Interreg
EVROPSKÁ UNIE
Rakousko-Česká republika
Evropský fond pro regionální rozvoj

Interreg
EUROPÄISCHE UNION
Österreich-Tschechische Republik
Europäischer Fonds für regionale Entwicklung

AT-CZ 167

HTPO

„Hydrotermální potenciál oblasti / Hydrothermales Gebietspotential“

Output T1.1.1

Structural geological - hydrogeological map series of the thermal water bearing formations in the region

Part I: Structural geological map series

Part II: Hydrogeological map series

Co-financed by the European Regional Development Fund

Integration into the project structure:

WP T.1	09/2018-08/2021	Geowissenschaftliches Modell der Thermalwasservorkommen Laa - Pasohlávky	Geovědní model výskytu termálních vod v oblasti Laa - Pasohlávky
Akt. T1.1	09/2018 – 02/2020	Geowissenschaftliches Basismodell der Thermalwasservorkommen Laa - Pasohlávky	Základní geologický model výskytu termálních vod v oblasti Laa - Pasohlávky
T1.1.1		**Strukturgeologisch-hydrogeologische Kartenserie der Thermalwasservorkommen in der Region**	**Strukturně-geologické a hydrogeologické série map výskytu termálních vod v regionu**

The works prior to this output were realized within the activity T1.1. The explanations for these map series can be found in the output T1.1.3 „multilingual explanations related to the compiled thematic maps.

The outputs of this study were most relevant for the following activities:

- Activity T1.4 „Dynamic reservoir model of the thermal waters in Laa and Pasohlávky“
- Activity T1.5 „Measures for supporting the transferability of project results“
- Workpackage T2 „Strategic measures for a sustainable and efficient management and utilization of cross-border thermal waters“

More information and other outputs for the project "HTPO - Hydrothermal potential of the area "Laa an der Thaya - Pasohlávky" can be found at

https://www.at-cz.eu/cz/ibox/po-2-zivotni-prostredi-a-zdroje/atcz167_htpo

https://www.at-cz.eu/at/ibox/pa-2-umwelt-und-ressourcen/atcz167_htpo

Contributions of partners

Partner	Kontakt	E-mail
Masarykova Univerzita	Slavomír Nehyba	slavek@sci.muni.cz
	Vladimír Opletal	
	Kateřina Chroustová	
	Bibiána Pasternáková	
	Tomáš Kuchovský	
	Adam Říčka	
Geologische Bundesanstalt	Magdalena Bottig	Magdalena.bottig@geologie.ac.at

EUROPÄISCHE UNION

Co-financed by the European Regional Development Fund

CONTENT

INTRODUCTION

The Project HTPO

The HTPO project deals with the origin, potential and joint management measures of cross-border thermal water resources in the Laa - Pasohlávky region. The thermal waters, which are already used for balneological purposes and which occur at depths of well over 1000 meters below the surface of the earth, have significant potential for future tourist or energetic applications and can contribute to the greening of the region.

Aims of the project

The HTPO project therefore aims to describe these thermal water resources in a joint geoscientific model and to evaluate the associated potential uses and conflicts of use. Based on the best possible knowledge of the thermal water resources in the region, strategies and concrete measures for future joint management are to be worked out together with decision-makers and regional stakeholders.

Aims of activity T1.1

As part of activity T1.1, existing geoscientific archive data are collected, processed and harmonized across borders (e.g. adaptation of formats). In addition, further data, in particular water samples from the existing deep waters, are collected and analysed in a harmonized measurement campaign. As part of the cooperation, cross-border geological and geoscientific basic models (stationary process models) are then set up, which are then subjected to a joint assessment (e.g. zoning of hydrostratigraphic systems or calculation of the expected reservoir temperatures and salinity) and a joint interpretation (e.g. identification of circulation systems and migration paths of the thermal waters in the border region). The determined results are made available to the regional stakeholders of the project as map series.

STRUCTURAL GEOLOGICAL AND HYDROGEOLOGICAL MAP SERIES

The cross-border maps are the product of the collection and processing of geological and hydrogeological data. The explanations for these map series can be found in the output T1.1.3 „multilingual explanations".

Part I: STRUCTURAL GEOLOGICAL MAPS

Using hydrogeological data, the potentially thermal water bearing geological formations were identified. Using geological data, a 3D model of the relevant geological formations was created (main output T1.1) and is visualized via the structural geological map series. The presented topics include the boundaries as well as the relief and the thickness of relevant hydrostratigraphic systems.

Part II: HYDROGEOLOGICAL MAPS

Hydrogeological maps were created on the basis of data from the geological model. Those data were used for the background maps and for the construction of the model of the studied hydrogeological structure. This structure consists of the main Jurassic carbonate aquifer (Altenmarkt Gr.) and hydraulically connected underlying and overlying layers. Attached hydrogeological maps show data that were fundamental for the numerical groundwater flow model described in WPT1.4.

