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Du glint baltique au lac Peïpous

Estonia's water bodies, between originalities and limits to qualify its limnic territories

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Conclusion

A large waterfall cascading over a rocky ledge, with a dark, mossy rock face on the right and green foliage on the left.

Fall of Jägala Joa (photo: Pascal Bartout).

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Version française p. 267

The five contributions presented in this issue provided an overview of the types of contemporary research in limnology, but they were not in any way intended to make it a comprehensive state. However, they have highlighted a number of environmental dynamics of this other "lake Country" to use J. Terasmaa's expression and we will focus on putting them in perspective to answer questions posed when this part was introduced. To do this, we will show the double originality of the Estonian limnic territories, but at the same time highlight a double limit to the invocation of this originality.

The first originality lies in the composition of the limnic corpus as demonstrated by J. Terasmaa through the analysis of the most exhaustive inventory of Estonian water bodies. Unlike all scientific productions dealing with Scandinavian or Baltic water bodies with the notable exception of the work of Kuusisto and Raatikainen (1988) in Finland, it would seem that almost half of the Estonian corpus is composed of artificial ponds. Of course, the value is uncommonly measured with the French data where almost all the bodies of water are artificial (ponds and swamps) (Bartout and Touchart, 2013), but they relativize the "natural" myth of the Northern water bodies.

Similarly, as shown in this table from the poster produced for the Vienna EGU Conference in 2015 (Terasmaa et al, 2015), focusing

on the only lakes (in the sense of more than 100 ha of area) allows to know the majority of the water areas in Estonia (more than 70% without counting the cross-border lake Peipsi) unlike France (which led us to produce the term "extended limnic ratio" at the expense of the more classical term "limnic ratio" in order to show that the water portion of a territory was not the only fact of lakes but of many water bodies, Bartout and Touchart, 2016), but if one sets as an objective to work on the shoreline length symbolizing the contact between the limnosphere (Touchart and Bartout, 2018a), the lithosphere and the atmosphere, then it is the small bodies of water like swamps (in Estonia) and ponds (in France) which constitute the first centre of scientific interest and not the Great Lakes.

Table 1: Comparison between Estonia and France of their area classes and shoreline lente (p. 268).

If Estonia differs from the rest of the world corpus by its specificities, is it a separate case on the Baltic scale? In fact, in the introduction of this part, we had raised that the current statistics linked Estonia to two different sets depending on the nature of the statistics used: either a Sweden-Finland-Denmark bloc or a strong resemblance with the indicators observed in the Baltic States and Poland.

We have therefore constructed a figure from the regional analysis of the limnic footprint index for the northeast part of the Baltic

area (i.e. Sweden, Finland, Latvia, Lithuania, Estonia, but also the north-west part of the Russian Federation) to determine whether:

- Limnic Estonia is homogeneous or heterogeneous;
- Limnic Estonia is linked to a territorial subset or is it original.

Figure 1: The limnic footprint index by regions of the countries bordering the northeast of the Baltic Sea (p. 269).

This figure 1 makes it possible to decide the debate linked to the approximate numbers produced at European level and according to the political and scientific viewpoints.

Estonia is very clearly homogeneous in the sense that all its regional levels ("Maakond") have a limnic footprint index greater than 1, therefore, at the scale of the territories studied, all Estonian territories have a very limnic intensity developed. In detail, this limnic footprint index is even very important, since only two regional sets do not have a limnic footprint index greater than 4 but between 1 and 2 (Hiiumaa) or between 2 and 4 (Saaremaa).

Apart from this Estonian homogeneity predominantly based on thousands of small bodies of water, the regional levels with very strong limnic footprint indexes are the result of the presence of very Great Lakes (central Sweden, southeast Finland, Kola Peninsula...). There is therefore a real Baltic originality of the Estonian limnic corpus, but to answer the question posed, the reality of the data presented here links Estonia more to Sweden and Finland rather than to the other Baltic countries.

All of this (table 1 and Figure 1) calls into question existing national or transnational inventories by demonstrating the preponderance of small natural and artificial water parts in this Baltic area, justifying all the interest that can bear scientific teams working for example on carbon burial within these original environment through their very low relative depth and the large relative amount of organic matter (Cole et al, 2007, Downing et al, 2008, Downing, 2010, Mendonça et al, 2017).

The second originality of the Estonian limnic territory lies in the very purposes of the studies carried out in this globally restricted territory. While traditional researches on the Great Lakes are still present, they are more open to systemic issues integrating the hu-

man sciences into the heart of reflection and the problem and not to the periphery to give good consciousness as it is unfortunately too often the case. The originality of the limnic corpus makes small pieces of water of the type thermokarstic lakes, flooded bogs and artificial ponds to study less known facets of science. The limnosystem is approached from a management perspective, at the Anthropocene level, by trying to establish an inventory of the specific functioning of these bodies of water and the anthropogenic pressures exerted on them.

Nevertheless, all these studies are not sufficient to characterize globally one or more limnic territories. Indeed, the first limit observed is related to the lack of data in the human sciences and the standing artificial water bodies. In this, we are far from the work carried out in France by Bedoucha (2011), Bartout (2015), Derex (2017) or Benarrous (2017), or even with those of the Czech Republic allowing a geohistorical retreat including cartography at the scale of two centuries (Pavelkova et al., 2016).

In fact, it is difficult to accurately trace a limnic territory of the limnoregion type because it has six basic criteria from three main entrances. Conceptualized for France (Bartout, 2015), it includes:

- "Natural" criteria with hydro-ecoregions and the potential of lentic reception;
- "societal" criteria with current valuations/uses and landscape trajectories;
- Limnic indicators with limnic footprint index and the share of lakes/ponds/swamps in the territory.

If the "natural" criteria and the limnic indicators are available today, building a limnoregion requires a much finer understanding of the societal criteria of current valuations and uses, as well as the landscape trajectories.

The second limit is technical and may question the conclusions given a few paragraphs before. Indeed, the enormous progress in the monitoring of water bodies at the level of Estonia has hardly any equivalent in Europe, if it is perhaps the Danes with the site Soer. In fact, is the originality of the Estonian lentic corpus real or is it the result of the lack of research on these issues in the other states bordering the Baltic Sea?

Big question... That can stimulate local, regional or international research, and highlight the very important shortcomings of all

current water management policies on the European perimeter by ignorance of the environment itself. For example, if we apply to Finland in close proximity the changes observed in Estonia between the various inventories presented as part introduction and that presented by J. Terasmaa, i.e. an increase of 1360%, the figure of 1 million of bodies of water of more than 100 m² could be approached or exceeded.

In the end, we must consider Estonia as a living limnological laboratory, the fruit of many influences, both natural and anthropogenic, which develops its own personality within a regional ensemble to discover or re-discover.

References (p. 271)