The Northbothnian Technological Megasystem: Urbanization, territorial metabolism and political ecologies.

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Planetary Urbanization (Brenner, Shmid, 2011) opens up a radical shift in analysis from urban form to urbanization process, as suggested through the radical hypothesis of the complete urbanization of society, put forward by Henri Lefebvre four decades ago. This situation means, that even spaces that lie well beyond the traditional city cores and suburban peripheries, have become integral parts of the worldwide urban fabric. Political-economic spaces can no longer be treated as if they were composed of discrete, distinct, and universal “types” of settlement.

Under such scope, in every region of the globe, erstwhile “wilderness” spaces are being transformed and degraded through the cumulative socio-ecological consequences of unfettered worldwide urbanization. In this way, the world’s oceans, alpine regions, the equatorial rainforests, major deserts, the arctic and polar zones, and even the earth’s atmosphere itself, are increasingly interconnected with the rhythms of planetary urbanization at every geographical scale, from the local to the global. These spaces become critical for urban development (and moreover, for urban political ecology debate). For that, Sweden is a paradigmatic case study where the urbanization of the southern part of the country is sustained upon an extremely intensive appropriation of natural resources from the North (Sörling 1988), (Tidholm 2014).

Norrboten, the northernmost land of Sweden, is a paradigm for territorial metabolism where a complex combination system of mining industry urbanization shaped the area. Thus becoming the connecting concept of Norrbotten Technological Megasystem NTM (Hansson, 1990) [fig.1], it’s key actors: natural resources, mining, transport, H₂O, energy, military infrastructure, mining communities, the indigenous Sami. Today the nature of industry remains the same, the social, political and economic leverage NTM exerts over the region is absolute; the economic profit, financial stability and wealth of the Swedish state take precedence over the environment. However, much of the industrial paradigm that underpinned its implementation is now under a severe change; as the global economy is facing an era of human development where resources, metals, minerals and energy will be more critical than ever, a renewed urban and territorial framework is urgently needed. The set of relations between environment and communities is currently under an unprecedented revision based on socio-environmental reflections.

This short paper will pose for discussion how heavy territorial infrastructure respond to the changing metabolism that is following after the short-term appropriation of resources so characteristic of industrial development in northern Europe. By critical graphic comparative analysis and trans-scalar research by design (Barcelloni & Cavalieri, 2015), the thesis will empirically investigate these processes to be able to cope with the debate on infrastructural adaptation through political ecology perspective.
Introduction

Have, even spaces that lie well beyond the traditional city cores and suburban peripheries, become integral parts of the worldwide urban fabric? Do really exist wilderness anymore? How is planetarian urbanisation becoming an interconnected reality in a glocal geographical scale? If 90% of Europe’s iron ore is extracted in the Norrbotten county, is this territory less connected to urbanization society cycles than cities like London, Berlin or Paris? How is the emerging, evolving and future transformation of a local megasystem justified by the extractivism of natural resources for the wealth of a state?

Urban political ecology asks questions about who produces what kind of socio-ecological configurations for whom (Heynen, Kaika, Swyngedouw, 2006), it comes thus to great interest in the present times to analyse those transformations happening in environments far away from the most populated areas, where nobody is watching. There is nothing unnatural about produced environments like cities, dammed rivers, or irrigated fields under the realising that produced environments are specific historical results of socio-environmental processes. The interest is so to understand the processes in those urbanization cycles at the multiple scales.

Under this scope, the northernmost part of Sweden is an example for territorial metabolism paradigm where a complex combination system is sustained through the flow of water (or power?) of a large sacrificed river; thus giving the start circulation to the interconnected hydropower system for energy supply, through the transportation in the railway Luleå-Narvik, following to the harbours. Raw materials from the mines are giving the basis for the extractivism and its urbanisation process.

The purpose of this short paper is to show how and why this socio-technological megasystem’s process emerged and evolved, taking as a start point today’s perspective, excavating the process of modern urbanization of the territory which eventually will embody in its material, symbolic, political and discursive constructions the expression of how the “production of nature” is both arena and outcome of the tumultuous reordering of socio-nature in ever-changing and intricate manners (Swyngedouw 2004).

