the term "angelisch" refers to the geographical area they are used in northern Germany. A third alternative was to apply a special kind of thatch to the upper region, which consisted of heath plants and herbs. Today a net is used, below which the plants are densely stuffed, forming a thick protecting "cushion" on top of the building.

On the roof ridges employing turf also some plants could thrive, and the "Dachkrut" (Sempervivum tectorum), was regarded in folk wisdom as auspicious, and called "Donarbart" referring to the beard of the thundergod Donar. It was

Fig. 24: German Hallenhaus, Lamstedt. (Photo: RaBoe/Wikipedia)

Fig. 25: House in northern Germany possesing a “Friesengiebel”, to ensure a safe escape and protection against burning thatch sliding down in case of fire. (after SEIDEL (2007))

believed, that a house, which possessed these plants, was not struck by lightning.

A special type of roofing is known in the geographical region of the Spreewald, due to the marshy ground small log buildings with saddle roofs predominate. The thatch is interestingly not made out of reed, but of reedmace (bulrush, lat. Typha) (Schrader, 1998). This and some rare examples in the Carpathian basin are the only cases known to us in European context were this plant is used as thatch proper. Usually it is processed to ropes and used to tie down the reed covering the roof.

If we turn to traditions in the Carpathian basin in the 18th - 19th century, we will notice that building types are quite different from those in Germany.

The usual house type in the Carpathian basin was the so-called “alföldi ház” (Hungarian plains house). These houses where rather small with two or three rooms (usually front room - kitchen - back room) and stables, storage rooms and workshops built behind the back room as annexes in the longitudinal house axis. Also an open porch with pillars on one side of the houses was common (“tornác”, “gang”) (Istvánfi, 1997).

In the plains (and of course also in the area of Lake Neusiedl) reed was used as thatch, as rye was not a common crop. As wheat-straw (wheat was mainly cultivated) was not suitable for thatch and reed available anyways in abundance due to large marshy areas and unregulated rivers, it was only natural to use it extensively.

The thatch was held down by sticks, which in turn where bound to the battens below, a technique we already have encountered. Sometimes also ropes wound out of the leaves of the reedmace where used, either to bind down the sticks or to sew the reed directly to the battens. The areas near the roof ridge where also protected in special ways: either

Fig. 26: “Angelische Reiter” – pieces of wood to secure the roof ridge. (after SEIDEL (2007))

Fig. 27: “Dachkrut” or “Donarbart” thriving on a roof ridge. It was believed, that the plant provided protection for the house. The term “Donarbart” is an explicit reference to the (red) beard of the mythological thunder-god Donar. (after SEIDEL (2007))

Fig. 28: House in the protected heritage part of the town Csongrad, south - east Hungary. It is a good example of the Hungarian plains house ("alföldi ház"). It is thatched with reed and the upper part of the roof is secured with wooden boards and pieces of wood joined at the ridge. (2003)

Fig. 29: Recently made reed roofing by a reed thatcher of the Lake Neusiedl area. Note the double layers in the ridge region and the braiding on the roof top. (Sopron, 2008)

the reed thatch was made stronger, with extra layers, or tiles where used to cover this area. Sometimes also wooden battens where applied over the reed thatch to hold it down, or pieces of wood connected by a wooden nail on the ridge. This method is very similar to the „angelische Reiter" in the German areas, although the wooden parts extend only a little bit over the ridge.

7 Historical European Tradition - (Rye) straw

As rye straw was cultivated extensively in the more mountainous and more northerly regions of Europe, it is only natural, that it has been used as roofing material. Rye has properties, which can make it comparable in quality to reed roof thatch, and also the way how it is applied, is sometimes quite similar. Usually winter-rye was used (planted in autumn) as it was stronger, and a variety with durable, long stalks where favoured. The rye was processed by hand, cautiously threshed, not to break the stalks. Afterwards it was combed and bundled. With the advent of modern harvesting and threshing machines and the change of the cultivated varieties the era of the rye straw roof ended abruptly, as the new methods of cultivation produced no strong stalked rye, and during the harvesting process the stalks were broken anyway, which resulted in material completely unusable for building purposes.

The most archaic roofing method with rye is, when there is no roof substructure at all, but the straw is heaped upon a kind of „platform" consisting of a not very sophisticated post and beam structure – usually this roofing was applied in the case of stables, where straw was at hand anyway. This kind of roof was called in the Hungarian areas „beetleback roof" (bogárhátú tető), due to its peculiar silhouette. The straw was often secured against wind by straw ropes, which had bricks tied to their ends and were placed across the ridge.

Another way of applying the straw was the so-called „trodden straw roof". In this case a rather steep roof structure was erected, with wooden sticks and nails protruding perpendicular to the roof plane. The straw was placed on this substructure and pressed and trodden into place – in this way a quite dense roof layer formed, which was fixed and held in place by the wooden sticks mentioned above. Wooden poles connected by rope and hung on both side of the ridge weighted down the uppermost zone of the roof. This roofing method was common in the eastern Carpathian mountains (Sabján, 2007).

