



# Medieval and early modern mining in the Northern Black Forest (SW-Germany): An integrated historico-archaeological approach and its synergetic effects

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## Abstract

Mining in the Northern Black Forest is studied as part of a doctoral thesis investigating all aspects of non-ferrous mining and smelting in the former duchy of Württemberg from its beginnings until AD 1700. At this time, Württemberg's mines were concentrated in the Northern Black Forest, where silver and copper veins cluster around Neubulach, below the *Königswart* and in the district of Dornstetten-Freudenstadt.

The thesis follows a truly interdisciplinary approach integrating written records, surface remains and underground workings. Since all three categories of evidence have suffered severe losses, their simultaneous consideration during every step of analysis and investigation enables powerful symbiotic effects and unlocks otherwise hidden information. Thus, a far more complete and comprehensive understanding of medieval and early modern mining and its development is achieved.

At Neubulach, extensive mining activities took place during the Middle Ages. Nevertheless, written evidence is scarce and most of the surface remains have been destroyed during the 20<sup>th</sup> century, but the 'old workings' are well documented in 16<sup>th</sup> and 18<sup>th</sup> century mining records and maps; and the underground workings accessible today show that the veins have been exploited to a depth of at least 100 m below surface prior to AD 1550. The medieval town centre of Neubulach is situated on the outcrops of the ore-bearing veins and represents a very good example for a small medieval mining town.

Although *argentifodinae* near Dornstetten are mentioned in AD 1267 and 1271, medieval exploitation remained limited and some of the most important veins remained untouched until the dukes of Württemberg took an active interest in mining from the 1550s onwards. The district developed and rapidly became the most important mining area in the Northern Black Forest, and in 1599, the Renaissance town of Freudenstadt with its spacious and regular layout was founded above the most important deposits. Although the mines mostly worked in deficit, about a ton of silver was produced which allowed the issuing of the so-called *Christophstaler*, coins exclusively minted from silver that came from the mines near Dornstetten and Freudenstadt.

## Introduction: Mining and smelting in Württemberg and the Northern Black Forest

The silver and copper deposits of the Northern Black Forest cluster around the medieval mining town of Neubulach, in the mining district of Freudenstadt-Dornstetten and close to the monastery of Klosterreichenbach, where a single, but rich lode is located below the mysterious *Königswart*. In 1320, Dornstetten and environs were bought by the counts of Württemberg, Neubulach followed in 1440 and in 1595, duke Friedrich I of Württemberg occupied Klosterreichenbach and *Königswart*. Thus, in the 16<sup>th</sup> and 17<sup>th</sup> century, the dukes of Württemberg controlled all the main non-ferrous metal deposits in the Northern Black Forest as well as several minor copper deposits in the Central Black Forest (Gutach, Tennenbronn; the deposits in Reinerzau and Alpirsbach do not seem to have been exploited before 1700). However, non-ferrous mining never achieved a major role in Württemberg's economy and remained rather limited in comparison to mining in Saxony, Tyrol or the Vosges Mountains in Alsatia. Nevertheless, non-ferrous mining and smelting in Württemberg and the Northern Black Forest has an interesting and stirring history of its own which has not yet been investigated comprehensively. In addition, the limited success highlights the difficulties impeding mining during the 16<sup>th</sup> and 17<sup>th</sup> centuries and allows to analyse their significance.

The history of non-ferrous mining and smelting in Württemberg from its beginnings until 1700 is therefore investigated as a doctoral thesis at Tübingen university, covering all the mining districts which became part of Württemberg prior to AD 1700. The thesis endeavours to achieve a comprehensive understanding and analyses written and archaeological evidence. Special emphasis is put on the historical development of the individual mines and the mining districts, the volume of mining and smelting, on the various factors governing its outcome and success as well as on overall aspects such as the role of the dukes of Württemberg and private entrepreneurs, mining legislation, organisation, technology, working and living conditions of the miners.

## The interdisciplinary approach integrating written, archaeological and underground evidence

The thesis follows a truly interdisciplinary approach considering written, archaeological and underground evidence within every step of analysis and interpretation.

