Zeitschrift: Bulletin de la Société Fribourgeoise des Sciences Naturelles = Bulletin der Naturforschenden Gesellschaft Freiburg

Herausgeber: Société Fribourgeoise des Sciences Naturelles

Band: 112 (2023)

Artikel: The Allschwil and Laufen tileworks (Canton Basel-Landschaft) : some historical and scientific aspects

Autor: Maggetti, Marino / Galetti, Giulio

DOI: https://doi.org/10.5169/seals-1046535

The Allschwil and Laufen tileworks (Canton Basel-Landschaft) - some historical and scientific aspects

Marino Maggetti und Giulio Galetti
Departement of Geosciences, University, CH-1700 Fribourg

Im Rahmen dieser Arbeit wurden 95 Dachziegel der Passavant - Iselin Ziegelei (PIC) und der Aktienziegelei (AZA) in Allschwil sowie der Ziegelei in Laufen chemisch und mineralogisch - petrographisch untersucht. Die Geschichte dieser Fabriken wird summarisch vorgestellt. Das Probenmaterial besteht aus Zufallsfunden an der Oberfläche, deren Zuweisung zu einer bestimmten Ziegelei auf Grund der Firmenbezeichnung eindeutig ist. Auf den Ziegeln konnten für PIC sieben, für AZA drei und für Laufen fünf unterschiedliche Firmenbezeichnungen eruiert werden, die auf Grund der eingebrannten Jahreszahlen mehrheitlich in den ersten Jahrzehnten des 20. Jh. zum Einsatz kamen. Die Allschwiler Ziegelwerke mischten oligozäne marine Mergel mit jüngeren entkalkten Loess-Ablagerungen des Quartärs. In Laufen war aber kein Loess vorhanden. Hier wurden kalkärmere und kalkreichere Schichten des Oligozäns gemischt. Die makroskopischen und mikroskopischen Untersuchungen zeigen unterschiedliche Grade der Durchmischung. Die Laufener Ziegel können chemisch gut von denjenigen aus Allschwil differenziert werden, beispielsweise auf Grund ihres hohen Chromgehaltes. Dies gelingt nur schwerlich bei beiden Allschwiler Produkten, was nicht erstaunt, da ihre Rohstoffe aus eng benachbarten Gruben stammen. Die 95 Dachziegel unterscheiden sich chemisch deutlich von den bisher untersuchten 277 schweizerischen Dachziegeln.

Ce travail présente les résultats d'analyses chimiques, minéralogiques et pétrographiques effectuées sur 95 tuiles provenant des tuileries Passavant-Iselin (PIC) et Aktienziegelei (AZA) à Allschwil et de la tuilerie de Laufon. Un bref aperçu historique de ces usines est présenté. L'ensemble étudié se compose de découvertes fortuites en surface, qui sont clairement attribuées à une tuilerie spécifique en fonction du nom de l'entreprise. Sept noms d'entreprises différents pour PIC, trois pour AZA et cinq pour Laufon ont pu être identifiés sur les tuiles, dont la plupart ont été utilisées dans les pre-

mières décennies du 20e siècle en raison des dates de cuisson. Les tuileries d'Allschwil mélangeaient des marnes marines de l'Oligocène et des dépôts décarbonatés du Loess (Quaternaire). La tuilerie de Laufon utilisait des couches de l'Oligocène avec différents taux de carbonates, car le Loess faisait défaut. Les examens macroscopiques et microscopiques montrent divers degrés de mélange. Les tuiles de Laufon se différencient chimiquement de celles d'Allschwil, par exemple grâce à leur forte teneur en chrome. Par contre, les deux produits d'Allschwil sont plus difficilement séparables, ce qui n'est pas surprenant puisque leurs matières premières provenaient de gîsements situés à proximité. Les 95 tuiles diffèrent chimiquement des 277 tuiles suisses examinées jusqu'à présent.