To focus this in the framework of the paper, the discussion will place the interest on the socio-physical processes, with the physical system: water (Lule river) as the backbone supporting the so closely related technological megasystems, its ultimate goal: extractivism (mining), a process located in the multiple scales. How closely related a political nationalistic perspective evolved, in the time of modern industrialization in Sweden, through the appropriation and sacrificing of the natural resources, all justified for the energy and the wealth of Sweden’s people?

The Northbothenian Technological Megasystem

Natural resources

Norrland is a very rich region in natural resources and it was well seen as an opportunity during the period of 1870-1920, where as the result of the modernization process a new picture of Sweden emerged. Industrial society demanded a more realistic vision of the country and a new national identity. There was an extended belief that Sweden had been blessed with good prospects in the form of superior natural resources, as the industrial breakthrough had shown that raw materials and their refining provided for success in the modern world (Sörlin 1988). As a result, hasty industrialization happened, mainly within extractivism in lumber industry and mining. This was followed by the beginning of a large-scale exploitation of the great rivers water flow, as technological advance brought the possibility to produce hydropower electrical energy. The far unimportant region had changed into an area of enormous national economic significance, which as a consequence brought tremendous scientific research interest, mainly concentrated on the natural resources and their utilization through inventory projects carried out under state supervision. Here the relationship between science and economic interests was not unambiguous, research on natural resources was carried out as a nationalistic act.

Mining

The mining industry is one of the world’s largest and Sweden is an important European participant. It dates back to the early 11th century and has provided for the country a stable financial foundation for centuries. However, it is not until the end of the 19th century with the confluence of modernization and advances in technology that the industry, and specially with the construction of the Malmberget railway between the harbours Luleå to Narvik, would turn intense extractivism into profitable. Mining was thus transformed into a key sector for the industrial breakthrough in Norrland and Sweden. In 1750, the export of iron ore accounted
Most of the iron ore in Norrbotten is located in the mountains Kuiruavaara, Luossavaara and Malmberget. Aitik is extracting other metals including copper, gold and silver. Yet mines have an extreme territorial impact, in the form of noises and dust, as well as pollution of air and water. Running a mine takes a lot of energy and water, and processing produces large amounts of waste rock, as well as leakage of polluted substance or metals to the surroundings and acidify the lakes and rivers. But mines in Sweden are often considered so important that protection agencies allow large emissions beyond what would be tolerated in other industries. Swedish law is benefiting mining corporations, and attracting foreign companies to the Swedish mining market. Legislation even allows mining companies to prospect and begin excavation on private land without the landowner’s consent. The mining industry’s so called national interest trumps other national interests, such as environmental protection, outdoor tourism, and the reindeer herding industry (Malmberg, Buckland, 2015). An exemplification of that, the mining industry is exempt from the landfill tax, has a lessened energy tax, and only pays the mineral charge on 0,2% of the excavated value of its minerals (Tidholm 2014). Nowadays, mining companies should be required to prove to be financial stable, and regulations ensure it in order to avoid the danger of going bankrupt, leaving mines with its pollutant stand to be bought by the Swedish state at a great expense.

The other side of the story in a local perspective is the strong labour movement characteristic of the region, with consistent strikes. That way, the rise of unionization in Norrbotten specifically can be seen as a part of the larger pattern of community resistance to the NTM. Another manner more apolitical without protest, is the search of diversification of the industry, as with the push for space research in Kiruna it is a desire to unbind from the monopoly of the Norrbotten mining industry.

**Transport**

The prospect of mining to a profitable one would change in 1878, with the technological method for industrial ore purification that British chemists patented, it meant that iron ore could be purified and the phosphorus removed. Industry became then a consequence. Now a larger transportation network [fig.2] between the north of Sweden to the coast for processing and exporting to Europe was needed.
To begin with, it meant the construction of a railway about 2000 kilometres long, between Luleå and Gällivare. Until then, transports had been carried out using reindeer and horses. Built by an English company, the railway was completed in March 1888, going bankrupt in 1889. A political regime shift that led to a transition from liberal to protectionist thinking was followed by the fact that the state took over the ore field (railway, harbour, surrounding infrastructure), and that mining rights were transferred in Swedish hands. The arguments put forward in the government’s proposal emphasized that a state takeover would have beneficial socio-economic effects.

