

**THE TERROIR OF CARNUNTUM
INVESTIGATION OF THE PHYSIOGEOGRAPHIC
CHARACTERISTICS AND INTERDISCIPLINARY STUDY OF
VITICULTURAL FUNCTIONS OF THE CARNUNTUM
WINE DISTRICT, AUSTRIA**

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ABSTRACT

During a three-year period, the vineyards of the Carnuntum wine district are investigated for their terroir characteristics. The interdisciplinary study is aimed at the description of the physiogeographic properties of the region and at the investigation of the main viticulture functions by means of climatology parameters, geological compilation, detailed mapping of the quaternary loess/loam cover of the region, detailed soil mapping, hydrologic investigation and mineralogical, sedimentological and geochemical analyses of soil and bedrock. Additionally, winegrowers of the region are asked to complete a questionnaire regarding their experience because their local and regional knowledge plays an important part in the study. The objective of the study is to compile thematic and synoptical maps by means of GIS as a first comprehensive examination of the natural factors of environment.

KEYWORDS

Austria – terroir – geology – soil – climate – questionnaire – GIS

INTRODUCTION

Carnuntum is a small wine-growing region in the eastern part of Austria (Fig. 1) with scattered areas of vineyards. Main varieties are Grüner Veltliner, Zweigelt and Blaufränkisch. The region is rich of Roman remains which play a major role in the marketing strategies of wines and of tourism as well. Modern winegrowing for high quality products is nowadays driven successfully by ambitious and innovative local winegrowers. For the first time in Austria, an interdisciplinary study of the habitat characteristics particularly with regard to winegrowing is carried out. This is the first step in developing the concept of terroir from a mere marketing tool to a scientific instrument and proving its impact on winegrowing.

During a three year period, 400 ha of vineyards in the wine district Carnuntum are investigated with respect to their terroir characteristics and dominating viticulture functions. The inter-disciplinary study is aimed at the description of the physiogeographic properties of the region and at the investigation of the main viticultural functions by means of climatology parameters, geological compilation, detailed mapping of the quaternary loess and loam cover of the region, detailed soil mapping, hydrologic investigation and mineralogical, sedimentological and geochemical analyses of soil and bedrock. A geoelectrical survey will complete the investigation.

Additionally, winegrowers of the region are asked to complete a questionnaire regarding their vineyard settings, their experiences and their traditional know-how, as local knowledge of wine growers is an important component of evaluation in addition to scientific investigations. Moreover, the questionnaire and the follow-up discussions present an opportunity to adjust the scientific language to habitual language use.

Results of the study will be compiled in thematic and synoptical maps by means of a Geographical Information System (GIS).

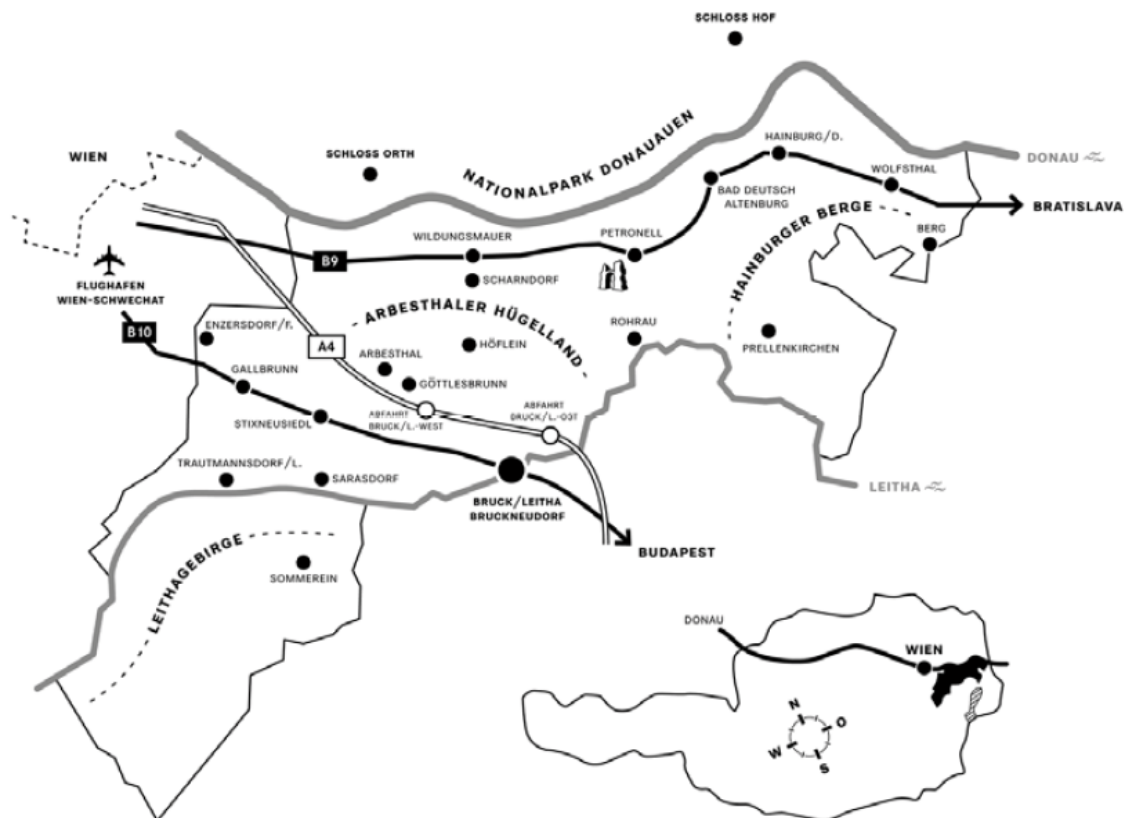


Fig. 1: General outline of the Carnuntum winegrowing district and its location in Austria (www.carnuntum-experience.com, press kit)

MATERIALS AND METHODS

The first work package of the study was to collect all geographic data and all available information, including land register, aerial photographs, digital elevation model, maps of soil assessment for taxation, and agricultural soil analysis. This collection of data turned out to be

a lot more time consuming than estimated because of widely dispersed data providers and their individual rules and methods of dissemination.