Co-financed by the European Regional Development Fund

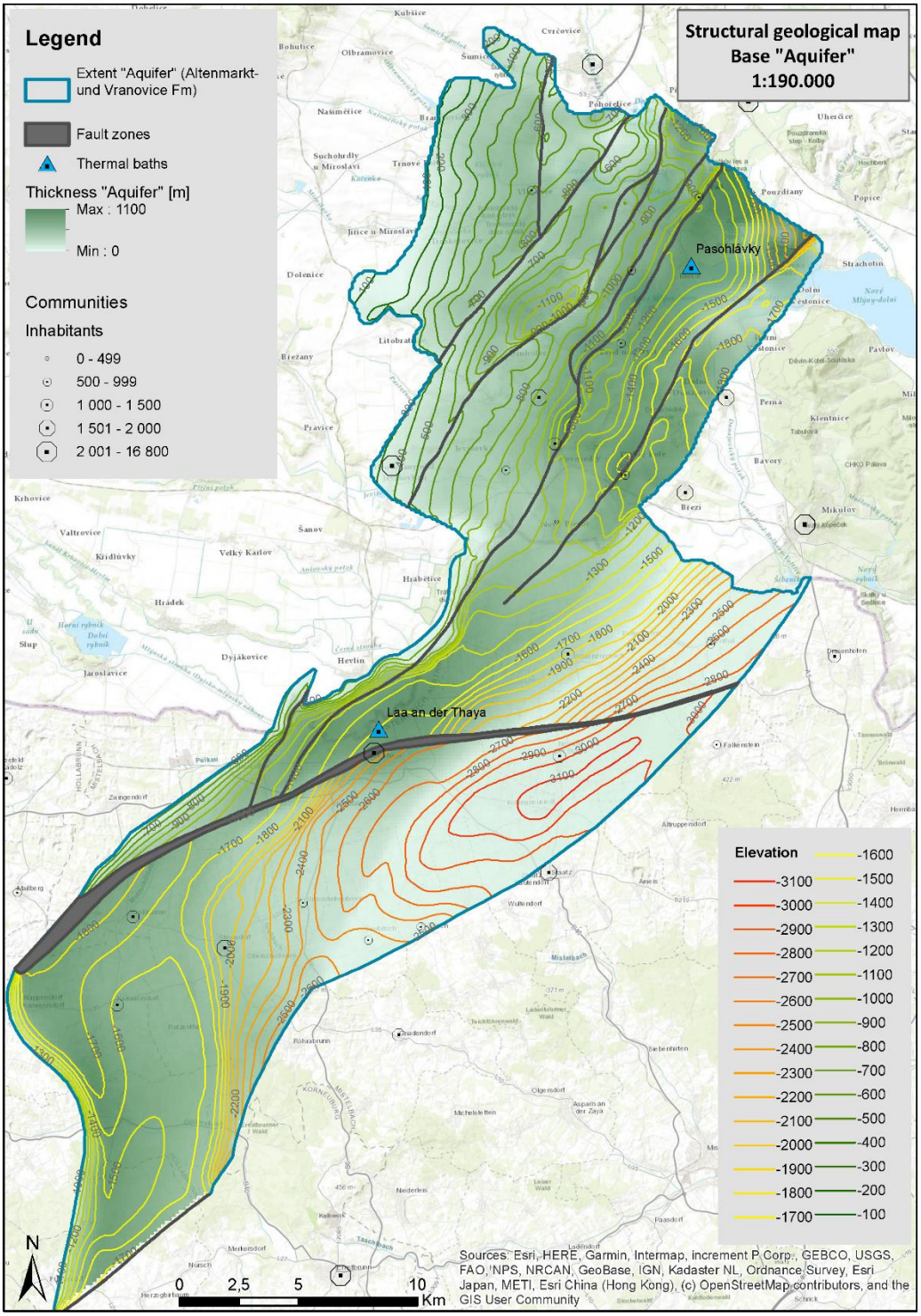

Figure 1: Map of the thickness and structure of the main thermal water bearing geological formation, the base „Aquifer“ – the base of the Altenmarkt and Vranovice Formation in the scale of 1:190.000. Structural data is exported from the geological 3D model (main output T1.1).

