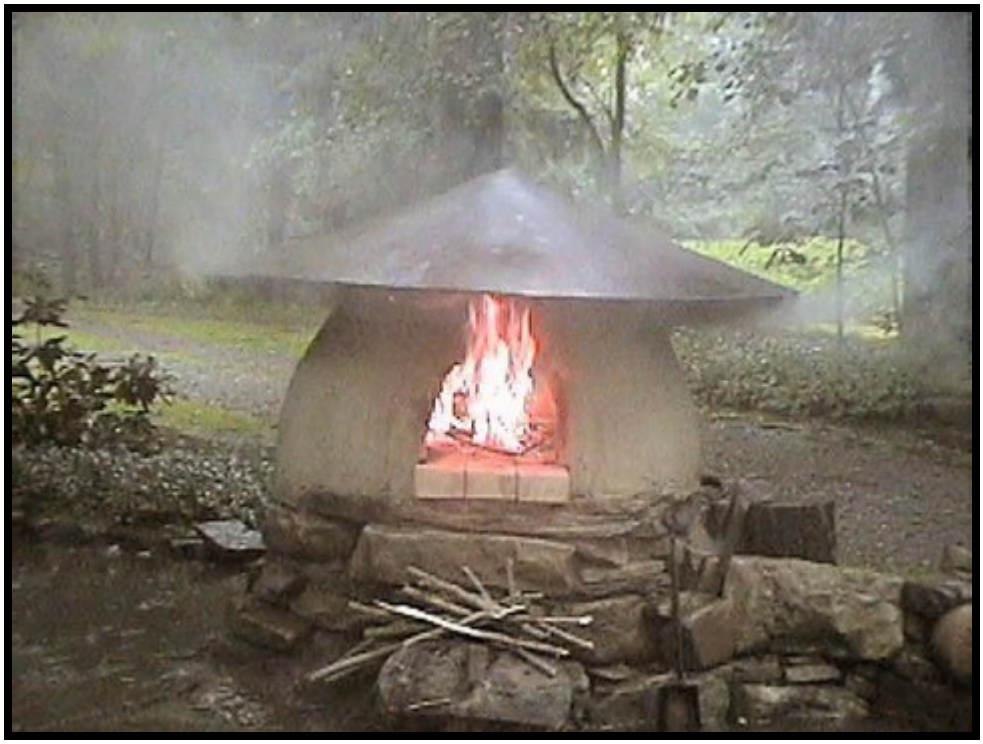
Greg's Earth Oven



It started with cob. (**Cob** is a building material consisting of clay, sand, straw, water, and earth, similar to adobe. Cob is fireproof, resistant to seismic activity, and inexpensive.) I have always been interested in natural, alternative, inexpensive, and do-it-yourself building techniques. Things like timber framing, straw bale, and rammed earth building. While surfing alternative building sites on the internet, I learned about cob. I had never heard about cob, it sounded interesting. Just dig up some sandy clay soil, mix it with water and straw, and build a house! Well, a house might be a bit much to start with, maybe try something smaller, just to get a feel for it. What could I build that was small and useful? - An OVEN!

An earth oven would be the perfect project to get to know about building with cob. And an earth oven wouldn't take too much work. It would be useful and fun and great to make pizzas and bread. I have the perfect spot for an earth oven, next to my fieldstone patio and fireplace. Part of the foundation was already there as a curve in the patio that fit the foundation outline nicely.

I dug down about 2 feet to provide a solid foundation. I wanted a good strong base that looked good and would last long time. The earth oven, with its stone base will be very heavy, and I didn't want it to shift and crack. The frost line here is supposedly around 3 feet, but 2 feet is deep enough to get to stable soil that won't be heaved by frost. I used 3 bags of Sack-crete concrete mix to provide a solid footing to begin laying the rock foundation.

I went rock collecting 3 times, filling the back of the van until the springs were near bottomed out. The pile of rocks I had to build the foundation looked enormous, but all but a small pile of odd-shaped rejects were used. The rock foundation is a little over 4 feet in diameter and about 4 feet tall - 2 feet in the ground and 2 feet above ground. I laid the stones in cement mortar, and kept the mortar raked well back from the face of the stone for a more natural look.

