Excursion report

- Geotechnics quartz pits -

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1. Introduction
In the context of the partnership between the TU-Bergakademie Freiberg and University of Mining and Geology „St. Ivan Rilski”, Bulgarian students visited the TU-Bergakademie. In the course of this visit, a geotechnical excursion took place with German and the Bulgarian students. The individual stops of the excursion are presented in figure 1.

![Figure 1: Location of the excursion stops (1 Freiberg; 2 Hohenbocka; 3 Osiecznica; 4 Wrocław; 5 Meißen; 6 Dresden; 7 Caminau) (modified after Google earth)](image)

The excursion had both geotechnical parts and cultural parts. The cultural parts were among others guided tours of Freiberg and Dresden, guided by the German students. The detailed course of activities is mentioned in table 1.

**Table 1: Program of the excursion with the Bulgarian students.**

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Chapter</th>
<th>Number within figure 1</th>
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<td>2.10.2017</td>
<td>Arrival of the Bulgarian students</td>
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<td>City of Wrocław</td>
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<td>8.10.2017</td>
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<td>9.10.2017</td>
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2. Geotechnical excursion stops

2.1 3. day – Quartz pit Hohenbocka of Quarzwerke GmbH

Date: 4. Oktober 2017

Editor: Tanja Bartel

At the first excursion day, the 4.10.2017 the target was the open pit of the Quarzwerke GmbH in Brandenburg in a distance of ca. 120 km. It is located in the south of Brandenburg, north of the village Hohenbocka within the district Oberspreewald-Lausitz. Here we got a guided tour of the spacious area.

It was surprising, that the whole factory needs only three workers per working shift. These workers control the sucking-boat, the wheel loader and the preparation. In addition there is one worker at the loading point, two workers for the maintenance and repair and seven at the administration.

The outcropping material is grey to almost white quartz sand. It was formed during the late Miocene of the Tertiary by shallow marine sedimentation. At the southern part of the mining lake there is lignite bearing silty bed load of an end moraine.

Since ca. 120 years these sought-after quartz sands are mined. In our modern time 400.000 t of raw material are mined per year. This material is mainly quartz, but also feldspar and kaolin. 95% of the production is under water within an excavation lake. With a boat we drove to one of the excavation areas and were able to watch the machines from nearby. A sucking-boat mines the sand at the mining wall at the bottom of the lake.

The quartz sands are partly so pure, that they are used for the production of glasses. So the factory provides several flat-glass-factories in Germany and Europe, like Guardian in Bitterfeld-Wolfen being reliant on very pure material. The purity can among others be seen by the colour of the sand, the brighter it is the high-grade it is, equalling a low content of additions and contaminations like iron ore lignite particles. Already by the aerial storage the sands are prepared by the reaction with the air.

The raw sands first are put into a rubbing-washer. Simultaneously the humid material and the sodium hydroxide (NaOH) are removed. By bloating the material, the lignite is removed and afterwards there is a grainsize fractionation. The last step is the „Wendescheidung“. At this process the material is fractionated by gravity on inclined paths. At the and the sand is stored
in dewatering silos and is dried for ca. 13h bevor it can be sold with 5% or 10% (mostly for foundries) moisture.

After the tour within the quartz pit Hohenbocka a 150 km journey was taken to Oseicznica in Poland.

2.2 4. day – Quartz pit Osiecznica of Quarzwerke GmbH
Date: 5. October 2017

Editor: Ralf Flötzter

The factory of the Quarzwerke-Group at the polish town of Osiecznica produces glass-sand with a grain size of 0.1 to 0.5 mm. It is a deposit that is mined by open pit mining and it is the purest sand in Europe. Among others it is used for the production of solar panels. The production is about 600.000 t per year.

Figure 4: Storage for pure sand

Because of the groundwater level being only about 2 m below surface, the dry pit mining of the 15 ha pit also is connected to water drainage processes.

The processing is similar to the one at Hohenbocka. But in Osiecznica kaolin and sand are separated by flocculation (figure 5). Afterwards also the kaolin is sold. The pit produces 3000 t per year.

