

THE ZIBBY GARNETT TRAVELLING FELLOWSHIP

Report by Chenelle Fatima Rodrigues



Straw Bale Building with Clay & Lime Plastering

Organised by; 'Earth, Hands & Houses' – Przelomka, Poland

20th June – 1st July, 2015

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1. Introduction

I am Chenelle Fatima Rodrigues from India. I was 26 years old student, studying MSc Architectural Conservation at the University of Edinburgh, when I received the ZGTF award.

While I was studying in the United Kingdom, particularly when preparing for my master's dissertation on conservation of earthen buildings, I also developed an interest in other natural building techniques. My interest in the latter mainly stems from the fact various other natural material are employed in earthen constructions, as well as my intention to promote ecological building for a sustainable future.

My niche interest however, rests in earth/mud as a construction material. I observed that though earth is found in most traditional constructions (if not as whole walls, at least as mortars and plasters), modern conservation approaches lay very little emphasis on this significant material. This observation was as a motivating factor to specialise in the conservation of earthen buildings. Through my conservation practice, I intend engaging in the repair of existing buildings as well as in the revival of the earth-building craft.

As a person who enjoys working with her hands and values practical training, I kept a constant look for hands-on workshops and training opportunities while at University. Until 'Earth, Hands and Houses', a natural-building initiative I have been keeping a tab on for a few years popped-up a newsfeed on Facebook announcing up-coming courses. I read more about the courses and understood that these natural building courses will aid my understanding of earth in as a traditional and natural building material, and would be an asset to my conservation practice. It was around the same time my conservation Professor circulated an e-mail notifying students of the ZGTF. It fitted just right.

Since travelling on the ZGTF, I have had various opportunities with earth-building. Currently, I am pursuing my post-master's degree, DSA – Architecture de Terre in France. The programme is solely dedicated to the conservation and revival of earth-building techniques and sums-up a perspective of earth-constructions across the globe.

2. Study trip

I participated in two workshops: (1) Straw bale building and (2) Clay and lime plastering in Przelomka, Poland.



Figure 1. The workshop site

I arrived in Warsaw on the 20th June 2015 and on the workshop site in Przelomka on 21st June. The Straw bale building workshop took place from 22nd – 24th June 2015, and the clay & lime plastering workshop was organised from 26th – 29th June 2015. The team used free time for site seeing. I spent 30th June in Warsaw and left Poland on 1st July.

I went to Poland with an agenda of learning straw bale building and plastering. I was also hoping this workshop would give me a better understanding of earth as a building material, and thus prepare me for my master's dissertation on conservation of earth-buildings. The trip however, far exceeded my expectations.

3. Costs:

At the time of application, I had estimated the trip to cost £933 – £1205, the ZGTF was generous to grant me £900. Contrary to the cost estimation provided at the time of application, in which I had included visa and insurance expenses, I did pay for the latter two from my own savings. The actual cost as calculated after returning from the trip amounted to £663.76. Following discussion with The ZGTF Trust, it was decided that I return £180.

The final amount thus received from The ZGTF was **£720**.

4. En route... campsite in Przelomka, Poland

Przelomka is a small village in North-Eastern Poland, close to the border of Kaliningrad (a Russia enclave) and Lithuania. It is 30kms away from the town of Suwalki.



Figures 2 & 3. The journey from Edinburgh to Poland

It took me two flights: Edinburgh – London , London - Warsaw, two bus journeys: Warsaw – Emilianów – Suwalki, a one-night stay in Suwalki, and finally a pick-up by my workshop instructor the following morning to get to Przelomka. That was one and a half days en route to get to my camp site. The site was more beautiful than imagined, so no complaints whatsoever.



Figure 4. River Hańcza, Przelomka – Poland

The site of the workshops was set in a small neighbourhood, surrounded by trees, hills and the river Hańcza. The team was based at the site of an aesthetically built straw bale house, the first one of its kind in the village.



Source: www.earthhandsandhouses.org

Figure 5. The natural build at the workshop site

5. The teachers: Earth, Hands and Houses

The workshops were organised by ‘*Earth, Hands and Houses*’, an organisation born out of passion for natural building about two-decades ago. Since then, it has shared its ideas and spread the concept of building with natural materials through the many participants who have attended the courses through the years.