Written evidence on mining in Württemberg during the Middle Ages is scarce, but from the 16<sup>th</sup> century onwards, there is a growing amount of mining records. Various reports give details on the dimensions of adits, galleries and shafts, describe the overall situation of the mines and the progress of work or discuss specific problems of technology, organisation or accountancy. Petitions and decrees, privileges and regulations yield information on organisation and legislation or on the miners' social situation while registers and accounts give an idea on production costs, wages and the overall economic situation. Although these various records contain manifold and interesting information, only a minority has been exploited by historians in a rather retelling approach [1].

The majority of these records is kept in the 'Hauptstaatsarchiv' (HStAS; main state archives) at Stuttgart, but they only represent part of the former records, while the bulk has been lost. Some of the lost records are quoted in 18<sup>th</sup> century literature in some detail [2], but still, the written sources on their own yield an interesting, but quite incomplete image of mining and smelting in 16<sup>th</sup> and 17<sup>th</sup>-century Württemberg.

As no excavations have yet been carried out, the archaeological evidence mainly consists of surface remains and underground workings. Surface remains, such as open-cast workings, dumps and various *Pingen* (any more or less bowl-shaped depressions caused by mining, e.g. breaches, small open-casts, costeans, collapsed shafts or adits, etc.) are usually difficult to date but give a good idea on the intensity of mining. Most deposits are covered by woodland and the preservation of surface remains is thus satisfying. More detailed information can be gained from investigating accessible underground workings. Their extent reflects the volume of mining and the time-span of operation. Even more important, they clearly show whether the veins have just been explored by adits and shafts, or whether the deposits have been exploited extensively. Driving techniques are discernible by tool-marks which also give some indication for dating or different periods of operation.

The simultaneous consideration of written and archaeological evidence thus leads to a far more comprehensive understanding and allows to evaluate and cross-check the evidence, as the following historical overview on the historical development of the two main non-ferrous mining districts in the Northern Black Forest will illustrate.

### Neubulach: The medieval mining district and town

The mining district of Neubulach is situated on the eastern fringe of the Northern Black Forest, about 40 km south-west of Stuttgart. Several ore-bearing veins strike across a plateau enclosed by the deep valleys of the *Ziegelbach*, *Nagold* and *Teinach* (fig. 4). The veins occur in the *Buntsandstein* (Triassic sandstone) and contain fahl-ores (*Fahlerze*, tetraedrite), emplectite and chalcopyrite as principal primary ores and numerous secondary minerals, especially azurite and malachite.

Written evidence on medieval mining at Neubulach is extremely scarce: The town itself is first mentioned in 1275 and there is indirect evidence for silver mines in 1286. Only in 1329, the mines are explicitly mentioned. However, the written records show, that despite its somewhat remote location, the town rapidly prospered and developed in the later 13<sup>th</sup> century. This rise was certainly based on a longer period of successful mining. During the 14<sup>th</sup> century however, the town and the mining declined, and in 1405 the town was freed from certain taxes because of its poverty [3]. Single mines were granted in 1406 and 1435 and in 1478, the names of several mines are mentioned, but in general, mining activity seems to have been rather limited throughout the 15<sup>th</sup> century and by the beginning of the 16<sup>th</sup> century, all the mines had been shut down [4].

More information on the medieval mining period in Neubulach can be gained from the archaeological, architectural and underground evidence:



The town itself is situated in the middle of the plateau just on top of the outcrops of the principal ore-bearing veins, and underground workings just below surface have been hit repeatedly during building development in the later 20<sup>th</sup> century. The town's street-plan [5] is rather irregular (fig. 1), suggesting that at first, the miners settled in the immediate neighbourhood of the shafts, similar to the mining settlement on the Altenberg near Müsen [6], excavated in the 1970s. Probably due to successful mining, the town prospered and grew, and finally, it was granted the rights of a town and fortified by walls. These were probably erected in the 13<sup>th</sup> century and have largely been preserved. Some houses in the town date back to the 14<sup>th</sup> century [7].

**Fig. 1:** A mine map from 1719 shows the medieval mining town of Neubulach and its irregular street plan enclosed by the medieval

walls [5].

