Volunteer Field Note – July 2018

Project: Making of Geo- Polymer cement, using material from the Sun Pyramid

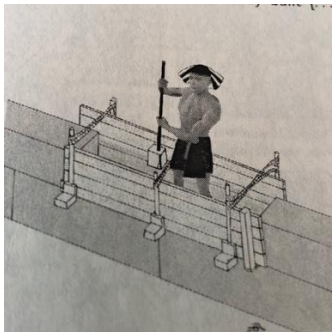
The project was the most interesting and at times mentally challenging work done by team 3, because few have ever tried to make geo-polymer cement from sandstone before. The process we followed was taken from a book by Jacob Davidovits - "**Why the Pharaohs built the Pyramids with fake stones**!" a full-scale experiment done in France in 2002. So, what was achieved in Visoko in July 2018?

Volunteers removing the clay deposits from Sonda 6 on the North face of the Pyramid



Three wooden moulds were made from help by the workers – We knew we had to make small boxes to allow the cement to set and dry, as Davidovits proved it was done in Egypt, for making the limestone base of the pyramid blocks on the Giza plateau.





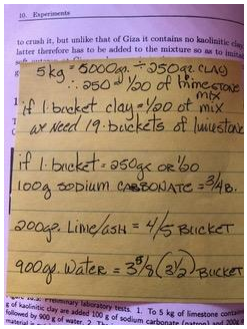
The start of the production process – Buckets of the red and blue clay were carried down to the Ravne Park for heating in a Celtic kiln, but first we needed to reduce the lumps of clay to a powder. Then chop the wood for the fire and prepare a clean plastic base for the mixing.



Cooking the Clay – We knew from the electron microscope analysis performed by Davidovits on a sample of the Bosnian pyramid concrete in 2009, he found it contained "poorly baked clay crushed with water possesses…" binding properties used to create the concrete blocks that look like natural pudding stone. This technique requires the clay to be baked to 500degs C to produce a strong binding material called metakaolin in geopolymer concrete. Our clay was placed on metal trays inside the kiln one on top of the other and baked for twelve hours.



Making the recipe – The composition of the concrete blocks on the pyramid were largely unknown so we improvised a recipe keeping the red and blue clays separate. After much discussion a formula of 90% to 95% conglomerate (sandstone with pebbles) taken from the Ravne 2 tunnel excavation site and the remainder made up of baked clay (geological glue) with some lime and water. All these materials were available in the Ravne area in vast quantities in the past, as the conglomerate from the tunnels was used to make the concrete blocks on the sides of the Sun pyramid.

Mixing the formula – We took 20 buckets of the conglomerate from the tunnel excavation, and left it to dry in the sun. Then using the equivalents above we mixed the clay with the conglomerate and water poured it into the mold, one for the red clay and one with blue clay. But we still had some conglomerate left over, so we decided to experiment further.



Making pre-historic concrete – The concrete blocks on the pyramid have been carbon dated to 29,200 BP so the BIG question was whether Neolithic man would have used such precise measurements to make 5-10-ton blocks with the conglomerate from the tunnels. We decided to test the hypothesis by varying the mixture further, by gradually increasing the amount of the clay to 20% and adding more lime. By the time we finished, we had three molds of what could be described as similar to the pre-historic concrete.



Results and conclusion - We proved that it is possible to for a small team of three men and one woman to cut the wood, collect and heat the clay, in an old-fashioned kiln, mix it with the local conglomerate (sand and stones) and leave it to set in wooden molds. With fine weather this took just four days of work, and we tried five different mixtures for the cement. The first two molds supervised by Richard Hoyle, used both red and the blue clay with a carefully measured scientific approach to the mixture.

After that we still had quantities of conglomerate and clay left over, so we continued to experiment filling the molds with a basic 'pre-historic' cement mixture. On reflection, the colour of the cement in the moulds is not the same as the blocks up on the Pyramid of the Sun. Obviously, the blocks on the Pyramid are far older, having weathered for 30,000 years and our cement still has not even set, so are we using the right clay? The clay we used was taken from Sonda 6, at the top of the stairs on the North face of the pyramid and the question is whether this clay is a primary or secondary type of clay? Clay deposits are often associated with low energy basins of water such as large lakes and we come back to the question of

another find made by team 3 - a small shell found when cleaning the dirt off one of the blocks on the Sonda. This raises more questions as perhaps, at some time after during the last ice age, around the time of the Younger Dryers Event (14,000 BP) the Ravne valleys were filled with ice and water, to deposit the layers of red and blue clay that were cleaned in July 2018.

Although we know the global temperatures during and after the last glacial period (14,000 BP) it is far more difficult to know what took place <30,000 years ago. I hope this project will inspire others to volunteer and make geo-polymer cement.

Submitted by David Pilsworth, author of the Tego Arcana Dei Series.

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