



## **Reconstruction of the Neusiedlersee (Austria/Hungary) based on historical topographic maps from 1507 to present**

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The reconstruction of previous landscapes is a very challenging undertaking and needs close interdisciplinary cooperation with various sciences (e.g. geology, geochronology, geodesy, remote sensing, hydrology, climatology, land surveying, palaeontology, archaeology, history and cartography). This presentation uses the Neusiedlersee area as case study to show the great value for landscape reconstructions that historical topographic maps may have. However, topographical maps cannot be used like georeferenced air-borne or satellite imagery that shows actual snapshots of the Earth's surface. Maps - and especially historical maps - may contain errors, inconsistencies and inaccuracies; some of them might be completely wrong for political and military intelligence reasons of the given time. Therefore, in close cooperation with historians and cartographers, the maps should carefully be checked for their contents, age, details of their production, cartographic parameters, and historical circumstances, etc., to exclude possible pitfalls as much as possible. The Neusiedlersee (German) or Fertő-tó (Hungarian) and the associated wetlands of the Waasen/Hanság are situated southeast of Vienna, at the eastern boundary of Austria, forming a unique landscape and environment at the western boundary of the Little Hungarian Plain. The present hydrographic conditions of the Neusiedlersee are: (a) the lake is very shallow (<1.8 m depth), (d) the Wulka river is the only major fluvial tributary, (c) the lake thus is

mainly depending on precipitation on, or nearby the lake, (d) the input of ground water is considered to be low, although details of the ground water budget are still under discussion, (e) the water balance is delicate, because of the high surface to volume ratio and the general climate boundary conditions. Continuous measurements of the lake water level started only in 1932; in this period, the minimum lake level (measured in altitude above the Austrian zero-level in Trieste, Adriatic Sea) was 114.50 m, the maximum 116.08 m and the mean value was 115.30 m (source: <http://byc.at>). The Neusiedlersee area is especially suitable for the reconstruction by historical topographic maps, because of the extremely flatness of its landscape and the amazing shallowness of the lake. Variations of the altitude rarely exceed 15 m within a few hundred square kilometers. This low relief of the landscape is an invaluable advantage for using historical maps for the reconstruction of former lake shore-lines, because even lake level variations of less than one meter affect large areas, which are far beyond uncertainties and inaccuracies of historical maps from the mid-18th century onwards. Maps not only show the extent of lakes in former periods, but they also give quite good age constraints for them. Generally, geochronology of late Holocene landforms is difficult and has comparably large errors. The things get even worse, the younger the investigated age period is. By using maps, the formation and modification of geomorphological structures can be dated very accurately. They may show anthropogenic modifications of natural conditions like channels or dams, which otherwise would be difficult to reconstruct. Historical maps contain other important information about former landscapes, which hardly could be obtained from solely geological investigations. In the case of the Neusiedlersee the existence and extent of reed surfaces in the lake is hardly possible to reconstruct from pollen analyses of sediment cores, but they can easily be reconstructed by historical, topographic maps. Beginning with - to our knowledge - the first historical map showing the Neusiedlersee (ca. 1490 Henricus Martellus Germanicus) there are many maps (and more or less exact copies of maps) showing the lake at various scales and variable accuracy. The first maps of the lake with nearly modern standards have been produced in 1784, when the first Austrian Land survey has been carried out in this area at a scale of 1:28,800. Historical maps of several mapping periods have been compiled and quality controlled in a GIS environment. In summary, the historic maps show that at least occasionally (a) the lake surface was much larger, (b) during periods with high water level the lake formed a continuous water surface with the Hanság area, (c) the rivers Ikva and Répce flowed into this large lake and (d) most of the maps show an outflow at the eastern part of the lake (Rábca river), (e) the lake was completely dry during a period in the late 19th century, (f) an artificial dam separates the Neusiedlersee from the Hanság since 1780, (g) the construction of channels started before 1784. During Danube floods at Győr, even Rába water flooded the Fertő-tó/Hanság area.