In certain areas rye was used exactly the same way like reed, in the Carpathian basin these were mostly areas were lowland regions with plenty reed changed to more mountainous landscape, where rye was the main cultivar. This method utilises wooden sticks to hold down the roofing material, which was not applied in bundles, but opened up and distributed in each thatching layer.

However, there are also other techniques, in which rye-straw bundles are tied down directly to the battens with a rope wound from the same rye straw. We encountered a similar reed processing method in Germany becoming increasingly popular from the 17th century on. The technique for rye straw roofing is attested from the 14th century on in the area of the Carpathian basin. However we can assume that similar methods existed even before this date. The techniques currently used in the Carpathian basin area seem to have originated from German speaking areas, as for example the Hungarian

Fig. 30: Archaic roof on a stable made of rye straw. No sloping substructure is used, the straw is heaped on the horizontal roof beams. (after SABJÁN (2007))

Fig. 31: Barn in the Rumanian mountain region near the valea draganuj with a trod-den straw roof (2011).

name („zsúp") and a high percentage of the technical terms in certain areas are in fact German loanwords („Schaub" or „Schab – Deckung"). Several varieties of this method are known, the main differences being whether one sheaf of rye is used as a single bundle or split in to several smaller bundles while „sewing" and binding it on the battens. This results in differences during the workflow and roofing process. The roof surface can either be stepped or smoothed, hips and ridges are always treated specially. Usually an extra layer of rye is applied, at the endpoints of a roof specially braided ornaments are put up. These are sometimes shaped like a man and called „priest", sometimes they have conical form and are topped with an upturned ceramic jug.

As we have seen, there is a wide variety how organic thatch can be used, the principles of applying it are very constant and are mostly the same. Even if the material changes (be it reed or rye straw) certain rules have to be followed, which are not dependent on the plant species used, but apply generally to most varieties of organic thatch.

Fig. 32: House with rye straw roof in an open air museum in south-west Hungary (2008).

Fig. 33: Traditional house in the area of Seewinkel (KUHN & NEUHAUSER, 2010).

Fig. 34: Erwin Sumalowitsch is one of the last reed cutters at Seewinkel (KUHN & NEUHAUSER, 2010).

The present European situation with a special emphasis on Lake Neusiedl

Reed is the striking heart of the landscape of the National Park Neusiedler See. An area of approximately 178 km², which is nearly half of Lake Neusiedl, is covered with reed. It adjusts the microclimate, functions as wind protection, cleans the water like a giant filter and above all reed serves as home and protection of rare animal species.

Still reed is an important identification mark of the vernacular architecture of the region around Lake Neusiedl. A house covered with reed will be identified as typical for the area „Seewinkel", which is located east of Lake Neusiedl. In former times all houses and barns where covered with reed. Nowadays thatched roofs are rarely seen. Reed became an expensive building material and it got a bad reputation as being easily flammable. But still it is important for the region and the appearance of the settlements and the cultural landscape.

Today there are only a few craftsmen left who know to cover roofs with reed. They are aware that cutting the reed is still hard manual work. Mr. Erwin Sumalowitsch, one of the remaining reed cutters says: *"In former times the harvest of reed was real hard, manual work. In winter people walked 3 or 4 km to the lake early in the morning. The reed was cut and bundle tied by hand. Then the bundles where put on sledges and hauled them to the storage areas. There the bundles where put together in form of cones. When there was no ice layer on the lake the work had to be done using boats. The harvesting of reed was hard labour for the people, it was really tedious work."* (KUHN & NEUHAUSER, 2010)

The laborious work of harvesting and processing reed make it costly compared to other building materials for roofs. But some people like the heat insulating characteristics and the room climate of a reed thatched roof. Reed carpenter Julia Nekowitsch is working with Hungarian employees, who have the knowledge about working with the material. She tells: *„Throughout the summer our Hungarian employees bundle up the reed. It is enclosed by hand and tied together with a machine. Thereafter, the bundles are packed together in large packages and led to the construction sites. Finally we use the material to cover the roof. But the important preliminary is done by our workers."* (KUHN & NEUHAUSER, 2010)

Julia Nekowitschis working on many construction sites in the area of Seewinkel and also knows about special legal regulations concerning reed roofs: *„In this area it is complicated to get the permit to cover roofs with reed, as the house are built close to each other. Only if the building is elder than 30 years or protected by monument conservation it is no problem to cover a house with a thatched roof."* (KUHN & NEUHAUSER, 2010)

The legal restrictions are the result of historic developments. Erwin Sumalowitsch knows about the fear of people of burning reed roofs*:" Reed has a negative image in this area. Many people believe that if you throw a bundle of reeds it is like a hand grenade, because of huge fires in the past. Most of these fires where set by the people themselves, because fires don't start at the roof easily. It had nothing to do with the reed roof. When you try hard you can burn everything but reed has the same fire rating as wood."* (KUHN & NEUHAUSER, 2010)

