



The Middle East cultures found the iron making about 3300-3200a and it took more than a thousand years before the skill spread into the Finland, in the early Roman iron age. Some of smelting places are known at Neittilä village of Kemijärvi and Äkälänniemi village of Kajaani. It has been possible to observe this displacement by studying changes which have taken place in the objects that have been found. Slag are known also at Porvoo from the iron age village Böle at Porvoo. By this project, three possible smelting furnance are finded from our home garden at Markkinämäki, Ahvenkoski and Paaskoski. The slag sizes signs suggest that it will be very old, how ever, older than Strömfors iron works anyway.

The popular iron making has aroused great interest everywhere in the world during the last few years. In Finland very little studies which are based on scientific measurings have been conducted mainly Kuralanmäki experimental area of Turku. During the last few years the reconstructions of the so-called peasant cabins which will be timed to the 1700's have been built several places at Tuusmäki village of Rantasalmi to Säyneinen village of Juankoski, Kaunislehto village of Hyrynsalmi, Fiskars village and North Karelian Iron Works Möhkö. Also in Estonia and Sweden several cabins have been built the hole ovens, dome ovens and parents have been reconstructed. Saaremaa Tiui village is the one of central experiment area of the sphere of the Baltic Sea by field's leading researchers draws it Dr. Jüri Peets from Estonia.

The process has been the same, it in all the oven models, the iron making was prepared from the ore with a straight process in which oven the temperature was first fomented so high that the slag material melted and only after that iron was reduced from the ore which had remained. The temperature of prehistoric blast furnaces remained relatively low (1100C °-1300C °) in which case other oxides of ore failed to be simplified and iron became surprisingly clean.

For example from the Estonian 28kg was found in the Varbola ancient castle altogether in connection with the excavation of the 70's, the parts of the slag some of which contained iron more than even 99%. To the second edge of slag fires had squeezed clay and one can conclude from this that the slag pieces had been hit loose based on the oven or from the walls.

Iron is among the most general mineral in the lithosphere. Mainly it is found in bedrock but some iron and manganese dissolve in the water forming iron hydroxides and drifting into gravel based lakes and swamps in which particles precipitate the oxygen and bacterium activity (for example *Callionella Ferruginea*, *Leptothrix Trichogenus*) together with ground water currents) from income to contain the crystal water Limonit in other words ore.

We found out also two possible smelting places from the Kymi river valley area with in addition to the slag, third one is possible to see also stone base of the smelting furnace. All smelting places have been founded extend to the altitude contour 10m what should refer a places of iron age. But the exact timing requires further examination. The ore field of the one being located on the perch rapids can be used to perceive impressions which can point ore for raising with the Middle Ages or before it. Anyhow, all discovery means that it come time to write new history from that area.

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These so-called iron bacteria use good for the energy which is created in the oxidising process and dozens of species can be found on the same area. Iron ions ( $Fe^{+3}$ ) is carried in the soil with the currents of water and reaching more containing oxygen surface layers and surface water, the oxidising and the precipitating begin for example around a shell, stone chip or water plant. Due to this so-called coin money ore may be created for example from the lake ore. Limonit is found in Finland in the moraine lakes and swamps of Eastern Finland and Northern Finland a lot. Swamp ore and lake ore is not very high in its content between 25-45% of the place on an average depending on. In the Kymi loose lake ore occurs, among others, in the southern parts of Tammijärvi and in the eastern parts of the province plate limonit. In the eastern parts of the province it possible that the surnames would refer to an obvious iron making, Hytti, Seppä, Seppälä and Rautiainen.

The ore which has oxidised contains plenty of quartz and organic impurities. Quartz and other impurities form in the melting the slag a central task of which to protect again from oxidising and burning it is, simplified, little pieces of iron. Struka cemetery area with twelve heap graves has been timed for a Roman iron age and it is natural to try the reconstruction of the oven type which will be timed to the same period in this simplification experiment.