In this work, 95 roof tiles from the Passavant-Iselin (PIC) and the Aktienziegelei (AZA) tileworks in Allschwil and the tilework in Laufen were chemically and mineralogical-petrographically examined. The history of these factories is presented in summary. The sample material consists of random finds on the surface, which can clearly be assigned to a specific factory based on the company name. Seven different company names for PIC, three for AZA and five for Laufen could be found on the tiles, most of which were used in the first decades of the 20th century as shown by the fired-in years. Both Allschwil tileworks mixed Oligocene marine marls with Quaternary decarbonated Loess sediments. In Laufen, however, there was no Loess. Here Ologocene layers with different lime contents were mixed. The macroscopic and microscopic studies show variable degrees of mixing. The Laufen tiles can be chemically differentiated from those from Allschwil, for example due to their high chromium content. This is difficult to achieve for both Allschwil products, which is not surprising since their raw materials come from open pits in close proximity. The 95 roof tiles differ chemically from the 277 Swiss roof tiles examined so far.

Introduction

The present work follows the research of MAGGETTI/GALETTI [MAG20, MAG22]. In 2020, 129 tiles from the brick- and tileworks of Corbières, Düdingen and Le Mouret, all situated in the Canton of Freiburg, were examined for their chemical, mineralogical and petrographical composition (Fig. 8.1). Our 2022 paper focused on the same aspects of 148 roof tiles from nine Bernese tileworks. We now show and discuss 95 roof tile analyses from Allschwil and Laufen (Tab. 8.5).

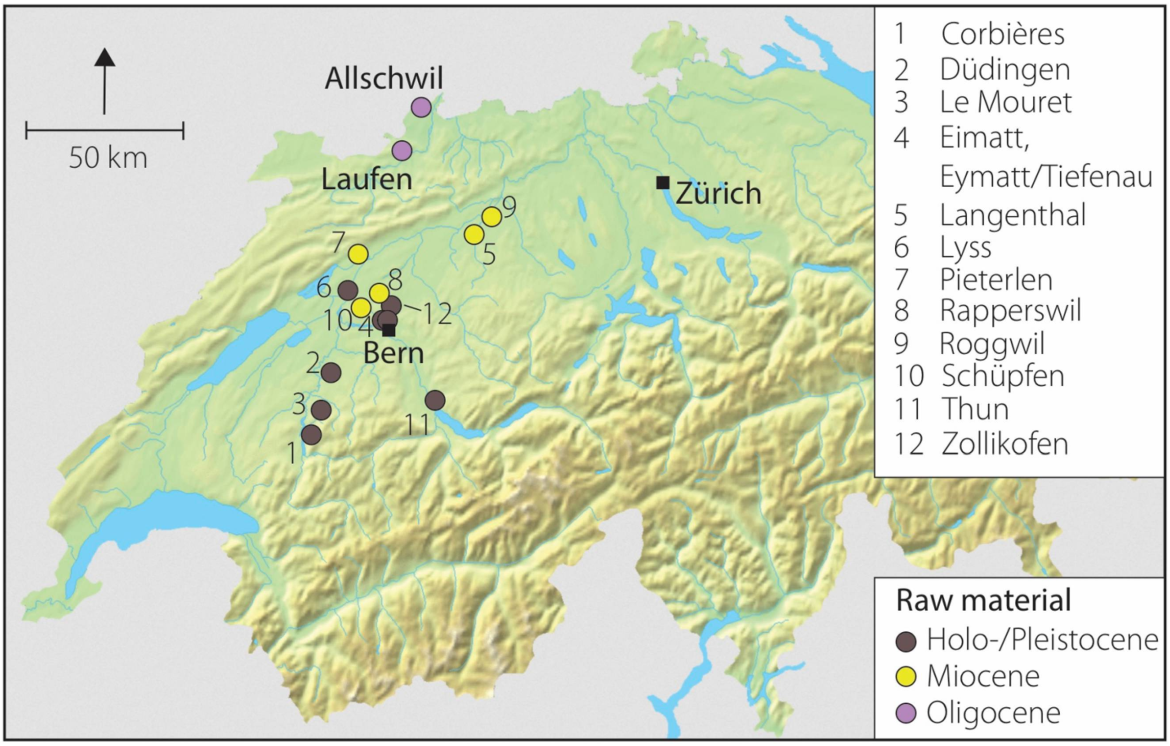

Figure 8.1: *Localization of the brick- and tilefactories from Allschwil and Laufen and of the 12 factories whose products were analysed by MAGGETTI/-GALETTI [MAG20, MAG22]. The three main raw materials are highlighted with different colours. Map © Wikipedia (accessed 2023,4,30). Graphic editing MARINO MAGGETTI.*

Geology, history and cartography

This section is primarily based on printed sources and published specialist literature. Archives were not consulted due to time constraints.