Co-financed by the European Regional Development Fund

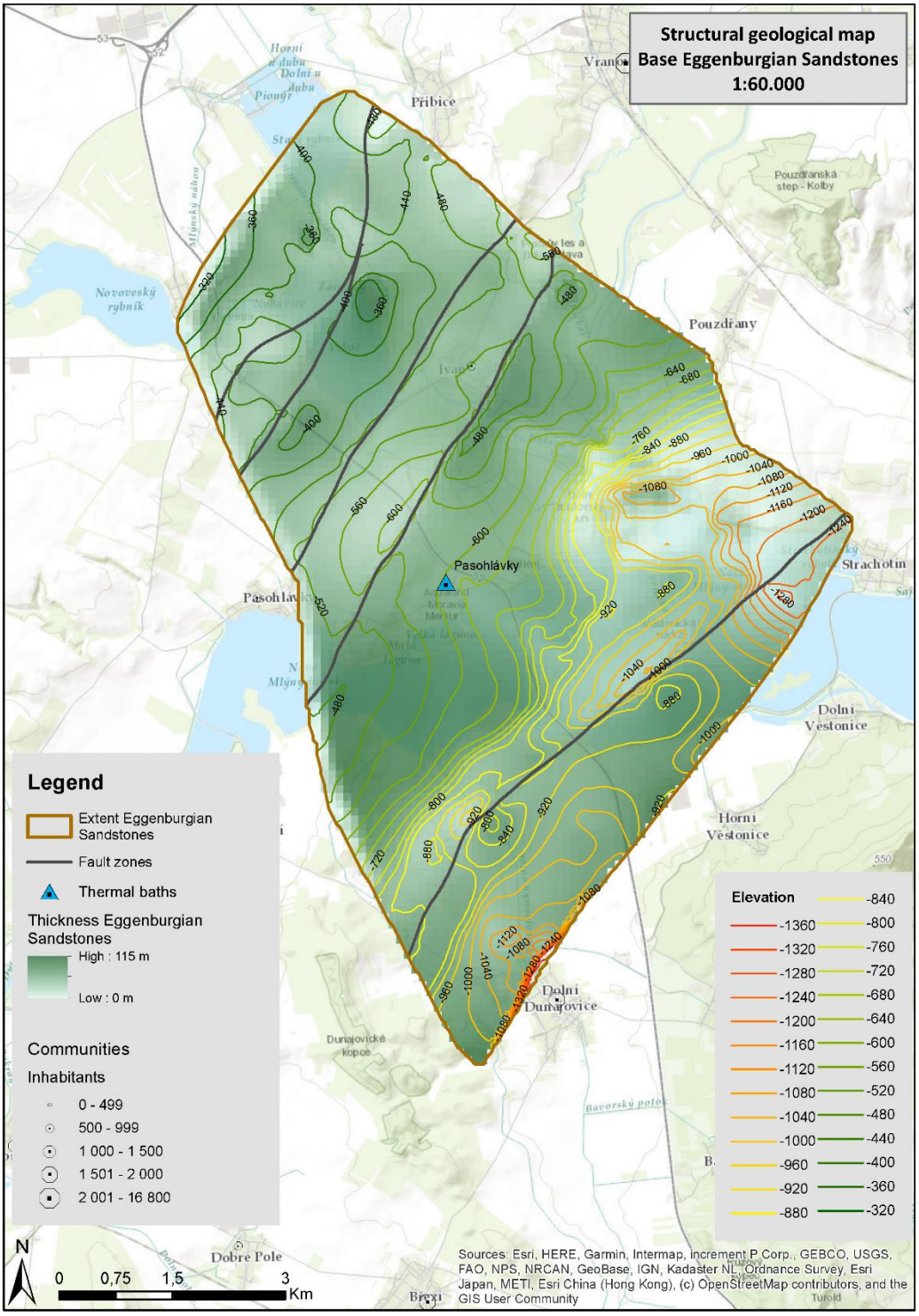

Figure 2: Map of the thickness and structure of the base Eggenburgian Sandstones in the Czech Republic in the scale of 1:60.000. Structural data is exported from the geological 3D model (main output T1.1).

Co-financed by the European Regional Development Fund

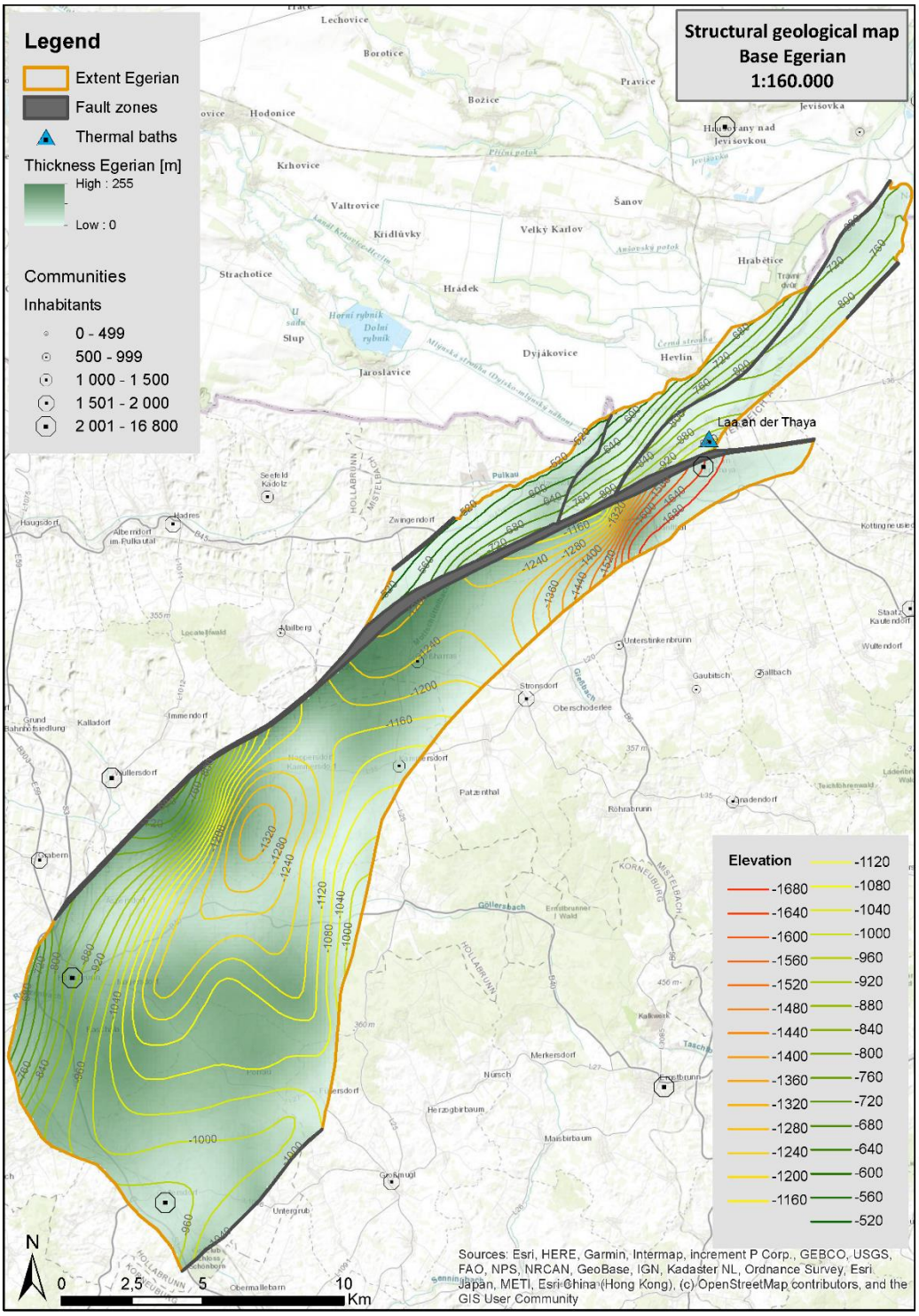

Figure 3: Map of the thickness and structure of the base Egerian Sandstones in Austria in the scale of 1:160.000. Structural data is exported from the geological 3D model (main output T1.1).