Figure 5: Flocculation basin for the separation of kaolin
The deposit is a part of the north-Sudetes-basin and is part of the upper-Cretaceous-sandstone from the Coniacium. The deposit forms an anticline. This shape of the deposit complicates the mining of deeper areas, because for the mining large amounts of non-paying material must be mined. A benefit of the deposit is its high quality of up to 80 ppm. The occurring contaminations are mostly iron, titanium and aluminium. This is proved regularly at the local laboratory by RFA.

Because of many integral nature, bird and wolf reserves an additional extension at the area of the deposit is difficult, but there are some reserves left.

2.3 5. and 6. day – Visiting Breslau / Viewing of the Politechnika Wrocławska

Date: 6. & 7. October 2017

Editor: Gerd Ploner

The cultural maximum of the excursion we reached by our visit at the polish city of Wrocław – named Breslau in German. It is part of the four biggest cities in Poland and is located in the south-west of Poland. As cultural centre of the region Breslau has many sights. Spiffing churches, museums and theatres decorate the image of the modern city along the Odra and especially the “ring of Breslau” being the historical centre of the city showed interesting views on the history of Poland.

Because of the hurrying ahead reputation of Breslau, most participants did not miss out of getting an own view during an extensive guided tour. Afterwards we used the possibility to explore the city along the river over many bridges to Polands oldest zoo on the area of the “century hall” on our own.

In the evening we celebrated the long-time cooperation of the TU Bergakademie Freiberg and the St. Ivan-Rilski-University Sofia at the comfortable flair of the old town.
Also the second day of our visit in Breslau was within the meaning of cooperation and friendship. In the morning of the 7th of October we were greeted friendly at the Technical University of the city, to be guided through the historical halls of the main university building and being informed comprehensively about the history of the university.

During the several hours taking tour on the campus of the university the director for international studies, Andrzej Moczko, explained everything interesting about the international partnerships and the many exchange programs of the TU al well as the student daily grind in Breslau. The highlight of the presentation was a trip with the university cable car named Polinka from one campus area over the river to the other one. The reason for the building of this extraordinary way of transport was a conflict with the city-owned traffic company. Because of the disunity and the occurring problem of the connection between the campus-parts the students of the institute of mechanical engineering processed this innovative way of transport.

On the other bank we were received by students of the faculty of geology and geotechnics. Also here we got an interesting guided tour to laboratories and lecture halls of the faculty. Thereby it was illustrated that the university sets great store by practical education. Our guests from Bulgaria took the opportunity to present their university.

The following lunch was used to exchange contact information and to start student cooperation between the faculties. Afterwards we drove home to Freiberg.
On Sunday we went to the city of Meißen with the Bulgarian students for to visit the oldest and famous porcelain factory in Europe there. Porcelain was on demand in Saxony since the beginning of the 13th century and it was well known as a precious property. But this luxury good must be imported from Asia, spatially from China for a long time. An own porcelain production started in the beginning of the 18th century when the alchemist Johann Friedrich Böttger published officially that he discovered a way to produce gold from useless material. August the strong, saxonian prince-elector in Dresden heard about this publishing and let him jail within the Jungfernbaetie for to get the precious noble metal. But Böttger was never able to produce gold from useless materials but nevertheless he became famous and rich by his work. Johann Friedrich Böttger and Ehrenfried Walther von Tschirnhaus were the first persons in Europe to be able to produce the precious “white porcelain”.

By this the foundation was given for one of the most successful company in saxonian history. By the decree of the 23th of January 1710 the “royal polish and prince-electoral saxonian porcelain manufactory” was found. Its first manufacturing plant was from July 1710 on the Albrechtsburg. The preferred motifs were landscapes, Chinoi-series and framed leaves and baroque strap work. Around 1740 the up to the usually taken Chinese and Japanese decoration was replaced by “German flowers”. Furthermore the so-called onion-decoration in blue underglaze (figure 8) came into the market.

A big part of the production range of the manufactory was the figurative sculptures. Already during the time of August the strong there was an intensive production of pomp and decoration crockery for the use at the court of Dresden and among this there was production of miniatures and pomp figures for representative and decoration purposes. During the detailed guided tour through the exhibition rooms a lot of background knowledge was communicated and an extensive view on the motive election was given. The most interesting part for our excursion group was the opened factory. Here every step of the porcelain production were shown live, questions could be asked and a feeling was given how many effort and labour is part of every handmade piece of Meißen porcelain.
Subsequent to the visit of the factory the group was divided into two groups. The Bulgarians and some of the German students used the rest of the day for to visit the old town of Dresden. The others went back to Freiberg with many new and interesting impressions of saxonian History.

