

Reassessment of the clay deposit “Loickenzin / Thalberg”

Client:

Bergwerk Thalberg GmbH Seeweg 2
12529 Schönefeld

Contractor:

GEOTEKT
Monika Dehne, Geologist Merseburger
Straße 14
37441 Bad Sachsa

GEOTEKT
Assessment of stone and earth deposits

Tel.: 05523/3482
Fax: 05523/2828



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Monika Dehne, qualified geologist

Bad Sachsa, 25 October 2023

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1 Contract

On behalf of Bergwerk Thalberg GmbH, the expert in clay and gypsum rocks, Dipl.-Min. Dr. Gerald Dehne, prepared the report: Evaluation of the "Loi-ckenzin/Thalberg" clay deposit (7 July 2011). This update essentially relates to new underlying data and the resulting reassessment of the clay deposit.

The clay deposit is a mining property (BWE) in accordance with Section 151 of the Federal Mining Act (BBergG), covering an area of approximately 95 ha, located in parcel 2 of the Altentreptow/Thalberg cadastral district (Mecklenburg-Western Pomerania) and owned by Bergwerk Thalberg GmbH. The sub-area 'Loickenzin/Thalberg' forms part of the 'Loickenzin' mining property, which covers a total of 208 ha.

- The relevant confirmation from the Stralsund Mining Authority pursuant to Section 23 of the Federal Mining Act (2011) can be found in [Appendix 1, Expert Report 2011],
- Bergwerk Thalberg GmbH is registered at Cottbus Local Court under file number HRB 11787 CB [Appendix 4],
- Tax status:

Relevant business tax office: Königs Wusterhausen, tax

number: 049/100/02339

VAT: Based on fees received, Section 20 of the German Value Added Tax Act (UStG)

With regard to the valuation, the following documents, among others, were taken into account; these can be found as appendices in the aforementioned 2011 report:

- Project proposal by the Treuhandanstalt (Directorate for Potash/Ore Mining/Stone/Earths) regarding the utilisation of the BWE deposit at Loickenzin (No. 169/90/634) and the BWE deposit at Altentreptow, east (No. 245/90/643), 1994 [Appendix 2, 2011 report]
- Clay deposits Altentreptow / Loickenzin – a data collection – by DURTEC dated 23 November 2009 [Appendix 3, Report 2011]
- Data documentation by Dr J. Schomburg (DURTEC) dated 25 May 2011 [Appendix 4, 2011 Report]

In accordance with the terms of the commission, prerequisites relevant to the report – primarily the contents of the deposits and the area specifications – are only mentioned in summary form with reference to the above-mentioned sources, as these were considered to form the basis of the commission.

The focus is on setting out the technical applications and the associated financial verification.

2 Raw material situation

The geological and resource-related conditions listed below are largely derived from the project proposal by the Treuhandanstalt [Appendix 2, Report 2011] and the further documentation from DURTEC [Appendix 3, Report 2011] and [Appendix 4, Report 2011].

The BWE deposit 'Loickenzin/Thalberg' is geologically and stratigraphically situated within the area of the Weichselian glacial ground moraine.

The deposit itself belongs to the so-called 'Rupelton', which occurs in three varieties and can be attributed geogenetically to a Tertiary, marine origin.

3 Reserve assessment

- Based on the assessment by DURTEC dated May 2011 [Appendix 4, 2011 Report], at least 12 million tonnes of the aforementioned "Rupelton" are recoverable.

It should be noted here that although the BWE covers an area of 95 ha, only approx. 60 ha have been explored. According to [Appendix 2, 2011 Report], only an area of 30 ha, with a thickness of recoverable clay of 35 m, was taken into account when determining the clay reserves. In this respect, the aforementioned 12 million tonnes represent the absolute minimum.

The BWE field 'Loickenzin/Thalberg' is categorised as a so-called 'prospect area' for the extraction of clay raw materials in the 'Map of near-surface raw materials (KOR 50)', which is published by the State Office for the Environment, Nature Conservation and Geology of Mecklenburg-Western Pomerania / Güstrow [Appendix 4, 2011 report], as a so-called 'Höffigkeit' area for the extraction of clay raw materials. However, as this classification was not taken into account in the current Regional Spatial Development Programme for the Mecklenburg Lake District of 2011 [**currently valid**, Annex 6, 2011 Report], a spatial planning procedure in accordance with the Spatial Planning Act (ROG) must be carried out with regard to spatial planning acceptance.

Accordingly, in the 2011 Regional Spatial Development Programme (RREP) 'Mecklenburgische Seenplatte' [Annex 6, 2011 report, **currently valid**], the BWE field 'Loickenzin/Thalberg' is not categorised as "reserved area" for raw material security.