The making of iron begins with the drying of ore and preparation in which case slag comes off it and the crystal water which has bound itself disappears. In the actual blowing lime gives birth to the calcium silicates which bind the minerals contained by the ore and slag of quartz. First lime will decompose into calcium oxide and carbon dioxide but then unite to be slag, in other words calcium silicate ( $\text{CaO} + \text{SiO}_2 = \text{CaSiO}_3$ ) with the rock materials of ore ( $\text{CaCO}_3 = \text{CaO} + \text{CO}_2$ ). The charcoal returns to be carbon monoxide ( $\text{C} + \text{O}_2 = \text{CO}$ ) with the blast air and is simplified when going through the glowing coals ( $\text{CO}_2 + \text{C} = 2\text{CO}$ ). At the bottom of the oven the coal and carbon monoxide, in other words coal gas reduces the iron oxides ( $\text{Fe}_2\text{O}_3 + 3\text{C} = 2\text{Fe} + 3\text{CO}$  and  $\text{Fe}_2\text{O}_3 + 3\text{CO} = 2\text{Fe} + 3\text{CO}_2$ ) to the metal particle which is called an piece of "iron mushroom" . So the coal of coal gas catches the oxygen from the ore when burning to be carbon dioxide and left iron stays. The bloom which has been created after the process is raised fast out from the oven and it is carefully sealed with a mallet in which case being slag still comes loose in it fasten. The upgrading is made in the blacksmith workshop's vague one by boiling a part of several times in the over 1000C temperature and by going on forging by blacksmithing`.

It was decided to use hematite as the reason for the choice was the fact that the local ore findings only two weeks before the blowings and not had time to dry it and to deal with ready. The body of the gulf oven was masoned from fire-proof bricks and the fire safe space was plastered from the alumiinisilikaatti-massa from the Rexrak Oy. The outer covering was masoned from the mixture of the local clay, quartz sand and peat of the river valley and hemp was used as the bandage of the cover. For dimension the oven was reconstructed to be responsible for the oven type of roman iron age that is younger than the average. With the material choices an attempt was made to make more blowing experiments possible because it was thought as a default that the grey clay furnance was melting down. We cant find out of yellow clay from the area. The first test burning showed 28.8 that the oven heated in the environment of the nozzle, at least 1200c° and outer covering also about 300-400c ° in which case the fibres of a hemp and peat charred in the clay cover. The patching was made with fresh clay when the blowing wore out.

The first test blowing began with 06.00 preheatings for which a pine tree was used. At 9.00 a 09.22 heating with the help of charcoals was continued and the first ore charge was loaded. A 15kg of ore of altogether 12 times was added, the 10 and the blowing were discontinued at 13.35. 2 Were created as a final result 5kg iron mushroom. Content of the iron was found to be high with senses which. More iron should have been created and the rains which have lasted can be considered as the reason for this for the whole summer. Start-specifically it was thought that the coarse gravel of the sandpit absorbed the rain water but the surface of the ground water rose near the surface of the experiment place eventually as the consequence of the rains of the weeks. The wet country chilled a masoned stone base for the oven in which case the productive of the fire energy fell and the amount of simplified iron became smaller. The preheating of the blowing (5.9) was made to an actual one during previous day 18.00-22.00 and the heating was continued even until 03.30 events since. At 09.00 a slag hole was masoned closed on clay lump. The charging of ore which continued until yht 9kg of altogether nine times was begun at 10.00, 12.50. A limestone it was thought that which was increasing the amount of the slag was added to hematite ore 5%. Iron was created in the actual blowing 3,51kg. So the result was better than in the training blowing. The reason may be a longer preheating time in which case the foundation of the oven warmed deeper..

I got its heavy impression that more important than grams, the tables and the stopwatches are the own senses of the human being to monitor the glow and by listening to the whistling of the blast furnace and can conclude the different stages, an air need...it is reliable for the like tacit knowledge that has been inherited from the time of the Kalevala...

The experiment had succeeded in spite of bad weather conditions and in addition to the native country 5.9 blowings followed experts from foreing. Earlier studies an archaeologist has been made with Timo Miettinen's management which show that there was settlement which will stay in the iron age in Kymi river valley. One can show with the help of the blowing experiment that the iron making may have been possible already in a younger iron age or even earlier in Kymenlaakso and that it has been possible to use local ores as a raw material.

Cold wind from North effected really only 2C° temperature rose easily without with the effects of my small field forge . It was possible even to use quartz sand to weld a few smaller pieces together and in that case the possible to hear amazing sound like hiss and bubble from the forge and quite as iron would have boiled as really iron and steel...to get a hardening steel, it is necessary take iron bloom on welding temperature 5-10 times...

The subject would require further examination and suitable would be to start in the future, the research programme which could be used to study the operation of several different furnace types (in situ) and the simplifying processes of local ores. The permanent experimental area which and in the history in addition to archaeology would serve craftsmen, the study of the field and learning could form around the subject in the future.

Next we will wait for X-Ray analyses even though with the blacksmith's senses I can see that iron is excellent, anyway. Also I think about the reconstruction project of the oven types of several different periods from a primitive open hole furnace to the free draught furnace of the 1200-1300's...

Ahvenkoski village 15.10.2004

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