The workshop on straw bale building, clay and lime plastering that I attended was led by *Jarema Dubiel*. He is a Polish Ecologist, Teacher and Journalist, well-known for his many environmental initiatives and lectures. He has been teaching with ‘*Earth, Hands and Houses*’ since 2002.



Figure 6. Jarema Dubiel

In addition to the instructor, the team consisted of seven participants, most of them from Poland. Piotr, Jarslow, Krzysztof and Slywia and Kris with their daughter, all had intentions of building a natural home for themselves in rural surroundings, to give themselves a better lifestyle. Finally there was Tuomas from Finland, a sculptor; Slywia and Kris were great assets to the team as they helped organise the workshop, especially with cooking our meals

On the first day of the workshop, Jarema introduced himself and asked each member of the team to do the same. We got to know each other and our motivation for attending the camp. We discovered that we shared similar intentions with regards to the conscious building for environmental sustainability. Throughout the workshop, we shared our ideas and experiences and got to know each other better, which was a great learning experience in itself! I had a good time working with the team!

6. The workshops: Straw bale building

“Bales” means rectangular compressed blocks of straw, bound by strings or wire.
(Magwood, More Straw Bale Building, 2016)

Straw bale walls may be built by placing small rectangular bales, essentially bricks, in a ‘running bond’ fashion. (Hollis, Practical Straw Bale Building, 2005)

During the straw bale building workshop, participants engaged in:

- understanding natural buildings techniques
- site preparation and selecting straw bales
- earth bag foundations
- building, stabilizing and compressing straw bale walls
- Installing windows

Understanding natural buildings techniques:

On the first day of the workshop, participants were introduced to various natural building and decorating techniques. There was an existing straw bale structure on site (built by previous workshop participants), in the construction of which other natural building techniques were imbibed. It served as a perfect model to refer to while Jarema (the Instructor) explained the various techniques that can be employed in natural buildings. These include wattle and daub, cordwood, use of glass in construction, etc.



Figure 7. Existing structure built by previous workshop participants



Figure 8. Cordwood technique



Figure 9. Use of ceramic in natural building

Site preparation and selection of the right straw bales:

It was decided that the structure built by previous workshop participants would be demolished to make space for the current team to build a new one. Breaking the structure proved to be a valuable exercise as construction details began showing-up as the structure was being demolished. Jarema was constantly around explaining these details and the purpose of imbibing them. For example, after pulling off the plaster, we were able to see wooden pegs and sticks that were pressed into straw bales and it was explained that that this was done to stabilise the straw bale walls.



Figure 10. Wooden pegs and sticks are used to compress straw bale walls

Straw bales for this workshop were sourced from a nearby farm. Jarema explained that long, crisp and golden coloured straw is an indication of good quality straw for building purpose. As a tip, he shared that straw for purpose of construction is best cut after the morning dew has dried-off the straw blades. They also need to be compressed into bales immediately. Ideal bales are rectangular in shape. Straw from Rye cultivation, he said were the best in comparison to the other varieties available in the region.

As a final quality check, Jarema recommends that the builder smells the bails to check for moisture just before they are used for construction. Dry and fresh smelling straw bales make good quality structures.

Earth-bag foundations:

Using flood control sacks or sandbags to act as permanent forms for earthen fill, earth-bag building is also known as flexible form rammed earth. The polypropylene sacks (used for sand bags and feed bags) are filled with sand or other well-draining soils for foundation building, and with clay soils for above-grade walls. Stacked in running bond (like straw bales), these earth-bags can create regular vertical walls or can be stacked to create vaulted or dome-shaped building (Magwood, *More Straw Bale Building*, 2005).



Figure 11. An example of earth-bag construction in process

Going by the prescribed modules of the workshop, the team began building an earth-bag foundation.

Figure 12. Steps we followed for building the earth-bag foundation:



Fill bags with earth



Fold the bag in a way that its joints don't jut out



Align the earth-bags in such a way that they form perfectly straight vertical walls. This step is crucial in order to secure the proceeding straw bale walls in place.



Compress using a bat



Compress using a ramming tool



Secure the bags in place using wooden pegs



Insulate the foundation wall using wooden frames and pebbles

Building, compressing and stabilising straw bale walls:

Jarema recommended that the straws be placed in the inside – outside position. (i.e. with the ends of the straws on the inside/outside) to allow for better air circulation.

As with the foundation walls, the layers of straw bales too have to sit in perfect vertical alignment with each other. We were able to achieve this by frequently checking the alignment using a wooden plank.