In the Altentreptow Local Land Use Plan "AT, F-Plan 5th Amendment" of 2014 (**currently in force**), the "Loickenzin/Thalberg" mining area is designated as an area for the extraction of mineral resources and is classified as a clay mining protection zone [Appendix 3]. The "Loickenzin/Thalberg" mining property is shown in the FNP, in part, on a differentiated area.

The spatial planning requirements are therefore met in the Altentreptow FNP.

In order to obtain a framework operating plan in accordance with Section 55 of the Mining Act (BBergG), the following planning criteria must be taken into account:

- the immediate proximity of the deposit to the town of Altentreptow to the east
- State road L 27 running north of the mining area
- Presence of the FFH area 'Tollensetal mit Zuflüssen' to the east.
- Arable land in the immediate vicinity
- No overlap with drinking water protection areas
- No biotopes requiring protection are known
- No involvement of or impact on NSG and LSG areas.

Even if restrictions were to arise in this regard, the above-mentioned 'conservative' deposit assessment ensures that reserves of at least 12 million tonnes will be available in any case.

4 Potential areas of application for clay raw materials

According to the statement issued by DURTEC on 23 November 2009 [Appendix 3, 2011 report], the clay raw materials can be used for the following applications:

- Brick industry
- Clinker and roof tile industry
- Wall and floor tiles (stoneware)
- Unglazed, frost-resistant floor tiles
- Ceramic engobes for roof tiles

- Expanded clay
- Sealing clay for waste management
- Water treatment

5 Assessment of raw material properties

On the basis of the available documentation (see above) regarding the mineralogical, geochemical and rheological properties, it was established that the clay raw material is primarily suitable for the production of sealing clay (bentonite), but can also be used for ceramic applications. This fact therefore forms the basis of the deposit evaluation.

The following analysis focuses primarily on its use as sealing clay.

In order to obtain a reliable estimate of the value of a comparable deposit, the undersigned contacted FIM Friedland Industrial Minerals GmbH, which extracts and markets raw clay (bentonite) with virtually identical raw material properties at its Friedland plant (D-17098 Friedland). In this respect, the regional and infrastructural connection is established, particularly as, geologically and stratigraphically (Tertiary, marine deposit), the material is virtually the same.

The raw material parameters of the so-called Friedland clay can be found in [Appendix 5, Expert Report 2011]. A current quotation from Friedland Industrial Minerals GmbH (19 September 2023) is attached as [Appendix 5].

The following criteria specified by FIM are decisive for its use as sealing clay:

- - Swelling minerals: 44%

- - Muscovite:	12%
- - Kaolinite/chlorite:	11%
- - Carbonates	2%
- - Pyrite	1%

By comparison, the values cited by DURTEC [Appendix 3, 2011 report] showed the following:

- - Swelling interlayered minerals:	35–40%
- - Muscovite:	up to 15%
- - Kaolinite/chlorite	15–20%
- - Carbonates	< 3%
- - Pyrite	< 1 %

From a mineralogical perspective, the differences are considered to be only marginal and therefore insignificant.

This is also reflected in the water permeability value, which is relevant for use as sealing clay.

Whilst FIM quotes a value of approx. $1.0\text{--}1.6 \times 10^{(-11)}$ m/s, this figure is $< 1 \times 10^{(-10)}$ for the 'Loickenzin/Thalberg' clay raw material [Appendix 3, Expert Report 2011]. Similarly, the cation exchange capacity is identical at 50–60 mval/100 g (FIM) and approximately 50 mval/100 g.

6 Planning and approval-related requirements

Although the "Loickenzin/Thalberg" mining area is owned by Bergwerk Thalberg GmbH in accordance with Sections 9 and 23 of the Mining Act (BBergG) and thus constitutes a legal title, the following planning must be carried out prior to the start of extraction:

- Submission of a framework and main operating plan in accordance with Section 55 of the Mining Act (BBergG) for the relevant sub-areas (approx. 1 ha each).
- Preparation of a corresponding landscape conservation management plan.
- Recording of circumstances relevant to species protection.
- Hydrogeological assessment.
- Technical report on the Water Framework Directive.
- Planning permission for the construction of access roads.
- FFH and environmental impact assessment.
- Conducting a regional planning procedure in accordance with the Regional Planning Act (ROG).

7 Cost estimation for the necessary planning

Given that peripheral areas must also be taken into account with regard to the planning area, an assessment area of approximately 50 hectares is assumed.