Co-financed by the European Regional Development Fund

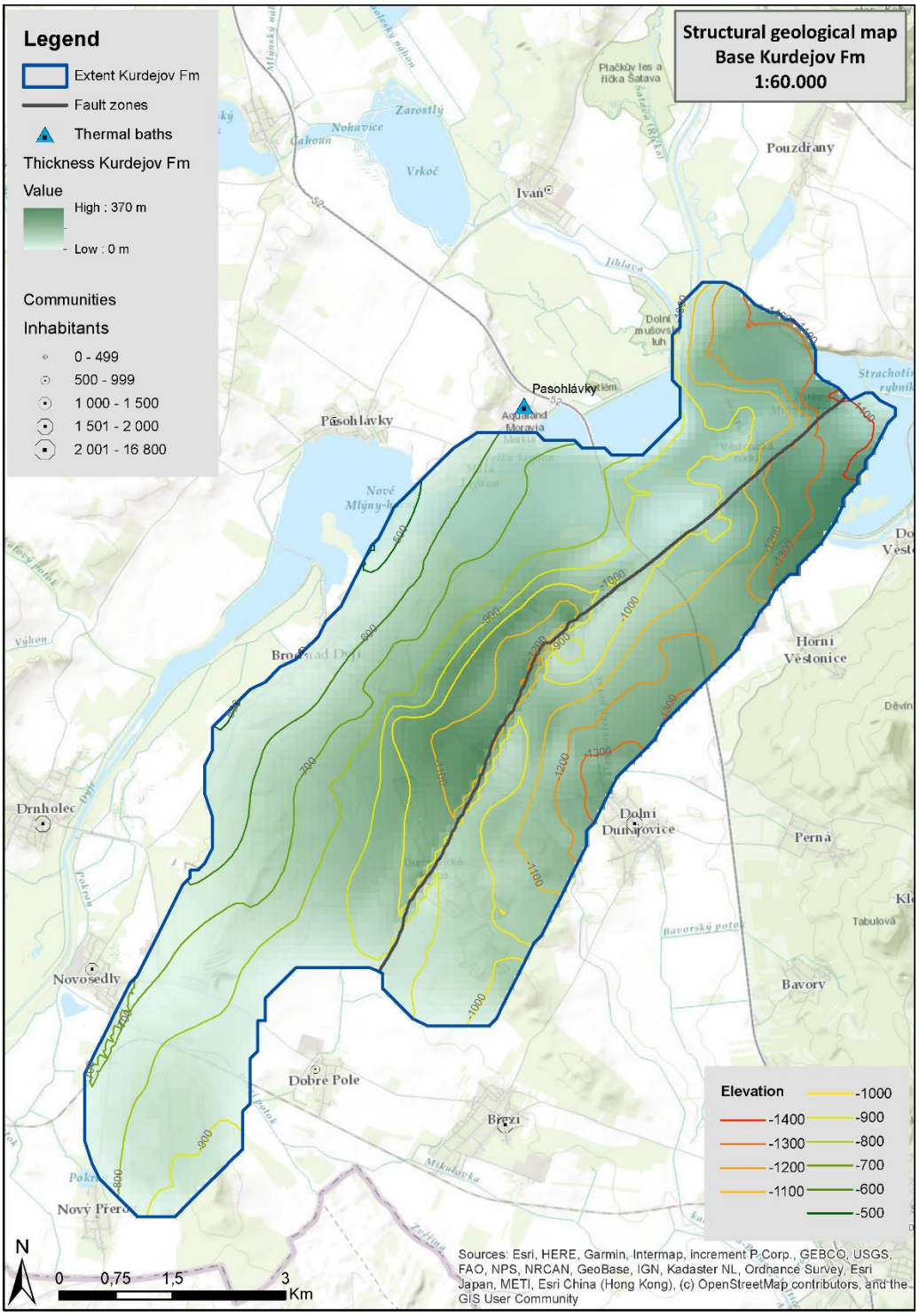

Figure 4: Map of the thickness and structure of the base Kurdejov Formation in the Czech Republic in the scale of 1:60.000. Structural data is exported from the geological 3D model (main output T1.1).