But there was still an obvious weakness on the transport side, Malmbanan reached only Gällivare, not to the larger and more accessible ore compound in Kiruna. As long as this was the case it resulted not economically viable to conduct mining in Kiruna. In 1898 a decision was made to build the Ofotenbanan, completing the last tram until the harbour in Narvik, being ready in 1903. As a consequence and in order to strengthen the defence of the railways and mines, the fortress building in Boden began.

Vital as well was to have a harbour from which to load the iron ore onto the ships that would transport it to Europe. The English companies placed the harbour in Luleå, the first loading was in 1887. In 1965, a decision to increase shipping potential was made to rebuild and expand the shallow harbour adding a new water with and increasing capacity from 4,300,000 to 9,000,000 tones. Ten kilometres were dredged, and a rocky shore was blasted away during construction. In 1994 it was decided to build a new harbour at Sandskär, being completed in 1996 [fig.3]. Aiming for higher security and ore capacity (both influenced by an increasing global need for iron), plans are to build a new harbour which will be connected to the nearby road, expected to be completed in 2020.

With the Ofotenbanan, the pressure on the mining system’s energy component increased. The state became in 1907 half-owner in LKAB, with the agreement for a significant increase in ore mining and transport. It soon became apparent that the energy part of both the mining and the transport system were not dimensioned for these new commitments. A change from steam to an electrified railway was foreseen, and the next system building decided, a hydroelectric power station in Porjus that came into operation in 1915.

\[ H_2O / \text{Energy} \]

At the end of the 19th century mining operations in Norrbotten required more energy for the extraction and transportation of ore, it was coinciding in time to when the state became half-owner in LKAB, and with the enlargement to the north of the railway to reach Kiruna [fig.7] and Narvik. At that time Sweden was entirely dependent on coal imports for its energy supply, thus “the white coal” or cheap electricity with hydropower was the answer, in 1910 the Swedish state commissioned what would be the largest hydropower station in Scandinavia: the Porjus power plant, producing a then-record breaking 50 MW upon completion in 1915 [fig.4]. Today it produces 480 MW, the 4th largest in the world. The 1st largest is now located further down the Lule river, Harsprånget power plant, achieving 977 MW.


Yet, how was the decision made and which were the aims for such an oversizing of the system? what was the future perspective in mind and flexibility taken in account for the building of the NTM? When the question of a power plant construction in Norrbotten began to be discussed during the first half of 1908, the purpose was producing electricity for the ore field and the mining in Kiruna and Malmberget. But viewed from the 1908-1909 horizon, the power plant could also fill a very valuable function for new industries whose operations were importantly based on good access to cheap electricity. It was thought that electricity could grow a major development block. Because back then it was not possible to transfer electricity over longer distances, the industries that wanted to use electricity had to be placed near the power plant. This change, concerning its purpose, was in line with the industrial police aiming at promoting Swedish industrial development and thereby increasing use of domestic natural resources. It was also a policy that had led to an ever-increasing government involvement in different areas. A criticism to the policy is that it largely affected Norrbotten, and yet it was designed by actors without anchoring in the county and without close cooperation with Norrbotten players (Hansson 1998).
A major difficulty in the building of the system was knowing how should have to be dimensioned and how to deal with the problems that arose. The power plant took a risk in getting larger dimensions on behalf of overcapacity for certain periods. Another option could have been to take energy from elsewhere in the cases needed, an approach termed by Hugues as an “economic mix”. This is what was the case in southern and central Sweden, where other possibilities for interconnection between different entities occurred. Later, and here will be argued it happened because of the contradiction of choosing a large energy system versus an interconnected flexible one; with the unexpected problems by the wake of the First World War, world economic problems turned the longer perspective of industrial visions down. The consequence of it was an overcapacity of the power plant, but by the moment when the crisis finally went away technological advances allowed long transfers of electricity to the centre and south of Sweden, leading to a complete override of the visions from 1910s [fig.5]. Today, nearly half of Sweden is met by hydropower. The Lule river is the largest source of hydropower in the country [fig.6] [fig.8], with fifteen hydropower plants run by the state-owned Vattenfall AB.