Following a demonstration, the team began laying the layers of straw bales and securing them one over the other using pegs that were sharpened on both ends. As we placed the bales one besides the other and one layer over the previous, we further compressed them by stitching them together using a straw bale needle and rope/string.



Figure 13. Using a wooden plan to assure that the layers of straw bales are perfectly aligned



Figure 14. Compression using straw bale needle and string

After setting each layer of straw bales, we were told to check for gaps between bales and stuff these joints with loose straw for better compression. On completing three layers, further compression was necessary. Long sticks were vertically placed on either sides of the wall and tightly stitched along with the wall with a straw bale needle and rope/string. Another compression technique was adopted after the sixth layer was up! A ladder (framed to the dimension of the wooden frame used while building the foundation wall) was placed on the top of the sixth layer. A hemp rope was passed from one side of the wall to the other and tightly fastened.

Figure 15. Compressing the straw bales



Compression

(a) using sticks after 3rd layer of straw bales (b) using ladder over 6th layer
(c) by fastening of the wall (d) using straw and soil fill gaps between bales

Another two layers of bales can be built over the ladder and can be compressed using just wooden pegs. After we had laid our final layer of straw bales, we filled the gaps between bales using straw and soil, as instructed. The wall was now ready for plastering!

Installing windows and damp proofing window sills:

While the construction was in process, we fitted the window frame on the part of the wall we had agreed on (Spaces/plan for doors and windows are best decided prior to construction).

We placed the frame on the wall on completion of the second or third layer of straw bales, over a plastic sheet and about 10cms inside from the outer wall the 10cms wall was then cut with a cutter/saw to form a rounded edge. The purpose of the plastic and rounded windowsill was to allow rainwater to flows out easily. As the window frame is being placed, straw bale layers continue to be raised on either sides of the window frame, thus integrating it with the structure.



Figure 16. Installing window frames and damp-proofing windowsills

6.1 Workshops: Clay & lime plastering

During the clay and lime plastering workshop, participants the team was directed towards:

- recognising clay found on site and soil testing
- understanding various factors before commencing plastering
- preparation and application of clay plasters
- preparation and application of lime plasters
- pigments and paints

Recognising clay found on site and soil testing:

At first, we were asked to merely see, touch and feel various kinds of soils and understand them in terms of colour, texture, grain size etc. After spending some time observing various aspects of soil by ourselves, Jarema explained that soils can be classified depending on grain size: fine particles may be termed as clay, coarse particles as sand, and small stone-like pieces may be called gravel. A mix of various particle sizes ensures better cohesion between grains and makes for good building soil. The team was introduced to various methods of testing soil, out of which the one which involved shaping lumps of soil into small cake-like shapes was the most useful.

This test helps determine which proportions of clay-sand-gravel mix will best suit your construction. After different proportions of soils are formed into small cakes, they are left to dry. The cake that cracks the least on drying is the one that is the best.



Figure 17. Testing different proportions of soil mixes

At our construction site in Przelomka – Poland, only clay and sand was naturally available and hence we conducted the test using these only. After the mud cakes that we had been dried, we saw that the proportion of 1:1 (clay-sand) had cracked the least and hence we chose it as the ideal mix for our clay plasters!

Understanding various factors before commencing plastering:

Before beginning plastering, it is crucial to consider various factors. I have listed some. It is recommended that various stabilisers, water proofing agents, etc. be added to soil to enhance its strength and that of the final structure. At the campsite, we were introduced to two traditional techniques that could be implemented with materials that were sourced from within the region. (1) We mixed cow dung with soil when making our plasters as cow dung acts as a natural water-proofing agent. (2) Jarema also taught us to make another water-proofing agent, traditionally used in Poland. It was made using the bark of birch trees.



Figure 18. Making of water-proofing additives to be mixed with plasters

Depending on the region where the structure is being built and the availability of resources, various materials can be mixed with soil to enhance the quality of the construction. For example, in Africa, the elephant droppings are used. While plastering a straw bale wall, it is necessary to leave a small part of the wall un-plastered and expose the straw. This allows the bales to breathe. This opening in the wall is called a ‘True Window’.