Co-financed by the European Regional Development Fund

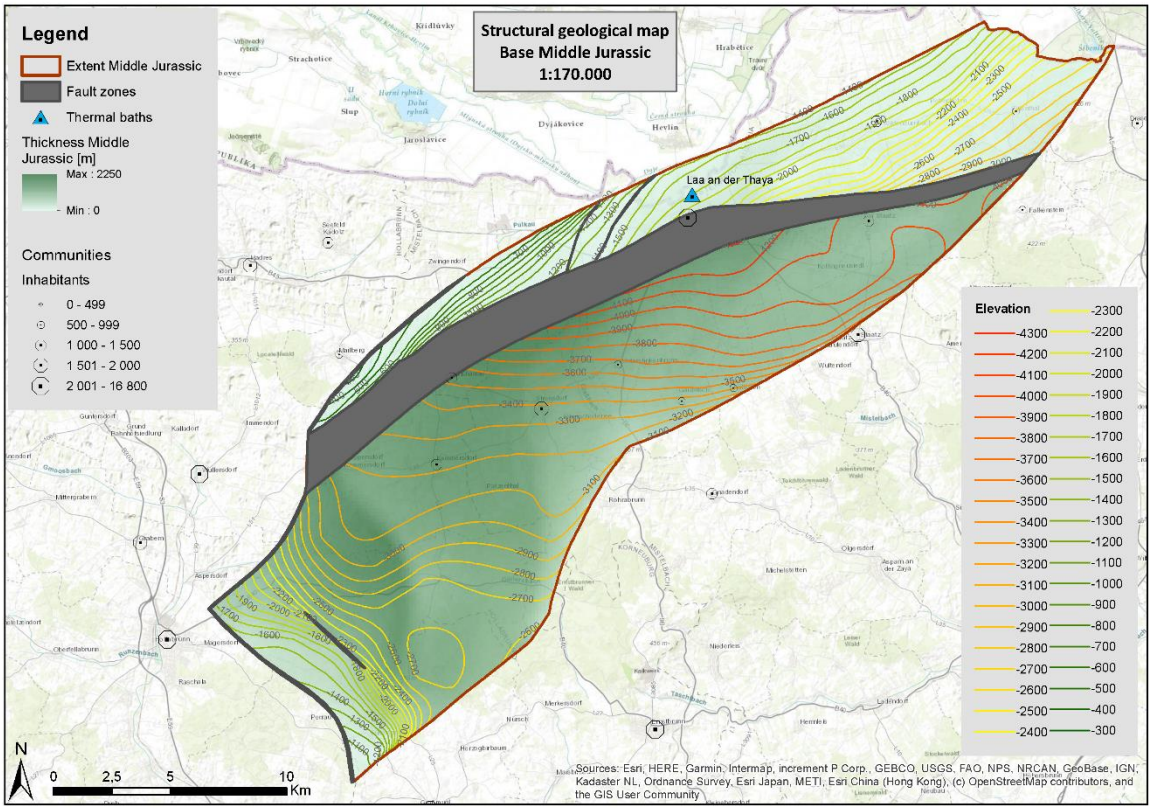

Figure 5: Map of the thickness and structure of the base of Middle Jurassic deposits in Austria in the scale of 1:170.000. Structural data is exported from the geological 3D model (main output T1.1).

Co-financed by the European Regional Development Fund

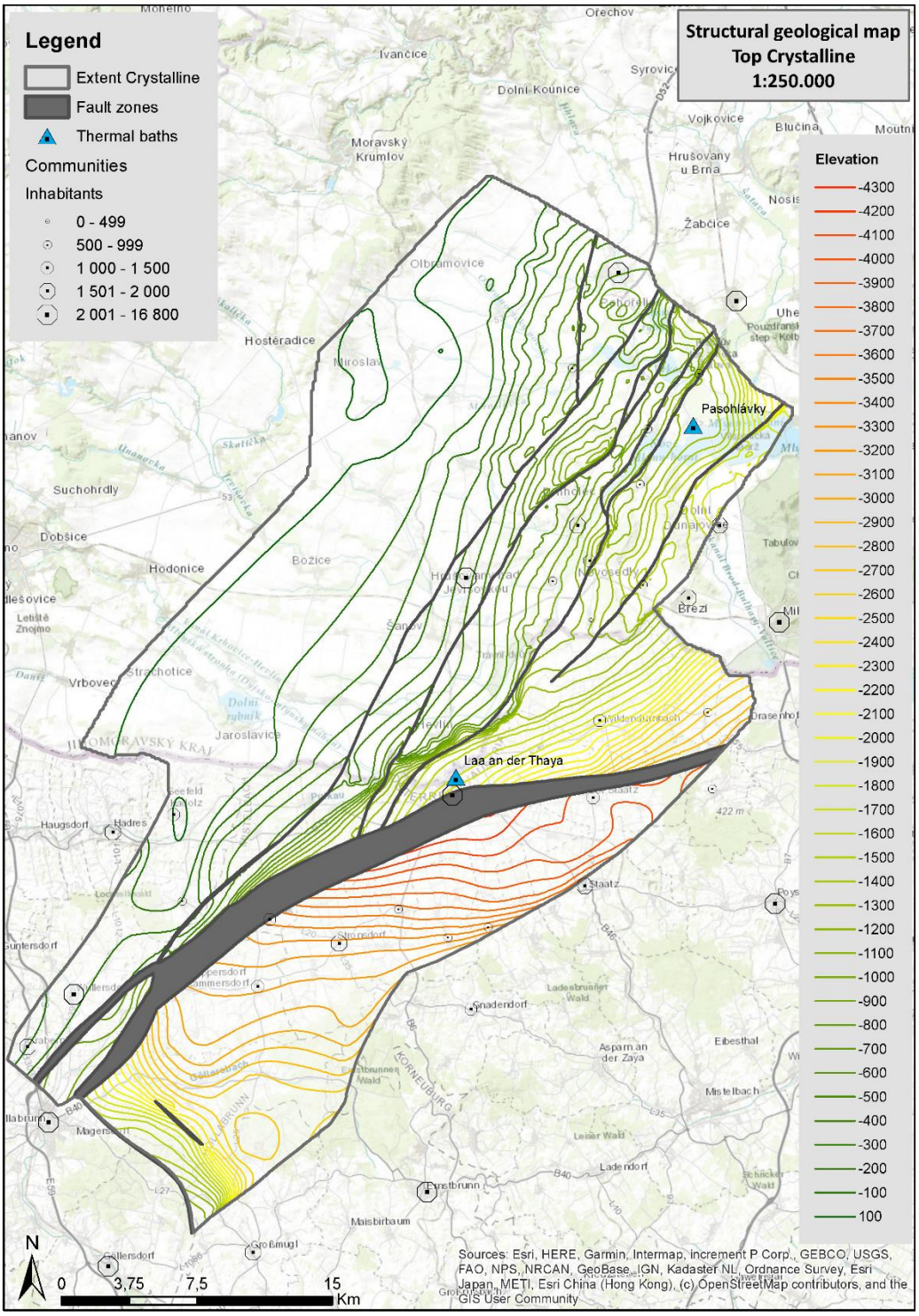

Figure 6: Map of the thickness and structure of the base of top Crystalline Basement in the scale of 1:250.000. Structural data is exported from the geological 3D model (main output T1.1).