2.5 8. day – Kaolin pit Caminau of Quarzwerke GmbH
Date: 9. October 2017, 8:00 AM

Editor: Hilmar Trillhaase

At the last day of the excursion we visited the kaolin pit Caminau. This pit is located along the Bundesstraße 96, north of the village Königswartha east of the village Caminau.

The Caminau Kaolinwerk GmbH is a company of the Quarzwerke Group and has nowadays 110 employers. The whole area has 290 ha, but only on 40 ha there is production on two production fields. The annual production is 200.000 t kaolin as granulate or mush. The production amount supplied to 70% by train and 30% by lorry to clients in the whole European Union, like Austria, Italy and Scandinavian countries. There the raw material is used for paper, coloured pencil cosmetic and chemical industry. The usage for ceramic is not possible because of the high iron content of the caolin.

The production is open pit mining on two fields, the south-eastern field and the bigger eastern field (figure 10). The topographical surface is about 135 to 138 m ASL, the lowest point of the pit is nowadays at 100 m ASL. It is planned to reach a depth of 85 m ASL. The upper 6 to 15 m is the overlaying material of the deposit and contains Pleistocene sands and lignite bearing silt.

Further on the bottom side there is the raw material as 12 to 40 m thick deposits. The natural deposit has no continuous structure or layering. The qualities vary a lot depending on the position. Therefore it can be rather seen as a zone shaped or lens shaded occurrence. The reason for that is the origin of the deposit, being autochthonous originated weathering products of the Lusatian granodiorite. The produced raw material contains on average 35% kaolin, 40% quartz and 25% silt. The 650.000 t of raw material per year are produced by four bucket chain excavators (SRs130) and by four mobile belts vehicles, each being 32 m to 45 m long, and brought to the 3.5 km long belt conveyor. By the belt conveyor the raw material goes to the storage in the divided qualities. The storage has a capacity of ca. 4.000 t, being enough for 1.5 days of production.
The next stop for the raw material is the sorting machine over four production lines. Therefore firstly coarse additions like stones and sand are filtered out. The remaining material runs in the following through 5 different hydro cyclones for to separate silt from kaolin. The outsourced sand goes, if it cannot be sold, back to the open pit as filling material. The silt is pumped into a tailing. The filtered kaolin goes to a circular enrichment and in one of 11 sedimentation basins with added flocculation agents before it can be sold. After this process, the water is pumped back to the separation machine and the thickened suspension goes to the production machine. At the production machine the bleaching is done first by two ozone-bleaching-systems and afterwards by a reducing bleaching-system (to additional are going to be build) The last step of processing is the pressing out of water. Thereby the six presses reduce the water content during process of 40 to 70 minutes and the following thermal de-watering reduces it to in the end a water content of 12%.

At the same time, the kaolin pit of Caminau is doing cultivation and renaturation. 15 ha of the renatured 33 ha are reachable by walking trails. Within the bordering forests, lakes and moist-biotopes 244 animal-species were established, 45 of them being on the red list of threatened species. Among this method also the attractiveness of the area for visitors is supported by the building of a viewpoint (castle ruin; figure 11), nature trails, local recreation areas and fish ponds. The data of the company shows a good feedback of the local people and of tourists.

Figure 11: View on the viewing point castle-ruin (photographed by Ralf Flötzer)
3. Acknowledgment

Figure 12: Excursion participants and workers of the Politechnika Wrocławska

The students and employees of the institute of geotechnics at the Technische Universität Bergakademie Freiberg like to thank sincerely all sponsors and suppliers for the possibility of the geotechnical excursion in 2017: Quarzwerke Gruppe GmbH, Technische Universität Wroclaw, exchange students of the university of mining and geology St. Ivan Rilski at Sofia, Porzellan Manufaktur Meißen and the Verein Freiberger Geotechniker e.V.