This results in the following costs:

Framework operating plan	approx. EUR	26,000.00
Landscape conservation plan	approx. EUR	23,000.00
Species conservation report	approx. EUR	11,000.00
Hydrogeological report	approx. EUR	11,000.00
Technical report on the Water Framework Directive	approx. EUR	7,000.00
Planning permission	approx. EUR	8,000.00

FFH or UVS	approx. EUR	15,000.00
Regional planning procedure	approx. EUR	23,000.00
Planning costs	approx. EUR	124,000.00

8 Cost estimate for land acquisition

Although the deposit itself is owned by Bergwerk Thalberg GmbH, the surface rights must either be leased or purchased.

As Bergwerk Thalberg GmbH has decided to purchase the land, costs of EUR 2.25/m² are currently to be expected for arable land, in accordance with the State Land Market Report published by the Higher Expert Committee (OGAA) for land values in the state of Mecklenburg-Western Pomerania.

The 'arable land' valuation represents a conservative approach, as parts of the BWE field are also used as 'grassland' and 'fallow land', for which standard land values are significantly lower.

When determining the requirements for the purchase of land, the following must be taken into account:

As explained above, the stock assessment related solely to an area of 30 ha, i.e. only approx. 30% of the BWE. However, with regard to land acquisition and also in the assessment of overburden and recultivation (see below), it must be assumed that significant areas in the peripheral zones, which are required for the construction of embankments, will be added. These can be evaluated as follows:

The total depth of the excavation is approx. 45 m (overburden + clay deposit). As the embankments must be constructed at a 1:2 ratio for safety reasons, this results in an additional land requirement of 90 m around the clay deposit. The perimeter of the clay deposit is approx.

2,200 m.

This results in a total land requirement of approximately 198,000 m². In addition, there is a 10-metre safety buffer zone, i.e. a further 22,000 m².

Consequently, the following costs must be taken into account:

- *Land acquisition (520,000 m² x EUR 2.25 / m²)* *EUR 1,170,000.00*

As the plots to be acquired do not necessarily coincide with the boundaries of the extraction site, it is necessary to include potential excess areas.

- *Overhang areas (520,000 m² x 20% = 104,000 m² x EUR 2.25)* *,234,000.00*

Taking into account a possible price increase for land in the Oberland region due to the rise in land value resulting from market developments compared to the current benchmark, it is necessary to apply additional costs of 30%.

Accordingly, the following costs must be taken into account for the

land acquisition, including surplus land and potential price increases, the following total costs must be taken into account: EUR 1,825,200.00

9 Cost estimation for overburden

According to DURTEC [Appendix 4, 2011 report], an average overburden thickness of 9 m should be assumed.

In this respect, the volume of overburden to be removed can be estimated as follows: Excavation area: $300,000 \text{ m}^2 \times 9 \text{ m} = 2,700,000 \text{ m}^3$

Slope 1:2 (height 9 m, width 18 m): $9 \text{ m} \times 18 \text{ m} / 2 = 81 \text{ m}^2$

$$81 \text{ m}^2 \times 2,200 \text{ m} = 178,200 \text{ m}^3$$

In total, therefore, a volume of overburden to be moved of approx. $2,888,000 \text{ m}^3$ can be expected.

Based on general empirical values for clay pits, the average costs for the removal and temporary storage of the overburden, assuming a transport distance of max. 500 m, are EUR 3.80 / m^3 .

Consequently, the figure for this item is:

Overburden ($2,888,000 \text{ m}^3 \times \text{EUR } 3.80 / \text{m}^3$) **EUR 10,974,400.00**

10 Extraction costs

Given that Bergwerk Thalberg GmbH intends only to sell the raw clay from the clay pit, the following parameters must be taken into account for the extraction costs:

- Dredging, loading onto dump trucks, transport up to a maximum of 500 m, stockpiling.

Costs of EUR 1.90 / t must be verified for this.

This results in a share of the extraction costs of:

Extraction (12 million tonnes \times EUR 1.90 per tonne) **EUR 22,800,000.00**

In this respect, therefore – in contrast to the 'Altentreptow, east' development project – no costs for groundwater lowering are to be included.

The following drainage measures must be taken into account:

- Installation of a sufficiently sized pump sump with a sludge trap
- Storage of the sludge generated in the pump sump
- Installed pumping capacity with sufficient margin of safety in the event of heavy rainfall
- Implementation of ongoing drainage during operational downtime
- Verification of the adequate dimensioning of the existing piped outfall for discharge

13 In-house road construction

Fixed price **EUR 70,000.00**

14 Administrative costs

flat rate (2% of the market value; see Chapter 16) **EUR 8,880,000.00**

15 Production costs (total)

In summary, the following costs (estimated)

):