The rock foundation was hollow in the center, and this hollow was filled with various things as I built it up. At the bottom, I used a layer of coarse washed gravel to provide good drainage for any water that might find its way into the foundation to easily leach out. Most of the hollow was filled with sandy gravel subsoil dug from the hillside behind my garage, and some extra odd shaped rocks not used in the walls. I added the filling in layers as the walls rose, packing it down well by pounding with a timber to prevent settling.

The top of the rock foundation received a special filling. I had a bag of pumice lava rocks sold for landscaping, and thought that a layer of this would provide some insulation below the sand and firebrick floor to help the oven hold heat longer. Above the lava rocks was a 4-inch deep bed of well-tamped sand that acts as a setting bed for the firebrick oven floor.

The sand was carefully leveled and tamped solid to receive the firebrick floor. I was able to scrounge some used firebrick from Grandpa Elton, and purchased 15 new ones, for the total of 21 bricks needed. I laid the bricks tightly together in a basket weave pattern, with 3 bricks forming the doorway hearth.

The sand that forms the void was packed and shaped to a beautiful pregnant dome. The sand was collected from a sandbar under a bridge in the forest. A lovely time spent collecting 12 five-gallon buckets of sand. This void is 27 inches in diameter and 16 inches tall.

Now, its time to add the first layer of earth that actually forms the shell of the earth oven. This is "cob" without the straw. Various combinations of sand, clay, and earth were tried. I made several experimental mixes with different proportions. The best was made from “Farnsworth Redi-mix”. This was soil dug from the newly exposed soil along the edge of Farnsworth Road. Bulldozers had just reconstructed a section of road, widening it and exposing fresh subsoil along the edge. The soil was definitely clayey and sandy. It packed into a nice tight ball, with some plasticity, did not crumble and you could feel a good bit of gritty sand in it also. I collected 10 - 5 gallon buckets full of this soil. Right nearby along Farnsworth creek, I also collected some more fine sand and some fairly pure clay.

The mix for the first layer of the dome was prepared by mixing 2 buckets full of Farnsworth redi-mix with the larger stones removed, and 1 heaping shovel full of sand. Half a gallon of water was added and the mix was kneaded and folded by foot power into a homogenous squishy glob of cob (without straw).

We began building up a 3 inch to 4 inch thick shell of the earth mix over the sand core. We formed rough large shaped pieces of cob and poked and prodded them together.

As we built higher, it was apparent that the mix was a little too soft. It was bulging out at the bottom from the weight and compaction effort of the layers above. But we kept going, shaving off the excess bulging with a trowel to get a nice uniform dome. We found that you don't want to pat the mix and smooth out all the joints as you build - this brings out the water and makes it softer so it bulges more. It worked better just to poke it together, and get the dome built up and not worry about the cracks and crevices between the cobs.

After the entire sand core was covered, we used a board and rocked it back and forth, up and down over the dome and patted it by hand to make a smooth even surface and close up the cracks. We used the board to try to push some of the lower bulging mix up towards the top, to even out the thickness.

When the first layer was finished, I used a notched trowel to roughen the surface, so the next layer would bind to it better. We let this first layer dry for 2 hot days, and came home to find some big nasty cracks across the dome. I figured that the mix was shrinking while drying, and the sand core prevented it from shrinking inwards, so it had to crack. The dome was drying well, getting quite stiff and leathery. I immediately cut out the door opening and scooped out the sand. The cracks, which were maybe 3/8" wide, then closed up quite a bit. I plastered the cracks shut. I let it dry another day, and built a very small fire inside, just to help it dry a little more. A collar of earth mix was added to reinforce the door opening. After another day of drying we started on the second layer.

The next layer used a little different mix, more of a traditional cob mix: 1 bucket of Farnsworth redi-mix, 1/3 bucket of fairly pure clay, 1 bucket of sand, about 1 bucket of loose straw, chopped to 3 or 4 inches long, and enough water to make a good squishy mix. It was maybe a little to squishy, as it started to bulge again, and I stopped after building up about 8" from the base. During this time, it was hot and dry, and some smaller cracks (about 1/16") were showing up in the first layer dome.