Figure 19. Making a ‘True Window’ when plastering straw bale walls

Before applying a new layer of plaster, make sure that you wet the old layer of plaster for reasons of adhesion. At the workshop, it was also recommended that the trowel be often wiped with a wet sponge during plastering to ensure proper application and smooth finish. Jarema further explained that the mix and technique of plastering could differ depending on the kind of wall one intends plastering and the kind of plaster one intends using. Also, it is only after applying several layers of plaster (may be up to seven) that the process of plastering is complete. Each of these layers could vary in terms of its mix, technique, thickness, etc.

Preparation and application of different layers of clay plasters:

We had a freshly built straw bale wall ready to be plastered, we had conducted tests to find the most suitable soil mix for our plaster as well as having gained a theoretical understanding on how plasters work. We were now ready to begin.

We decided on three layers of plaster for our straw bale wall:

Layer 1: slurry using only clay (no sand)

Layer 2: cob plaster i.e. a mix of soil and straw

Layer 3: the simple, tested mix of 1:1 (clay:sand)

We also planned on a final stabilisation layer i.e. an application of wheat flour glue.

As explained in simple words, plasters are made by mixing the materials you decide for your plaster. It's important though that the materials are mixed thoroughly well.

We began preparing our first layer of plaster: the slurry (only clay, no sand). It did require a lot of effort before the mix was ready to be used as plaster. As we began applying the plaster, we saw that this layer helped smooth the little strands of straw that were jutting out of the bales and formed a more uniform base for the next layer.



Figure 20. Preparing our first layer of plaster: the slurry

For the second layer, we had decided to use the cob technique (soil and straw). We began by preparing large quantities of soil using the tested proportion (1:1, clay:sand), we also added some cow dung so that it could improve the water-proofing qualities to the soil. Straw from the left over bales was mixed with the prepared soil, we also reused old chunks of cob plaster salvaged from the building we had broken when we started. The latter was made possible by soaking the chunks in water and letting them disintegrate (Another advantage of natural building – materials can be recycled and reused).

As a plaster application tip, Jarema shared that lumps of the soil mix can be thrown on the wall and then smoothed using a trowel, the ‘throwing’ allows for better adhesion.



Figure 21. Preparation of cob plaster



Figure 22. On application of cob plaster

Finally, the wall was ready for the third layer of plaster, the tested soil mix of 1:1, clay:sand, we gently rendered this layer using a trowel and a float.



Figure 22. Application of third layer of plaster (1:1 clay:sand)

At the workshop, as an added step, we were taught to make a natural stabiliser-polish using wheat flour and water: wheat was mixed with cold water and added to boiling water at intervals. When the boiled water formed a paste-like consistency, we applied it on the final layer of plaster using our fingers. On drying, it displayed a smooth, glistening wall surface.

While the team was working on plastering straw bale walls, Jarema went an extra mile and made sure that we gained hands-on experience with other building and plastering techniques as well. He taught us to consider techniques like wattle and daub, cob, glass bottles, etc. in natural building.



Figure 23. Wattle and daub method involves twining sticks horizontally and vertically to create a frame/wall over which plaster is applied.

Preparation and application of lime plasters:

Just like soil is mixed with water to make clay plasters, lime is mixed with water to make lime plasters. Before we began working with lime, we received recommendations on precautionary measures and tips useful in the preparation and application of lime plasters.

Health & Safety

Participants were asked to wear safety glasses to protect their eyes. This was because if lime gets in contact with your eyes, you risk permanently damaging them. We were also given protective gloves to wear because lime could burn your skin. Even if a little lime touches your skin, it was advised that it be washed off quickly.

Tips:

It is best to prepare lime plaster a few days before you would want to use it. The longer you let the lime rest after it is mixed with water, the better the quality. Avoid mixing or using lime in direct sunlight as it affects the quality of lime. If direct sunlight cannot be avoided, consider covering the lime using a plastic sheet. After application of lime plaster using a trowel, a wet brush can be used to smooth the plaster.



Figure 24. Application of lime plaster

Pigments and paints:

At the workshop, it was clearly explained and demonstrated that pigments may be mixed with clay, lime, wheat glue, water, etc. in different proportions to achieve the desired colour, shade, effect, etc.



Figure 25. When pigments are added to mixtures that largely constitute clay, they make



Figure 26. When pigments are added to mixtures that largely constitute water, they make paints.

7. The Polish experience: Suwalki – Przelomka – Warsaw

During my stay in Poland I spent a day in Suwalki city, eight days at the campsite in Przelomka, and one day in the capital city of Warsaw.