Planning costs	EUR	124,000.00
Land acquisition	EUR	1,825,200.00
Overburden	EUR	10,974,400.00
Extraction	EUR	22,800,000.00
Reclamation (overburden)	EUR	13,284,800.00
Reclamation (pioneer plants, etc.)	EUR	2,080,000.00
Road construction	EUR	70,000.00
Administrative costs	EUR	8,880,000.00
Total production costs	EUR	60,038,400.00

This means that, with a forecast stock volume of 12 million tonnes and production costs of

EUR 5.00 / t

16 Determination of the net market value

As already mentioned in Chapter 5, the undersigned has received a current offer from Friedland Industrial Minerals GmbH (FIM) [Appendix 5], which states that the current price for raw clay, which is of identical quality (see above), under the same delivery terms is

EUR 37.00/t

, which, based on an estimate of 12 million tonnes, amounts to a total value of

EUR 444,000,000.00

would correspond to.

Subtracting the production costs mentioned in section 15 gives a net market value of

EUR 32.00 / t

Consequently, with a projected stock volume of approximately 12 million tonnes, the net market value is

EUR 384,000,000.00

17 Concluding remarks

Finally, the following is a summary of the assumptions that led to the above valuation.

In the reserve valuation within the BWE 'Loickenzin/Thalberg' field (95 ha), only a mining area of 30 ha was assumed, as this area, comprising a contiguous clay complex with a clay thickness of approx. 35 m and only 9 m of overburden, represents the field that can be utilised most efficiently from an economic perspective. The clay areas still under exploration within the exploration field (60 ha)

were not taken into account, as the overburden-to-clay ratio is less favourable here; however, this does not mean that these clays are fundamentally unmineable, albeit under less economically favourable conditions.

With regard to planning costs, the undersigned, as the owner of GEOTEKT / Bad Sachsa, can draw on decades of experience in carrying out mining and land restoration planning.

With regard to the direct comparison of the clay raw materials ‘Loickenzin/Thalberg’ and ‘Friedland’, it should be explicitly emphasised once again that, geochemically, mineralogically, stratigraphically and rheologically, these are virtually identical deposits.

The decisive factor in assessing the market value is their suitability as high-quality sealing clay, which is based on the high proportion of swellable clays (e.g. montmorillonite). This means that these clays have very low water permeability, making them particularly well-suited for well and landfill construction.

Furthermore, they exhibit a very high cation exchange capacity. This criterion is decisive for their use in water and environmental remediation (adsorption of pollutants), including their application in nuclear waste disposal.

Whilst the so-called ‘ceramic’ clays (kaolinite, illite, etc.) are widespread in the Federal Republic of Germany and consequently have a significantly lower market value, swellable clays with the aforementioned properties are extremely rare.

Finally, it should be noted that in the estimation of recultivation costs (Chapter 11), a possible subsequent use was not taken into account; namely, use as a landfill site, which, given the technological properties of the clay, would of course

possible. This could generate additional value from the mining areas. However, we have refrained from such an assessment at this stage, as it is not possible to estimate future landfill requirements in the region, even in the medium term.

18 Declaration

I hereby declare that I have carried out the valuation to the best of my knowledge, free from any bias and personal interest in the outcome.

The reassessment of the "Loickenzin/Thalberg" clay deposit was carried out solely by the undersigned, based on the 2011 report and the new underlying data.

Bad Sachsa, 25 October 2023



- Monika Dehne –

- Dipl.-Geol.-

GEOTEKT
Geologisches Planungsbüro
37441 Bad Sachsa · Merseburger Str. 14
Tel.: 0 55 23 / 34 82
Fax: 0 55 23 / 28 28

Data used

- [1] Quotation from FIM GmbH dated 19 September 2023
- [2] Altentreptow Land Use Plan, AT, 5th Amendment, 2014

Documents and sources from the 2011 report

- [I] Confirmation from the Stralsund Mining Authority regarding the sale of the Loickenzin/Thalberg BWE deposit dated 13 May 2011
- [II] Project proposal by the Treuhandanstalt (Directorate for Potash/Ore Mining/Stone/Earths) regarding the utilisation of the Loickenzin BWE deposit and the Altentreptow/eastern BWE deposit from 1994
- [III] Clay deposits Altentreptow / Loickenzin – a data collection – DURTEC / 23 November 2009
- [IV] Data documentation by Dr J. Schomburg (DURTEC) dated 25 May 2011
- [V] Quotation from FIM GmbH, including a data sheet on Rohton dated 9 June 2011
- [VI] Regional Spatial Development Programme for the Mecklenburg Lake District / Regional Planning Association for the Mecklenburg Lake District / 2011
- [VII] Evaluation criteria for industrial minerals, stones and earths / Part 1: Clays / Geological Yearbook Series H, Issue 2, BGR Hannover, 1997
- [VIII] Photographic documentation / July 2011