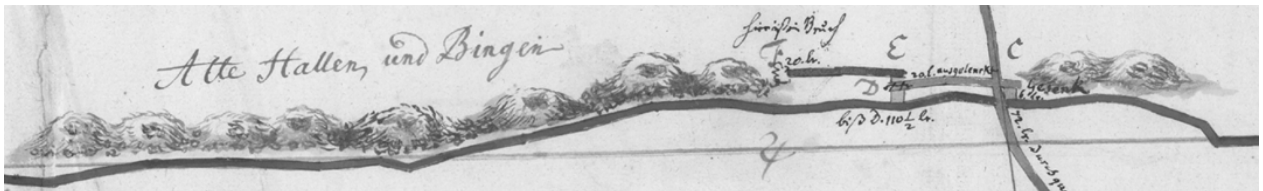


Until the second half of the 20<sup>th</sup> century, numerous mine-dumps and *Pingen* (more or less bowl-shaped depressions caused by mining, e.g. breaches, small open-casts, costeans, collapsed shafts or adits, etc.) had been preserved next to the town. They followed the outcrops of the principal veins for a length of more than 2 km. Their impressive extent is repeatedly discussed in 16<sup>th</sup> century and later mining records and already then, nobody could recall when and how these had been worked [8, 10].

**Fig. 2:** This elaborate mine map of Neubulach from 1719 [5] shows the extent of the medieval mine-dumps

(greyish blue), lined up along the outcrop of the principal lode (black line). The map thereby records archaeological evidence that not longer exists.

As there is not any hint for earlier settlement or mining activity, the majority of the mine-dumps and *Pingen* is most likely the result of intensive mining during the 13<sup>th</sup> and 14<sup>th</sup> century. Today, these surface remains have vanished: The mine-dumps have been exploited as road gravel from the 19<sup>th</sup> century onwards and from the 1920s till the end of WW II, they have been re-worked for bismuth. Finally, after WW II, the entire area once covered by mine-dumps and *Pingen* has been developed for houses. Mine plans from the 18<sup>th</sup> and early 19<sup>th</sup> century however, depict these remains and even illustrate their structure in detail (fig. 2): The mine-dumps are lined up like pearls on a necklace. Most of them feature a distinct depression in their centre indicating a collapsed shaft (fig. 3). After exploitation of the uppermost parts of the veins, the medieval miners obviously exploited the veins by underground mining based on shafts sunk in regular intervals.



**Fig. 3:** This detail from a mine plan from 1757 [9] shows that most of the old mine-dumps along the veins' outcrops featured a distinct depression in their centre marking a collapsed shaft. This shows that during the Middle Ages, the veins were exploited underground by shafts sunk in more or less regular intervals.

All the shafts have collapsed or been filled in, but four adits allow access to parts of the old workings. These adits are driven from the deep valley of the Ziegelbach, which cross-cuts the south-eastern end of the veins (fig. 4). The upper-most adit, the 19<sup>th</sup> century *Wilhelm-* or *Hella-Glück-Stollen*, has been opened to the public as a show-mine. When the miners reached the two principal veins in 1825 respectively 1831 after 94 m respectively 230 m cross-cut, they immediately hit into old workings and found that the veins had already been stoped intensively (fig. 5). These stopes can still be accessed today, but they are largely collapsed and filled in. Nevertheless, they demonstrate that the veins have been mined completely over-hand and under-hand. The written records clearly show that this period of intensive exploitation pre-dates 1550 [8].