We weren't able to work on it for 2 more days, so the lower part of the second layer got to dry quite a bit. The final batches of earth mix for the second layer were made with a little more sand, as follows: 1 bucket redi-mix, 1 bucket clay, 2 buckets sand, 1-1/2 buckets cut straw, water to make a little stiffer not so squishy mix. The first layer inner dome was getting pretty dry, so I dampened it and rubbed it with muddy watery soil mix to help the second layer bond. The second layer was finished, a full 4" to 5" thick over the 3" to 4" thick first layer, and smoothed and shaped by rocking and rubbing with a board. We left this layer a little rougher, with its straw stubble and small holes and joints showing, not completely smoothed out.

I made this thick wooden door from a section of tree trunk, hacked into shape using a chainsaw, circular saw, and handsaw. The top photo shows the back side of the door that fits into the oven opening, the bottom photo shows the door in place. Over the next few days, I helped the drying along by building small fires and letting them burn out, not heating up the oven fully. A bunch of small cracks showed up on the surface, but the straw seemed to keep them small, short, and well distributed. After a week of drying, we were impatient to give the oven its first full firing and cooking test.

I filled the inside with lots of wood and fired it up. It smoked lots of smelly black smoke and had a weak flame. Fooling around, propping up a small section of 5" diameter stovepipe with an elbow on one end, I got a better draft and cleaner burn. Later after more firings, I found that a small fire, taking up only the middle section of the oven floor with lots of space around the edges worked better, burned cleaner, and heated the oven up faster with less wood. The stovepipe really helps with the draft, especially when the wind is blowing towards the door opening.

For first firing we cooked pizza, then bread, and brownies. The pizza was a little sandy on the bottom but everything tasted great. Success!

The next week, we decided to give the oven a final coat of horse manure plaster, or "litema" as described in Kiko's book. We took another trip to Farnsworth creek and collected 2 buckets of clay and stopped at a farm along the way home to get 2 buckets of fresh horse manure. I really didn't have any guidance on the proper proportions for horse manure plaster, so started to experiment. First, the horse manure was rubbed against a ¼" mesh wire screen to break it up finer. Then I made a mix of ¼ bucket of fairly pure clay with water to cover. This was kneaded and stirred until it was a soupy clay slip, like creamy pancake patter. To this slip, I added about ½ bucket of the shredded horse manure and mixed it into a thick paste, churning it with a wooden dasher.

I then put 1 bucked of the fairly pure clay onto a tarp and kneaded it with feet into a smooth uniform mix. Added a little water to soften this hard clay, then about ½ bucket of fine sand plus the manure-clay slip paste previously prepared. This was folded and kneaded by foot until smooth, gooey, and spreadable, kind of like thick oatmeal. There is a lot of clay in this mix, with only a little sand. The final mix was something like: 1-1/4 buckets clay, ½ bucket sand, ½ bucket horse manure. Probably too much clay as it turns out.

The oven was prepared for plastering by first dampening it with spray from a hose, and then the surface was rubbed well with some of the manure plaster goop thinned quite a bit with water, to help the plaster stick better. The horse manure plaster mix was spread over the oven about ½" thick. It smelled like a bad cigar, but looked beautiful, smooth and rounded.

Upon drying 1 day many cracks were opening up in the new plaster. They were well distributed, about 1/8" to 3/16" wide, all over the surface. I'm sure that this is the result of too much clay in the plaster. But, the plaster was adhering to the surface well and looked hard and durable. After a few days of drying, with some more minor cracking, I filled the cracks by rubbing them full of the same manure plaster with a good bit more fine sand added, say 1 part of the above plaster to 1 part sand. This filling has since dried and looks good and smooth. Small cracks still open up when the oven is fired, but they just about disappear as it cools down again. This plaster seems to strong and hard, tough yet flexible, and looks like it will hold up well.