Microclimatic observations are carried out since April 2009. The equipment comprises three main stations and five sets of transect stations. At the main stations, observations include precipitation (April – November), air temperature and humidity, solar radiation, soil moisture and temperature (at depths of 10 cm, 150 cm and 280 cm). At the transect stations, evapotranspiration (Livingston spherical ceramics), air temperature and humidity (at 50 cm above ground) and soil temperature and soil moisture (at 5 cm depth) are recorded.

Existing maps on soil and geology proved to be unsatisfactory. Consequently, detailed fieldwork with hand augers was carried out during the first year to amend soil and geology maps. The soil description comprised soil type, parent rock, texture, soil depth and lime content. Parallel to geological mapping, rock samples were drawn for a survey of the variation of chemical composition and grain size distribution. Additionally, the measurement of geoelectrical profiles on three selected slopes was arranged.

Chemical analyses of vineyard soil samples taken every five years since 1991, were statistically evaluated in the wine producing area near Vienna, of which the Carnuntum region forms one part. Additional geochemical data from former geochemical and geological surveys were collected and are now available in a GIS application for choosing sites for detailed soil and rock examination. Content and type of clay minerals will be a special topic within the range of analyses.

A great deal of work was put in the design of the questionnaire which aims to make the long-term experience of local winegrowers on vineyards and vine available for the study. This seems especially important due to the fact that the project is lacking the attendance of viticulture science. In the questionnaire, sections refer to the locality of the vineyard, to the rootstock, variety and age of the plantation, to weather and soil conditions, to climatic changes and the development of phenology, to dangers of erosion, to soil quality, to water and canopy management and to the practice of fertilizer application among others. All answers to the questionnaire were entered into a database to be evaluated at a later stage.

RESULTS AND DISCUSSION

In June 2010, half way through the project, the research layout and a few preliminary results are presented at the congress in Soave.

The impact of hedgerows and orography on evaporation and air humidity becomes clearly evident due to the spatial variation of the wind field. Nearly everywhere, summer soil temperatures at 5 cm depth are higher than air temperature at ground level by 0.5 – 1.9°C depending on soil texture, slope, and aspect. The effect of cooling at higher altitudes is small (0.0 – 0.6°C) since the relief is modest, but there is an impact from the soil type and its impact on moisture status. On the other hand precipitation may differ significantly due to local rainfall or thunderstorms.

Evaluation of soil mapping at high resolution is in progress. Based on the results, locations for digging and sampling for physical and chemical analysis will be chosen. Later, physical soil characteristics will be calculated via transfer functions, e.g. available water capacity.

The results of the analyses of vineyard soil samples since 1991 indicate that the contents of P and K have decreased significantly since the beginning of the investigation period, whereas the concentration of Mg has remained constant. The reason for this development is the high level of PK fertilisation lasting until the late nineteen-eighties, followed by a significant reduction of fertiliser use. Soil Mg contents mainly depend on site conditions and are

predominantly situated in a high supply class. However, K and Mg are known as antagonists, and with decreasing K and constant high Mg supply, K uptake could be inhibited.

Detailed geological and lithological mapping permitted the distinction of nearly twice as many geological units as shown on existing maps. Most vineyards lie on loess, fewer sites are located on fine-grained, calcareous Neogene sediments and Quaternary terraces with loamy covering. Few but special vineyard sites are situated with their highest parts on Triassic limestone and dolomite and on Paleozoic granite as well. The next step will be correlating geological and pedological maps and integrating both sets of information.

About one half of the winegrowers responded to the questionnaire. In relation to the area of vineyards these answers represent about two thirds of the vineyards. Answers were submitted either manually, by mail or FAX, or digitally as word- or excel-files. To build a database was essential for further evaluation. First steps of the evaluation show some clear patterns, e.g. the correspondence of water supply problems to geological units (terraces) or the danger of frost damage to distinct levels of altitudes.

CONCLUSIONS

The objective of the study is to compile thematic and synoptical maps by means of GIS. These will give winegrowers and consultants an overview and first support in planning viticultural measurements such as choosing rootstock and varieties. Furthermore, results will provide a base for the amendment of communication between winegrowers and the oenophile public. With only half of the work completed, it is early for a serious assessment of the efficiency of the applied methods to achieve results. However, the recent presentation reveals that winegrowers who gained insight into scientific research are eager for more detailed studies. In consequence, a follow-up study which includes Automatic Resistivity Profiling is in preparation. For the succeeding steps of interpretation, a basic knowledge of soil variability and rock characteristics will be essential. Furthermore, a study including investigations of the vine biology and chemical and sensoric analyses of the wines is aspired.

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