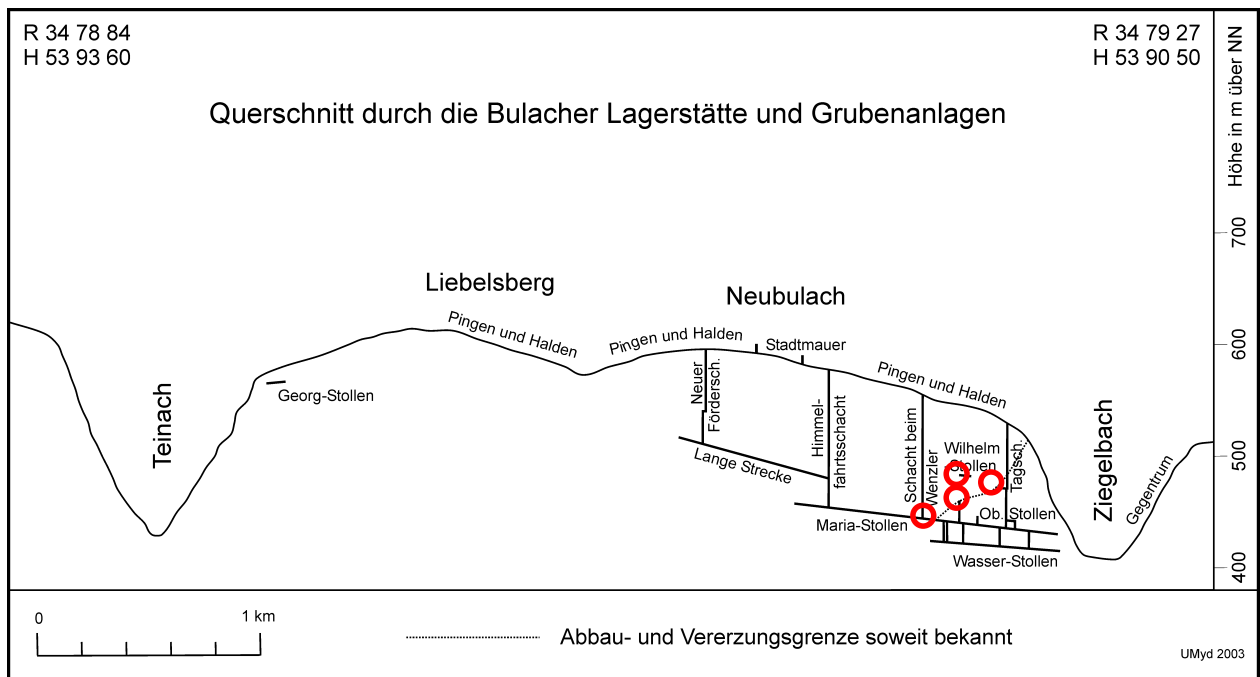


Fig. 4: This cross-section runs along the strike of the principal lode at Neubulach and shows the most important shafts as recorded in 16<sup>th</sup> to 19<sup>th</sup> mining records and plans. The adits driven from the Ziegelbach valley are still largely accessible and recorded in modern surveys and 18<sup>th</sup> century mine plans [8].

The red circles mark old stopes that are still accessible and most probably date to the 13<sup>th</sup> or 14<sup>th</sup> century.



Fig. 5: The so-called *Azurithöhle* ('hall of azurite') in the *Wilhelm-Stollen* and present-day tourists' mine is the largest old stope still accessible. It probably dates to the medieval heydays of mining and was enlarged during the 19<sup>th</sup> and 20<sup>th</sup> century.

The lower adits, the *Oberer Stollen* (15<sup>th</sup>?/16<sup>th</sup> c.), *Maria-Stollen* (14<sup>th</sup>?/16<sup>th</sup> c.) and *Wasser-Stollen* (late 18<sup>th</sup> c.), were driven as drainage-adits and to explore the veins in greater depth. They follow the strike of the principal lode from the Ziegelbach valley towards north-west, i.e. towards the town. By the end of the 16<sup>th</sup> century, the longest adit, the *Maria-Stollen* was extended to undermine the medieval town centre in a depth of about 130 m. In the very south-east, i.e. close to the Ziegelbach valley, the veins are not mineralised. As soon as the adits reach the ore-bearing zone below the plateau, they immediately hit into old stopes. The lower-most adit, the *Wasser-Stollen*, however, did not reach considerable ores at all. Thus, ores were only found below the plateau and they seem to have been concentrated in the upper parts. This zone however was completely mined

prior to AD 1550, most probably during the 13<sup>th</sup> and 14<sup>th</sup> century. Therefore, the deposits had already been entirely exhausted by the end of the Middle Age.