Co-financed by the European Regional Development Fund

PART II: HYDROGEOLOGICAL MAP SERIES

Map of hydrostratigraphic units

On the map in Figure 7Figure **7**, the model of the hydrogeological structure (based on the geological model) is shown in the left part of the figure. This model consists of six hydrostratigraphic units, which are distinguished by different colours: Crystalline rocks – red, Middle Jurassic (Dogger) – dark blue, Upper Jurassic: Altenmarkt Gr., main aquifer – blue, Mikulov Marls – grey, Kurdejov Lm. – light blue and Lower Miocene (Egerian and Eggenburgian) – yellow. The legend for these units is located in the upper left corner. The model shows the location of the active thermal water wells. This location is represented by a black dot with a description of the well name MUS-3G and Laa TH N1. In the close vicinity of these deep wells, two cross-sections were created: AA' by the well MUS-3G and BB' by the well Laa TH N1. The cross-sections are represented by a white line with the description. The map is completed by a graphic scale and a north arrow. The cross-sections are shown in the right part of the figure. The cross-sections show the intersected hydrostratigraphic units and the position of the pumped wells – in the cross-section AA' there is the well MUS-3G and in the cross-section BB´ there is the well Laa TH N1. The cross-sections are supplemented by the vertical scale with the depth values in metres above sea level (masl). Each cross-section has the graphic scale and the north arrow. The hydrogeological model and cross-sections are 3x exceeded for a better illustration. The model was created in the software Groundwater Modeling System (GMS, Aquaveo) and subsequently processed in the program Surfer (Golden Software). Because of the used features in Surfer (Golden Software), the map was supplemented by graphic scale, not representative fraction in ratio 1:50000.

Map of hydraulic heads

On the map in Figure 8, there are the derived hydraulic heads ($h_{f,i}$) plotted on the background map of the surface of the main Jurassic carbonate aquifer (Altenmarkt Gr.). The background map was created on the basis of data from the geological model, which were used in the form of XYZ points. This background map shows the top of Jurassic carbonates that lie at depths approx. from 100 to 3000 m below sea level. The top of Jurassic carbonates is displayed in shades of blue colour, the darker it is, the deeper they lie. The map includes a colour scale showing the depth of the top of the Jurassic aquifer in metres above sea level (masl), the scale shows an interval of 200 m, the shallowest parts are displayed in light blue and the deepest parts in dark blue colour. For a better visualization of the depths, the background map is supplemented by light grey isolines. On the map there are also faults displayed in the form of dark grey thin lines. The map shows the location of deep wells (reaching the aquifer) by a black dot. By the each well, there is the label with the well name and given hydraulic head ($h_{f,i}$). The map also shows the course of the Dyje river, the main river in the studied area, which is represented by the blue line. By this line there is the label with the river name and the arrow showing the flow direction. The state border is displayed as a black line with the label CZ/AT. In the lower part of the map there is a graphic scale and the north arrow. Below the map there is a legend. The map was processed in the program Surfer (Golden Software). Because of the used features in Surfer (Golden Software), the map was supplemented by graphic scale, not representative fraction in ratio 1:50000.

Map of hydraulic conductivities

On the map in Figure 9, there are the derived hydraulic conductivity values plotted on the background map of the surface of the main Jurassic carbonate aquifer (Altenmarkt Gr.). The background map was created on the basis of data from the geological model, which were available in the form of XYZ points. This background map shows the top of Jurassic carbonates that lie in depths approx. from 100 to 3000 m below sea level. The top of the Jurassic carbonates is displayed in the shades of blue colour, the darker it is, the deeper lie the carbonates. The map includes a colour scale showing the depth of the top of the Jurassic aquifer in metres above sea level (masl), the scale shows an interval of 200 m, she shallowest parts are displayed in light blue and the deepest parts in dark blue colour. For a better visualization of the depths, the background map is supplemented by light grey isolines with the given labels. On the map there are also faults displayed in the form of dark grey thin lines.

Co-financed by the European Regional Development Fund

The map shows the location of deep wells (reaching the aquifer) by a black dot. By each well, there is the label with the well name and given hydraulic conductivity values (m/s). The hydraulic conductivity values of the Lower Miocene sediments are displayed by brown colour, the Kurdejov Lm. by light blue colour, the Jurassic carbonates (Altenmarkt Gr.) by blue colour, the Dogger by dark blue colour and the Crystalline rocks by red colour. The map also shows the course of the Dyje river, the main river in the studied area, which is represented by a blue line. By this line there is the label with the river name and the arrow showing the flow direction. The state border is displayed as a black line with the label CZ/AT. In the lower part of the map there is a graphic scale and the north arrow. Below the map there is a legend. The map was processed in the program Surfer (Golden Software). Because of the used features in Surfer (Golden Software), the map was supplemented by graphic scale, not representative fraction in ratio 1:50000.