[fig.7] Photo “Malmpallar i Kiirunavaara”, how the railway and electricity were conquering the territory of the northernmost part of Europe, arriving to Kiruna. Source: from Kiruna. F.G. Landströms Bokhandel: Kiruna.
[fig.8] Transformations in the building of some of the fifteen dams located along the Lule river, on the left 1960s, on the right the present. From the bottom to the top: Suorva, Messaure, Porsi, Laxede, and the dried tram of the Lule river affluent, between Lenti power station and Vuollerim. Source: from web www.kartbild.com.
Military infrastructure: Boden, Lule river

When the Riksdag and the Norwegian parliament in 1898 decided to extend the ore from Gällivare via Kiruna to Narvik, it meant that the last railway tram would be built, requiring an increase in defence prevent- ing the risk of possible interests from Russia in northern Sweden. In 1900 a parliamentary decision was made for the construction of the fortress in Boden: a facility widely acclaimed for defending the great stagnations made in the north. At the moment the decision was taken, the mines were still in private hands but with the 1907 Riksdag decision, the state was to become a half-owner in LKAB.

The securing with the defence at this stage, would lead to control the risk and make further decisions on the building of the megasystem. The next one to be taken was for a power plant with the dimension to respond on Malmbanan and LKAB’s needs. A review in a time of great change with long perspective will lead to consider a hydroelectric power capable to reach and expand for higher demands, opening the possibility to the increasing of production and further industrialization of the region (which for other unpredicted reasons such as: the irruption of the First World War, the transport side where long distances caused problems, long and cold winters which caused very long periods of downtime in the shipping industry, underdeveloped education with no prepared people in technological fields...didn’t turn to be as planned).

Community conflicts

Mining communities, urban transformation in Kiruna and Malmberget, Aitik.

Mining is the backbone of the Swedish state and is threatening Norrbottens communities, its land and livelihood, bringing unsta- bility through weak regulations and environmental transgressions. Kiruna and Malmberget (main iron ore mine towns) buildings will need to undergo radical changes in the coming decades, being strongly affected by what is happening in the world at a global scale. This is, as iron ore prices began to rise in the early years of this century thanks to growth in China, LKAB decided by this influence to continue mining (Sjöholm 2015). Thus, company’s operations will be secure for many years and mining will continue reaching new main levels. As a consequence, towns will gradually be affected by the continuation of mining, forcing to move - relocate buildings (cultural heritage considered) or demolish. The land between town and mining will be converted into a park buffer area. In 2004 the Municipality of Kiruna issued a press release stating: “Vi flyttar en stad” (we are going to move a town) [fig.9].

(fig.9) The headline “Vi flyttar en stad” (We are moving a city) appeared on the news in 2004. Source: from the web www.samhallsomvandling.lkab.com.

Pollution, global warming, and the peculiar industrial accidents in Kiruna and Malmberget are all slow-onset disasters, which can take generations to become understood and are often seen as inevitable (Malmberg, Buckland, 2015). From the beginning of the mining first settlements or shantytowns, they were decided to be built the closest to the centre of the mine, as transportation in Norrbotten was difficult the shortest distance from the homes of the workers to the mine pre-vailed. Hence, when the mine proved profitable towns were dismantled and rebuilt on the same spot, a largely unplanned growth repeated throughout the histories of
Kiruna, Gällivare and Malmberget. Without the possibility to rely on other sources of energy for transportation alternatives, it was decided to build on top of where iron depots were, if known that one day would possibly be extracted it was the condemning of the town to be moved in a future scenario. When taking in account today’s process of moving the towns, the one-company town LKAB is aiming to protect natural reserves, avoiding further proximity to current and future mining operations. But as LKAB is the one supplying the buildings, roads and infrastructure for the new towns, community is solely depending on the industry for sustenance. The administrative role in the relocation process serves to further strengthen their political and social influence (Malmberg, Buckland, 2015). The mining community was dependent upon the LKAB company for sustenance up until the 1950s, when the Swedish state bought a controlling interest putting in theory the community wealth at first priority, but as one of the several consequences to industrialization: in practice, financial interests often comes first.