Nevertheless, mining at Neubulach was resumed during the 16<sup>th</sup> century [10]. Some work was made during the 1530s and 1540s. More intense attempts were made after Christoph had become duke of Württemberg in 1550 and took a very active interest in mining. In 1551 the mines at Neubulach and Dornstetten were visited by foreign experts, including the wide-known Johann Haubensack who was employed as *Landrichter* (judge) in the prospering mining area of Ste Marie-aux-mines (Markirch) in Alsatia. As an immediate result, minor mining activities were started, and from 1558 onwards, intensive efforts were made to re-work the vast mine-dumps from the earlier, long-forgotten heydays of mining at Neubulach. A stamp-mill and a smelter were built and up to 70 miners and workers were employed, but re-working the tailings remained unsuccessful. The same is true for the search for new veins and the re-opening of the drainage adits. When Christoph died in 1568, the mines at Neubulach were again shut down, since the attempts had proven that the district's deposits had been exhausted during the Middle Ages: There were no un-worked veins to be found, the ores on the drainage levels was poor and their haulage costly, nor were there any substantial amounts of silver or copper left in the old mine-dumps.

The same is true for the next phase of mining in Neubulach from 1596 to 1608, when Friedrich I was duke of Württemberg and also took a very strong interest in mining. After that, the mines around Neubulach remained un-worked for more than 100 years [10].

### **Freudenstadt and Dornstetten: The Renaissance town and early modern mining district [11]**

Mining in the district of Dornstetten-Freudenstadt was based on numerous mineral veins, very similar to those around Neubulach. They also occur in the *Buntsandstein* (Triassic sandstone) and fahl-ores were the most important primary ores, while emplectite, chalcopyrite and bornite are less frequent [12, 13]. The ores were concentrated in ore-shoots, while other parts of the veins contained few or no silver- or copper-bearing minerals. The most important veins were found west of Freudenstadt in the Forbach valley which became known as '*Christophstal*' from the 1570s onwards.

A document from 1267 gives the first written evidence for mining in the Northern Black Forest by hinting at *argentifodinae* (silver mines) in the parish of Dornstetten. The document was confirmed in 1271, but there is no further evidence for mining activities in the district until the 1520s. The 16<sup>th</sup> century mining records report only limited 'old man workings' and most of the important veins obviously remained unexploited until after 1550. This corresponds to the archaeological evidence, as there are only few surface remains of possible medieval origin.

In the 1520s and 1530s some mining was undertaken near Dornstetten, on the Schöllkopf south of Freudenstadt (including the *Besucherbergwerk*) and probably also at Hallwangen. These mines were abandoned a couple of years later, and when Christoph became duke of Württemberg in 1550, all the mines had been shut down and become inaccessible. Christoph however showed a significant interest in mining: Already in 1551, he issued new mining legislations and initiated the inspection of mines in Neubulach, Reinerzau and around Dornstetten, but it took till 1558/1559 until mining operations were taken up in the Dornstetten-Freudenstadt area. During the first years, the duke financed the mines on his own, but in the early 1560s, a *Gewerkschaft* (mining company) was formed which took over some of the mines in the Christophstal, especially the *St. Christophs-Erbstollen* (St. Christopher's drainage adit) and a shaft called *Heilige Drei Könige*. From the early 1560s, only little written evidence has been preserved, but the *St. Christophs-Erbstollen* is well documented in an 18<sup>th</sup> century mine-plan and the shaft has been re-opened to the public in recent years. In fact, it provides the most illustrative example for the symbiotic effects of the simultaneous consideration of written and underground evidence.