I have been covering the oven with a plastic tarp to keep the rain off, but really would like some permanent weather protection. The next project is to build a "hat" for the oven before winter. Rather that build a shed roof over it, I am thinking of casting a thin concrete dome, like the cap on an acorn, which will sit on top of the oven with a few inches of air space between. It will overhang the edges and keep all but the most driving rain off.

We have used the oven a number of times, learning a little bit more about firing and cooking in it each time. I have built a peel for handling the pizza and bread from a piece of old sheet metal, and have a rooker and scuffle for pulling out the coals and dusting off the firebrick floor.

I've been using the oven for 3 years now, its working great with very little maintenance needed. The pile of firewood under the tarp to the left is enough for about a zillion firings. The pile of firewood on the ground under the oven is what I use for a typical firing. You can see the steel plate roof that I added to protect the oven from the rain.

Many folks have asked about what I finally used for my oven roof. Being an enthusiastic scrounger/recycler, I found a heavy steel plate conical room from some type of farm structure on an old abandoned farmstead, and dragged it home. I made three bumps of cob on top of the oven to support the roof a few inches away from the top. The steel is heavy and just sits on top, held by its own weight. It works great to protect the oven, and looks cool when smoke from the fire is spilling out around it. My idea of a concrete roof would have probably worked OK, but I would need a gang of strong youths to pick it up and place it on top.

We are ready to light the fire. You can see that the clay around the doorway has crumbled away some. It is a bit fragile, getting broken off when putting in chunks of wood or scraping out ashes. I have had to add a new layer of clay when the gap around the door became too big, but only once in three years. I have also quit using the stovepipe shown on page 3 - I found it burns just fine without it, the front of the oven is stained black with soot though. When you first start the fire, the inside of the oven gets covered with black soot too, but as it heats up to cooking temperature, all the black soot burns away leaving the orange clay color that you see in these photos. This is one way to know if it is hot enough to cook - the black soot should be gone from inside.

I usually let the fire burn for around 2 hours. If you keep it going longer, it seems to hold the heat longer, but a 2 hour burn is about the minimum to cook a bunch of pizzas or bread. It works best to let the fire burn down to coals, then add another pile of wood, 4 or 5 or so sticks from an inch in diameter to just smaller than your wrist, and let them burn down. I usually re-load the fire this way maybe 4 times in the course of a 2 hour burn. Near the end, let the fire burn down to coals and spread them out evenly over the floor to give a nice even heat, and let it soak for 10 or 15 minutes.

When you're ready to cook, scrape all the coals and ashes out. I use a flat-ended shovel to pull out the remaining coals; I then swab the floor with a wet rag on a long stick to sweep out the ash. Everything is cooked right on the firebrick floor. The oven will be very hot inside now, and it should rest for a while to even out the heat and cool down a little. There are various ways to tell if it is the correct temperature for baking, and the correct temperature depends on what you're going to bake. For cooking pizza you want it hot! I usually let it rest about 15 or 20 minutes with the door off after removing the ashes. If you can stick your closed fist in the oven and hold it for a slow count of 6, then it's ready for pizza. Keep a close watch on the first pizza to make sure it's not too hot - It will take only 3 or 4 minutes to cook! I use a wooden "peel" to slide the pizza in and out. It takes practice to get that raw pizza to slide evenly off the peel and onto the firebrick floor - eat your mistakes! After the pizza goes in, the wooden door goes on to hold in the heat.

Here it is, hot and bubbling. I always make lots of different pizzas, one after the other. Since they take so little time to cook, you can make a number of different style topping for different people's tastes, all hot and ready quickly. My favorite topping is sliced tomato (no sauce), with artichoke hearts, mozzarella, and wild mushrooms, drizzled with olive oil.

I also like to bake bread in the oven - it turns out nice and crusty, you can't buy it at the store like this. The oven needs to be a bit cooler for baking bread than for pizza. Even cooler yet is good for cookies or brownies, or a dessert of baked pears with butter and brown sugar. We have not cooked many main dishes - had a nice chicken once. But I'm sure it would work fine for roasts or casseroles.