Co-financed by the European Regional Development Fund

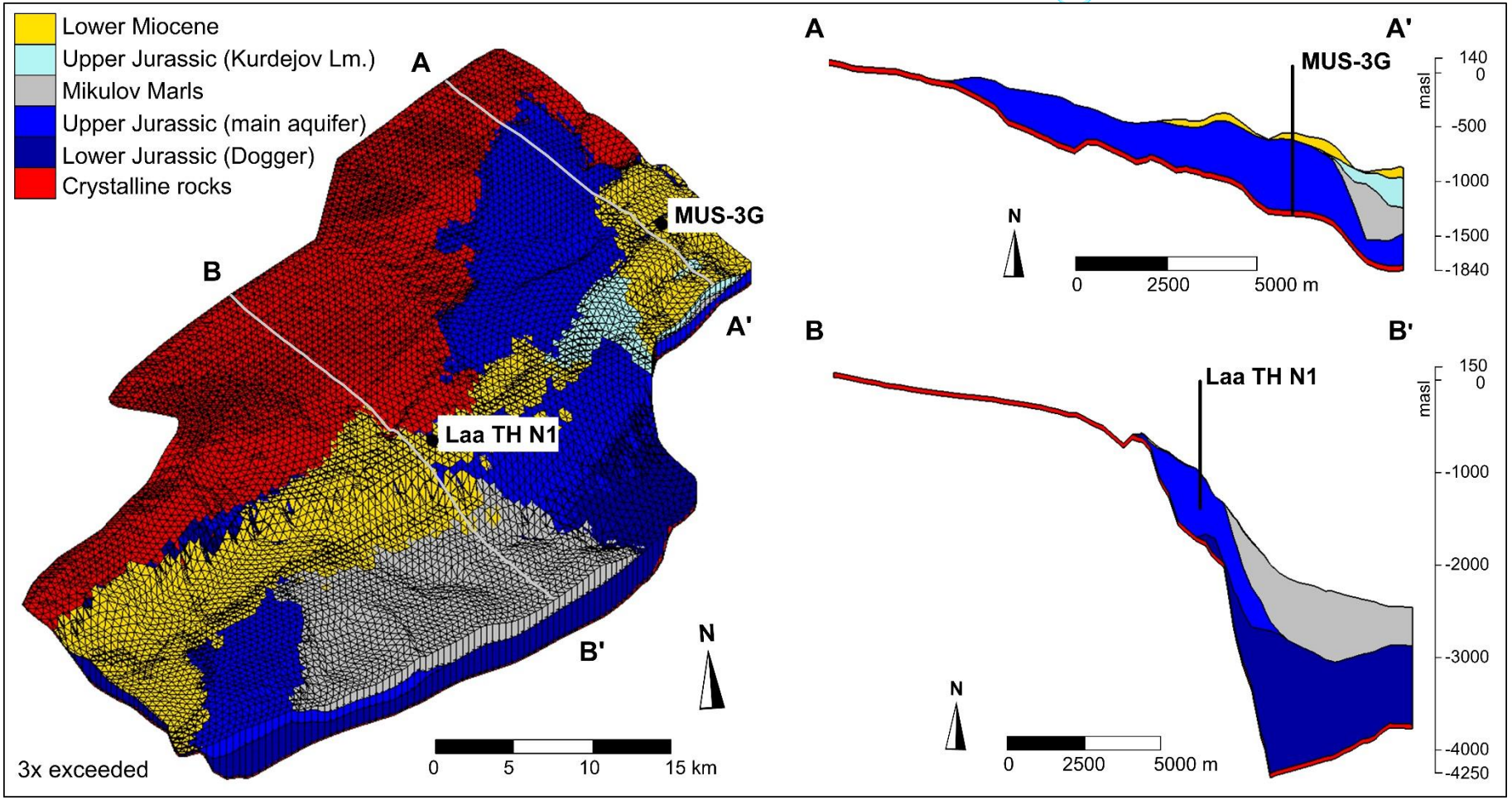

Figure 7: Map of the hydrostratigraphic units based on the geological model. The map shows the 3D model of the hydrogeological structure and two cross-sections AA‘ and BB‘ created in the close vicinity of the thermal wells MUS-3G and Laa TH N1.