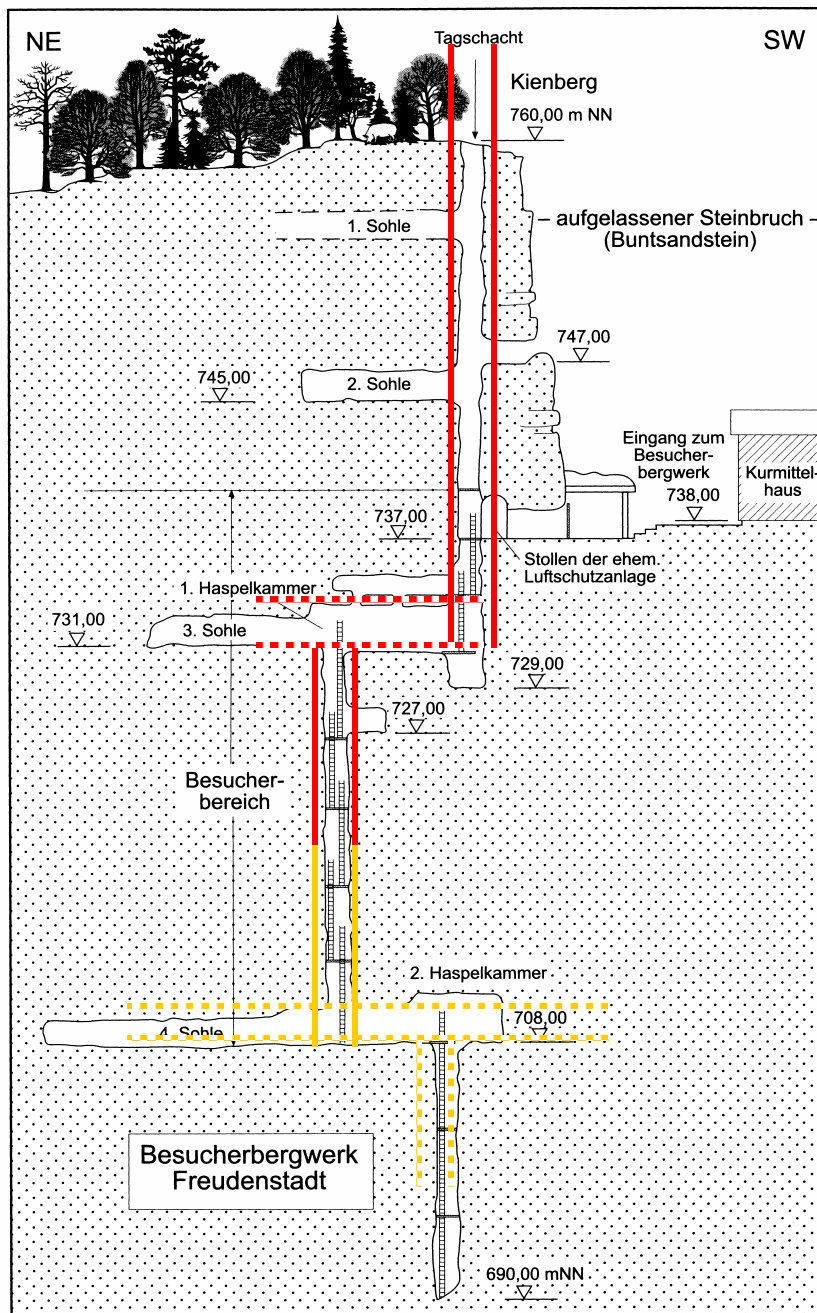
### **An example: the '*Besucherbergwerk* (tourists' mine) Freudenstadt'**

The existence and location of the mine had been forgotten, but in 1996, a brick wall in an underground WW II air-raid shelter at the southern fringe of the modern town of Freudenstadt was suspected by amateurs of local history to cover access to an unknown mine, which proved to be true when the wall was removed [13]. During the following years, the mine was cleared and today, it is entirely accessible. The mine is basically a shaft staggered in three sub-shafts connected by short levels, reaching to a depth of 70 m in total (fig. 6). Additional levels were driven for further exploration of the deposit. The hading shaft follows a vein, which is up to 1 m wide. It consists mainly of baryte and quartz, but also contains some iron and manganese oxides and hydroxides. Sulphides as well as other silver or copper minerals are virtually absent. The miners obviously took advantage of natural fissures and as a result, they left almost no tool-marks. A partly illegible inscription of five characters may indicate a date and has been interpreted as 1556 or 1756. Obviously, the purpose of the mine was to explore the vein, but its name, its age and even its objective (iron, copper or silver?) is not discernible from the underground evidence.

Several mining records from 1559 and 1560 however, describe a staggered shaft, that was begun around 1530 and re-opened in 1559. The upper shaft is described as 36 metres deep. From its bottom, a short level ran eastwards to the second shaft, which reached a depth of 12 metres around 1530 and was deepened to 24 metres in 1559/1560, when levels were driven towards the east and west. Finally, a third shaft was proposed to be sunk from the latter. The vein is reported to consist of *Spat* (baryte) with some '*Wit-ternus*' and '*Brand*' (secondary iron and/or manganese oxides or hydroxides). These minerals were interpreted as the gossan of a silver-bearing vein and the miners hoped to find an enrichment zone with silver ores in greater depth.