Suwalki:

I had an overnight stay in Suwalki before I headed to the campsite in Przelomka as the journey was too long. I reached the city quite late at night and was fortunate enough to have had a hotel reservation and to have met a kind pedestrian who helped me find my way to the hotel. The following day, I walked around the city, discovered various living quarters, visited the churches and the Konopnicka museum, and tasted some Polish food.

Figure 27. Sightseeing in Suwalki



The first Catholic church in Suwalki



Soczewiaki, a Polish dish



The statue of Maria Konopnicka, a Polish Poet, outside a museum dedicated to her

Przelomka:

Our workshop was set in the beautiful surrounding of Przelomka village, during the workshop, I lived in a homestead right opposite the campsite.



Figure 28. The homestead in Przelomka

Food was served at the campsite! Following Polish lifestyles, three meals were served: breakfast, a lunch-time meal called ‘*obiad*’, and supper. Slywia and Kris, who prepared our meals, would often go to the nearby forest and pick wild herbs and flowers which were served as salads and used as garnish. I had the pleasure of eating edible flowers and wild strawberries, something I had not tasted before. Exciting meals indeed!

Figure 29. A selection of natural foods



During free time between workshops, the team went around exploring the countryside or spent time together by the campfire. We visited the Bridges in Stanczyki (one of the largest viaduct constructions in Poland), a local ethnographic museum (a private collection displayed in the owner's house itself), straw bale houses of the region, etc. We also spent time by the lake, and trekked across the forest to see a cheesemaker.

Figure 30. The lovely country side



All throughout the workshop, my dissertation on earthen houses was on my mind, and I wanted to see the traditional earthen houses of the region and get to know of any traditional practices/stories associated with them. I not only explored some of these houses but also had a chance to talk to one of the owners to inquire about its history.

Figure 32. Traditional houses



A 100-year-old traditional earthen house around Przelomka

The owner relating the history of his mud house

I also got to know of many interesting stories surrounding Poland's the mud houses, it was Jarema who shared many of them. One of the stories was that according to a Polish tradition, a family would bury lime on the birth of a male child, so that it ages to quality and provides a durable plastering material for the heir when he grows to be 25 – 30 years old and is ready to repair his ancestral house or build a new one. These stories enhanced my ideas of traditional building and conservation practices.

Warsaw:

I had one day in Warsaw; Slywia and Kriss being from Warsaw kindly offered that I could stay with them, Jarema, also is from Warsaw and offered to show me around. I was fortunate indeed as he knew much about the history of the city, in fact, he had been actively involved in various political and environmental initiatives and gave me an insider's perspective.

Figure 33. Being a tourist in Warsaw



Visiting local markets with the locals

Warsaw University library, a green building



Tatar, a Polish special



Frederick Chopin Museum



A view of Warsaw city



Amphitheater at Lazienki Park

8. Conclusion

I had left for Poland with an agenda of learning natural building and exploring the Polish culture. ‘Earth, Hands and Houses’ had clearly communicated our course of learnings during the workshops, but I am glad that I did not plan a strict itinerary for my free time. I met an interesting group of like-minded people at the workshop, as we latterly explored the Polish countryside and Warsaw city together I was happy to listen to so many views and perspectives as it broadened my understanding of not just natural buildings and of Poland but on a variety of subjects. We exchanged our experiences on travels, cultures, foods, music, etc. An irreplaceable experience indeed.

As intended, I learnt straw bale building and clay & lime plastering as was planned, the workshop superseded my expectation and taught me many other natural building techniques like ‘cob’, decorating techniques such as imbedding colourful glass bottles and ceramics into the construction, etc. The tips we received were very helpful in improving work efficiency.

During the workshop, I remembered the instructor saying that ‘one finds ways that suit them best as they move along and continue building’. I realised that at this workshop, I became more comfortable with using various building tools. I have decided that I prefer tools that are smaller in size given my petite stature; an important lesson came in the form of letting go of ideas that may be too rigid and purist. I learnt to be okay with the use of plastic in a natural build – until a better and more eco-friendly material is available.

The trip proved to be very useful to my master’s dissertation on conservation of earthen buildings. It added value to my research through the understanding I gained on using mud as a construction material, through the mud houses I explored in the Polish countryside and the folk stories surrounding traditional Polish earth-houses that I manage to hear of. Most of all, my experiences on this trip to Poland were of value to my overall understanding of people and cultures in different parts of the world. It is an asset to my career as a Conservator of Earthen Buildings.