Co-financed by the European Regional Development Fund

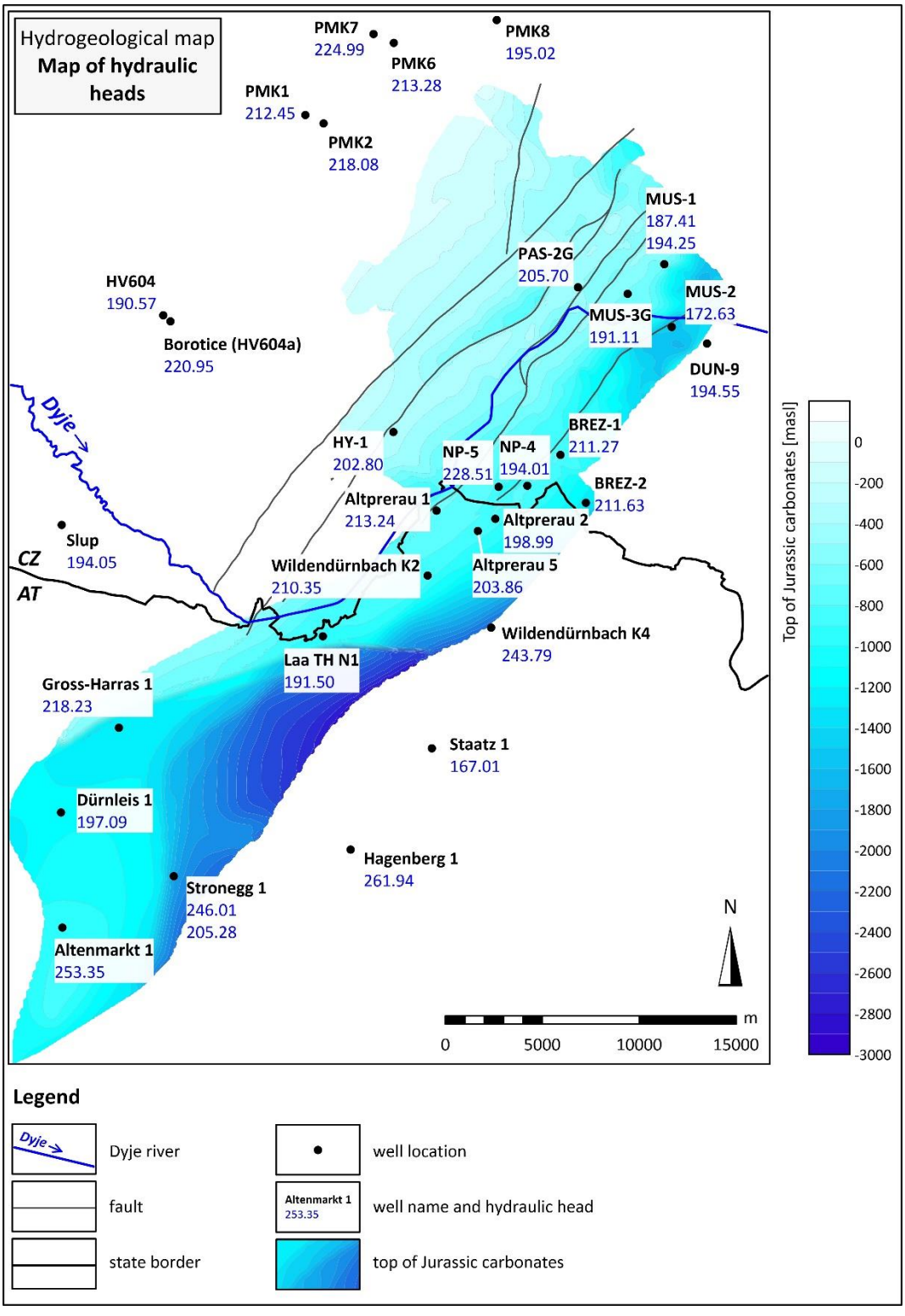

Figure 8: Map of hydraulic heads on the background map of Jurassic carbonates. Hydraulic heads were derived from pressure measurements and direct observations at 30 deep wells. The map was processed in Surfer (Golden Software).

Co-financed by the European Regional Development Fund

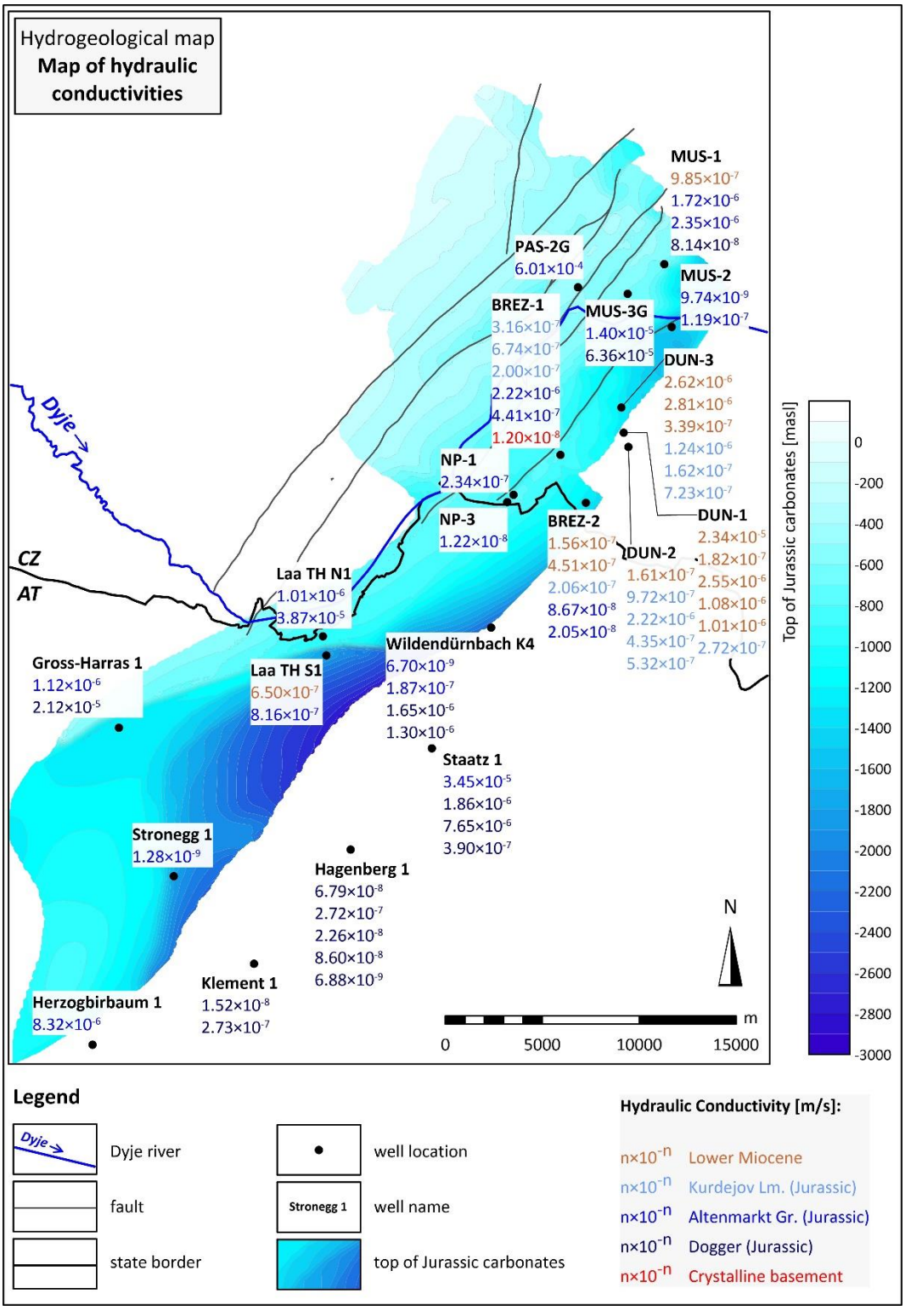

Figure 9: Map of hydraulic conductivities on the background map of Jurassic carbonates. The map was processed in Surfer (Golden Software).

Co-financed by the European Regional Development Fund