[fig.10] A comparison from the top to the bottom, of the mining and towns of: Kiruna, Malmberget, Gällivare and Aitik. On the left 1960s situation, on the right the present astonishing transformations can be seen. Source: from web www.kartbild.com.
Kiruna, Malmberget/ Gällivare and Aitik, serve as examples for a reflection on the interactions between
generalized industrial megasystems and their surrounding communities in Norrbotten and Sweden at a large.
Three different physical realities in the extractivism coincide with different processes and consequences to
their communities [fig.10]. First, in Kiruna, the mine is deep below the Kirunavaara mountain. As volumes of
rock are removed from the mine, the ground above is liable to cave in proportionally. The Kirunavaara iron
ore body slopes, at an angle, beneath the outwards towards the town. The ground seeps and falters, and will
eventually cause the town to crumble into a pit of waste rock, a slow process but inevitable. If mining
operations ceased today, the surface would destabilize within a few decades. As mining operations continue,
the sinkhole expands even further. LKAB estimates the town will be unliveable within a century. Hence, the
town is facing a relocation due to an impending surface collapse. Second, in Malmberget, the mine is open-
pit. In the 1980s, the pit, nicknamed Kaptengropen [fig.11], began to expand of its own accord. LKAB
evacuated the nearby buildings, moved some structures and abandoned others entirely. The ever-growing pit
divided the town in two. Houses and neighbourhoods were swallowed by the dangerous sinkhole. Between
the risk of rock falls and the threat of relocation, the town of Malmberget began to dissolve socially and
economically. Mining ceased and a majority of residents moved to the neighbouring Gällivare. Now with
population 6000, it was once a much larger community, and the city plan reflects that. Most houses and
streets are empty. The pit only becomes obvious when driving through town, with many roads closed and
blocked off. Here, the town is suffering an irreparable damage causing the migration of its residents to the
neighbour town Gällivare. Third, in Aitik, the mine is open-pit very automatized and increasingly digitalized.
Because Aitik began operations in the 1960s, modern automotive technology meant that its workers could
simply live in the nearby town Gällivare. There was no need for a hyper-local mining community, as in
Kiruna and Malmberget. There are no community issues, no cost of human impact, and no evacuations.
When the mine begins to crumble into instability in the coming decades, it can simply be abandoned. With
the precautions of modern mining technology, yearly tests for groundwater pollution are reassuringly
negative. While there are other environmental impacts, Aitik has the smallest social footprint of any major
industrial mine in Norrbotten. As a result, Aitik has a relative lack of community impact.

Some questions arise to be critical in the following research. Was the first urban setting decision condemning
the town to be moved in its future development, due to the building of homes on top of hypothetical or
known location of iron depots? What are the social problems related to, if LKAB is versus the municipality,
taking responsibility on the moving process while being a public company? How will the moving of the
towns be perceived in the history, as old buildings or as complex historical environments?

[fig.11] The ever-growing expanding pit in Malmberget, nicknamed Kaptengropen (Captain pit), dividing the city in two.
Source from the web www.thepoliisblog.org
The indigenous community today: The Sami

The construction of roads, railways, dams for hydropower, and pollution of fields and mountains for the mining industry requires numerous environmental changes, which came in expense to the economy of the indigenous community inhabiting Norrbotten and the region of Nordkaloten: The Sami. These changes are affecting them in numerous ways and for instance disrupting the annual migration of their herds, as well as often poisoning the animals. In this socio-physical reality comes in evidence how the infringement of larger megasystems have repercussions as representatives of a common industry-first attitude.

The long-lasting conflict between Sami and the affection by industrialization process intensified when operations and the community of Kiruna were established, here the government breached the development limits set by the parliament in 1867, which through the cession of land traditionally owned by the crown or state, was becoming the property of individuals. There was to be no new settlement outside the development limits, and the land was instead to be used solely as reindeer grazing land, but in the practice this was not followed. A hundred years before it had been another conflict, the ratification of the Swedish-Norwegian border (1751), when the feeding areas became regulated through taxes. These regulations applied more or less up until 1905, when the union between Sweden and Norway was dissolved (Lundholm, Groth, Petersson, 1996). Later, from the LKAB's first managing director in Kiruna Hjalmar Lundbohm, came the doctrine “lapp skall vara lapp” (Lapp should be Lapp), arguing that reindeer-herding Sami should not be integrated into industrialised society, neither commercially nor culturally. This way the Sami reindeer-herding culture would be preserved for the future, believing that if they had contact with “civilisation” then could be tempted to give up their nomadic lifestyle (Viklund, Brunnström, Sjöholm, 2015).