The described shaft perfectly fits the dimensions of the *Besucherbergwerk* and can be identified as being the very same. This linkage allows the otherwise unknown location of the reported shaft and establishes the age and former objective of the *Besucherbergwerk*. Furthermore, a mine called *Heilige Drei Könige* is mentioned in 1564. This mine was somehow related to the *St. Christophs-Erbstollen* and both explored the same vein, although in 1564 and later-on, work concentrated on the adit's level only. From 18<sup>th</sup> and 19<sup>th</sup> century maps, the *St. Christophs-Erbstollen* is known to have been located at the mountain's foot below the *Besucherbergwerk*, which is thus likely to have been known as *Heilige Drei Könige* in the 16<sup>th</sup> century.

On the other hand, the written records do not indicate, why and when the mine was closed. This however can be deduced from the underground evidence: The third and lower-most shaft only reached a depth of



about 18 m. Here, the vein wedged out, which was most probably the reason for abandoning the mine. These 18 metres would correspond to 1 or 2 years of work, and thus operation came to a stand-still around 1562.

Fig. 6: Cross-section of the Besucherbergwerk Freudenstadt. The coloured lines show the dimensions of the shaft *Heilige Drei Könige* as given in records from 1559/1560. Continuous lines indicate shafts of recorded depth, dashed lines represent levels of known direction, but unrecorded length or proposed shafts. Red lines mark shafts and levels from around 1530, yellow lines those from 1559/1560. The recorded dimensions of the shaft *Heilige Drei Könige* almost perfectly fit the Besucherbergwerk which can thereby be identified. (Coloured lines by the author; survey and drawing by W. Strittmatter, published in [13].)

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In 1559 and 1560, mines at Hallwangen, near Dornstetten, in the Chris-

tophstal and on the Schöllkopf south of present-day Freudenstadt were in operation, but during the next two decades, the mining activities became more and more concentrated in the Christophstal valley in the district's western-most part. At first, success remained limited and closure was imminent, when a new and richer vein was found in the *St. Christoph-Erbstollen* in 1567, and in the year to follow, the even richer lode at the Kehrsteige was discovered. It proved to be one of the two richest lodes in the district. Later that year, a second *Gewerkschaft* was founded, and several claims were granted to individual miners. Due to this impetus, the operations were continued even after Christoph had died in late 1568 and his son Ludwig showed little interest in reigning and mining. During the following years, the two companies co-operated tightly (they finally joined in 1575) and drove the *Vertragstollen* (contract adit). In 1567 and 1571, larger quantities of ore were transported for smelting trials to the then extremely prosperous and far more important mining district around Ste-Marie-aux-mines (Markirch) in the Vosges. These trials were successful, and in 1572 a smelter was built in Christophstal. The silver was bought by the duke and minted. In 1573 the first *Christophstaler* were issued (fig. 7), coins exclusively made of silver from the mines and depicting St. Christopher to show the origin of the metal [14]. Encouraging events, such as the discovery of the rich lode at the Kehrsteige, the successful smelting trials in Ste-Marie-aux-mines and the



*Christophstaler* motivated private prospecting and exploring, and additional mines were opened. However, silver production and mining declined in the later 1570s and was finally abandoned around 1580.

**Fig. 7:** The *Christophstaler* minted in 1572 was the first of a series of coins made of silver mined and smelted in the Dornstetten-Freudenstadt district (photograph by Ulrich Klein, published in [14]).

In 1593 after Ludwig's death, Friedrich I became duke of Württemberg. He took an even stronger interest in economic progress and activities, including mining, than Christoph had done. Friedrich was among the earliest protagonists of mercantile politics in Germany and extended his princely power [15]: He maintained an absolutist understanding of reigning, expanded his territory by various purchases and in 1595, he occupied and annexed the priory of Reichenbach and the nearby mines at Königswart. Already in 1594, Friedrich had resumed mining operations in Christophstal, and during 1595 and 1596 the mines in Neubulach, Gutach and Tennenbronn were re-opened, too. In addition, numerous prospects and mining trials were begun throughout Württemberg. Most of them were totally unsuccessful as they were often based on mere hope. Finally, the Königswart mine was re-opened in 1603, after Friedrich I had officially bought the rights over the priory of Reichenbach from the counts of Eberstein and thus legalized his annexation.