Mr. Arie Van Hoorne from Netherland, who is working as reed carpenter in Seewinkel describes how to make reed roofs fire proof: *„I am living here in a wooden house with a thatched roof. I mounted the reed directly onto a full casing of 5 cm solid wood. In this way the reed can hardly start to burn.*

At this house there was air between the reed and the construction underneath. Without this space the fire rating and the isolation is much better." (KUHN & NEUHAUSER, 2010)

The thatched roof has a negative reputation in Austria, whereas in many Western countries the prestige of the reed roof is closely linked to tradition. Therefore around 98 percent of high-quality reed around Lake Neusiedl is exported to the Netherlands, Germany and England. There it ends up on the famous thatched roofs. New buildings could have already pointed out that the image of the reed to pursue a new path. The potential of this domestic construction material is far from exhausted.

Fig. 35: Reed harvesting is still a hard work (KUHN & NEUHAUSER, 2010).

Fig. 36: Julia Nekowitsch works as reed carpenter (KUHN & NEUHAUSER, 2010).

8 The Importance of Documentation and Education in the process of preservation of traditional techniques

The knowledge about vernacular architecture and building traditions is stored in the minds of the people living in the built environment developed over centuries. For a sustainable preservation and a futher development of architecture this knowledge has to be taken into account. So it is important to raise the awareness about the value and the potential of the cultural heritage in architecture.

Considering World heritage as 'living memory' may encourage us to become our own storytellers of past present and future.

In this creative and constructive process we are inextricably linked to our way of perception as process in time and space. We establish a 'murmuring dialogue' with those different voices, faces, atmospheres, of our ancestors.

Former (human) world (re-)constructions such as history, reflect message, spirit and a multitude of constituent factors. Sensing traces and bits of these construction 'events' in former times (e.g. in documents, remaining buildings, plants or stories) we evaluate some of these traces as authentic pieces, as material or immaterial evidence. From these we start our interpretations, aiming at reconstructing the original context. Thus we construct a continuous story, recreate an unknown integrity.

A general human principle in establishing life and orientation and meaning in our human limited time span is develops along the questions: 'who are we?', 'where do we come from?', 'where are we right now?' and 'where are we going?'.

In world heritage as 'living memory' we may keep up a vivid potential of natural and cultural singles, ensembles and sites, in order to develop future perspectives and strategies in terms of a universal dialogue along similar principles.

By realizing our active share within our 'living memory' as a laboratory of world perception and world construction we may use this creative capacity and become aware of our individual and common human potential.

Fig. 37: In the Netherlands reed roofs are still common says Arie van Hoorne (KUHN & NEU-HAUSER, 2010).

Fig. 38: Using a reed roof on a supermarket (KUHN & NEU-HAUSER, 2010).

Thus we would establish world heritage as a connection between our own sphere and other spheres, as natural and cultural dialogue toward a living heritage. To implement these ideas within the education enables a better understanding for traditions, traditional techniques and their potential for future planning's taking preservation into account.

9 Conclusions

Reed has been used as building material in many traditional building cultures all over the world. The popularity of the material changed by the times but still many people appreciate its material properties. And for many people reed is the characteristic feature for certain traditional buildings. Whereas the techniques vanished or nearly vanished in some places it still in the minds of the people. A rainessance of reed as building material can be observed in parts of the world, where its function and quality has been realized.

The recollection on building traditions may start a revival of reed as a building material not only for covering roofs but also using its significant performance for modern buildings.

With recording and documenting the techniques of roof thatching and using reed for other building purposes we can help to keep to keep an important part of world's cultural heritage alive.

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11 Source of Figures

All figures not listed here were fotografed or drawn by Ferenc Zámolyi.

Fig. 5: Josef Schuller, 2006

Fig. 12: Erich Lehner

Fig. 13: after LEHNER (1990)

Fig. 14: after BADAWY (1954), p.34

Fig. 15: after BADAWY (1954), p.34

Fig. 16: after BADAWY (1954), p.35

Fig. 17: University of Addis Ababa, Dirk Donat, 2010

Fig. 18: University of Addis Ababa, Dirk Donat, 2010

Fig. 19: Erich Lehner, 2004

Fig. 21: after BALASSA (1980)

Fig. 22: after BALASSA (1980), historical aquarell painting of Koszkol Jenö

Fig. 23: after BÁRTH (1982), p.49

Fig. 24: RaBoe/Wikipedia, http://commons.wikimedia.org/wiki/File:Lamstedt_boerdehuus_loomst_03.jpg

Fig. 25: after SEIDEL (2007)

Fig. 26: after SEIDEL (2007)

Fig. 27: after SEIDEL (2007)

Fig. 30: after SABJÁN (2007)

Fig. 33 - 38: KUHN & NEUHAUSER, 2010