One could argue here towards the necessity on leaving any kind of false ideal interpretation, their lifestyle or conditions for survival like anyone else also changed, together with technological developments and urbanization. Thus, today with technology, migration takes place by truck, milking or cheese production became rare and evolved to meat production. Forced migration and the survival of the group amidst the modern industrialized society spreading its characteristic large-scale concept, are the current challenging processes. The traditional Sami way of life is based on other basic values, with the reindeer-keeping the Sami has learned to adapt his life to his natural environment, understanding the vital importance of protecting the land.

Environment questions are given a higher priority nowadays when initiatives like new dam projects are discussed. How to use natural resources? Where are the interests and how are they weighed against one another? Where is the compromise between the needs of the larger society to use the assets for the good of the whole nation, and the self-evident right of the Sami to live in accordance with their traditions?

Case study not sufficiently investigated

After 1920, the once perspective of the northern region as the symbolic future of Sweden has turned to another reality of economic decline. Economic reliance is a major repercussion of the NTM. It is so that when an industrial town is founded adjacent to some natural resource, the community that grows up around it tends to be predominantly employed in that specific industry (Malmberg, Buckland, 2015). This is the case of Kiruna, Malmberget, Gällivare and the majority of small industrial towns in the region. When the most part of the residents are employed in one central industry, the wealth of that industry tends to parallel the wealth of the town. The same, the wealth of the NTM, and all the myriad industries it contains, tend to parallel the financial and social well-being of those living in the region. Thus, the specific industry tends to gain influence in the politics of the region. By a similar mechanism, the environmental concerns of the region tend to be weighed against the benefit of the industry, which is given preference in nearly all cases. Now, futures

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1 Nationalistic thinking caused a deterioration in the situation of the Sami. The treaty of 1751 allows for Sami to cross the Swedish-Norwegian border, and that applied more or less right up until the end of the alliance in 1905. The result, specially for Sweden, was that Sami from Norwegian Finmark and the Torne Valley continued with their reindeer-keeping as far south as the upper reaches of the Ume river. This brought a cultural clash between groups of Sami, as they did not speak the same language, they had different methods of reindeer management and their way of life was different. Criticism is levelled at the decisions made by authorities concerning mandatory measures in general, and in particular at the fact that two management systems came to be side by side. The northern Sami had practically ceased their milk utilization at the beginning of the 20th century, concentrating instead on meat production. Thus, extensive reindeer-keeping evolved. Therefore the new arrivals brought reindeer herds which mixed with the existing herds where the Sami still practised intensive husbandry, i.e. grazing and milking. If we move on to the last two decades, we can note that the milk economy was not viable, whatever the geographical area.
continue to be formulated for Norrland, stemming from contemporary idea currents like ecological consciousness and visions of hi-tech societies (Sörlin 1988).

Conclusions

What emerges from this first horizontal analysis in the urbanisation processes of the NTM shows that the optimistic decisions, by the building of the large megasystem made at the time where the region was seen as “the Land of the Future” (Sörlin 1988) with abundant natural resources, didn’t meet the desired expectations. The high dependence from the different elements make the system less strong in adaptability when shortcomings arise. Be an example the First World War with its counter effects, or the technological advancements allowing for the energy to be transferred to the south of the country as soon as overcapacity affected the system. Energy could be in the future better produced nearby in a distributive manner with less damage to the always linked processes of the planetary environment. But even back in time, one could see that the south of Sweden was not relying in a unique large system, instead in a network of, where providing for energy in a more diversified manner.

The settlements designed just to extract the needed resources for a society in a national or global scale can lead to a weak basis of local social structure, no diversification of the economy and avoidance to accept the richness complexity of “the place” are threatening large systems from the very start point. Lefebvre asked: “If the traditional is dissolving, and urbanization is being generalized across the planet, can new forms of citizenship be constructed that empower people collectively to appropriate, transform and reshape the common space of the world?”

So it could be argued that the subject for empowerment should come to be the “society” power, taking the bottom approach. If as in this case study of a large megasystem: one-company town, top-down energy and transportation rigid systems are the “game rules” [fig.12], how could they be transformed by whom and how? Why and when will that happen?
Measure provisory town. During the years of the hydropower plant construction (1957-1963), a temporary town for approximately 1,350 inhabitants was built to allocate the workers. On the top the plan to build the dam with the town, in the middle while under construction in 1960, at the bottom the present situation where only the streets remain. Source: from Statens Vattenfallswerk, web www.kartbild.com.
Bibliography