Again, Christophstal became the most important mining district in Württemberg; the smelter was repaired in 1596 and from 1597 onwards, new *Christophstaler* were minted. Although other veins were exploited too, the mines at the Kehrsteige were again the most productive. Here, water-powered pumping machinery was installed, a drainage adit was driven and in 1598, these mines were taken over by a new *Gewerkschaft*. Probably the most prominent and certainly the longest-lasting activity of Friedrich I was the founding of a new town called 'Freudenstadt' on the highland just above the Christophstal mines. The regular street-plan resembled a nine men's morris board and featured a large place in its centre, where a palace was planned, but never built. In recent years, some scholars pronounced the idea that Friedrich I had founded Freudenstadt mainly as a new capital [16], but mining was certainly an important reason, at least for choosing the location of the new town.

The annual production of silver peaked 100 kg in 1603/04 and 1608/09, but decreased after 1615 [14]. During the first decade of the 17<sup>th</sup> century, iron, copper and brass workings were established in Christophstal, processing the copper from the mines and making use of the water-power and the immense quantities of wood in the surrounding forests. After the sudden death of Friedrich in 1608, mining, smelting and metal-working was continued in Freudenstadt-Christophstal and Königswart, whereas the mines in Neubulach and Gutach were shut down. However, the mines at the Kehrsteige declined in the second decade, probably due to partial exhaustion, but other mines were continued, including the *Friesenloch* mine, which worked on the district's second-richest lode. Nevertheless, most of the mines were somewhat run-down in the mid-1620s, but the Friesenloch and Kehrsteige mines were cleared in 1627. The success of this new attempt is unknown, but at the latest, the mines were abandoned when a fire ravaged Freudenstadt in 1632 and in 1634, the horrors of the Thirty Years' War reached Württemberg, when the imperial troops invaded and looted the country after the defeat of the Swedish army in Nördlingen. The mines, smelters and metal-workings are said to have been completely destroyed and till the war was ended with the Peace of Westphalia in 1648, Württemberg was virtually ruined and had lost more than half of its population.

Nevertheless, in 1659 the *Friesenloch* mine had been re-opened, and in 1663 five mines were in operation. Less details are known on this mining period, but obviously the mines called *Haus Württemberg* and especially *Dorothea* were the most productive, the latter probably being identical with the *Friesenloch*. New water-powered pumping machinery was installed in 1666 and in 1667, more *Christophstaler* were minted. However, production seems to have been rather low and the mines were mostly abandoned in the later 1670s.

## Conclusion

Non-ferrous mining in the Northern Black Forest shows a manifold history. The two main districts Neubulach and Dornstetten-Freudenstadt saw a very different development. At Neubulach, mining flourished during the 13<sup>th</sup> and 14<sup>th</sup> century and at the underground exploitation was based on numerous shafts. The deposits had already been exhausted in the later Middle Ages and the town itself represents a very good example for a medieval mining town that began as a small mining settlement. The development of the Freudenstadt-Dornstetten district is quite different. Here, medieval mining was limited and most deposits remained untouched until the later 16<sup>th</sup> century, when the dukes of Württemberg took an active interest in mining as part of an early mercantile system. This approach is also reflected by the new Renaissance town of Freudenstadt which was partly founded as a mining town.

Both districts show the variety of synergetic effects gained by an integrated approach. At Neubulach this is especially true on the macro-scale: The extent and age of the impressive medieval mining activity in Neubulach can only be understood by combining the scarce written records from the Middle Ages, the architectural evidence, the investigation of the underground workings and the analysis of 16<sup>th</sup> and 18<sup>th</sup> century mining records.

In the Dornstetten-Freudenstadt district, the symbiosis works rather on the micro-scale: Single mines, e.g. the *Besucherbergwerk* and their individual history are understood far more precisely and comprehensively, if investigated by an integrated and simultaneous analysis of written records, surface remains and underground workings. The thesis studies all the mines of the district in such detail and will thus allow a detailed understanding of each mine and its development. These data will then provide the basis for a comprehensive analysis and understanding of the mining history of the entire district and for evaluating the extent and success of mining as well of the various factors governing its development and outcome.

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