Allschwil (Canton Basel-Landschaft)

The history of the tile production in the Basel region has been outlined by WULLSCHLEGER [WUL31] and FÄSSLER [FÄS93]. For the persons involved see BIRKHÄUSER [BIR97]. In the following we deal with two of these brick-and tileplants, namely the so-called PIC (production 1878–1975) and AZA (1897 ?–1975) factories.

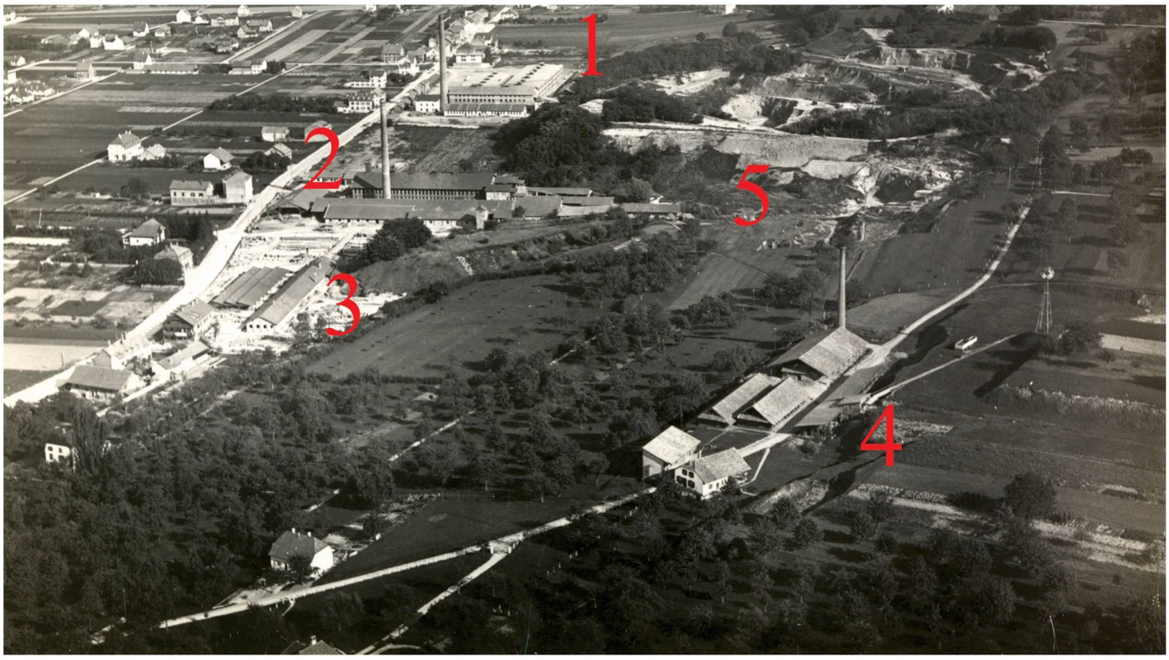

Figure 8.2: *Aerial view of the brick- and tileworks in the Allschwil-Mühleweg area. View to the northeast. Photograph* Walter Mittelholzer. *Factories: (1) «Passavant-Iselin» (PIC), (2) «Aktienziegelei Allschwil» (AZA), (3) «Kaminwerk Allschwil», (4) «Tranzer», PIC and AZA open pits (5). © ETH Zürich Library, image archive, LBS_MH03-1556, Dating 1918–1937. Public Domain Mark.* `http://doi.org/10.3932/ethz-a-000492570`.

Short history of the PIC factory

In 1878, Hans Franz (Von) Passavant (1845–1909) founded in Allschwil the first mechanical brick and tile factory of the region (Fig. 8.2). Passavant had previously worked in his parent's bank and married 1874 Anna Margaretha Iselin (1855-1935; (`http://www.stroux.org/patriz_f/vnQV_r.pdf`). The full name of the company was «Thonwaarenfabrik Allschwil Passavant-Iselin» (SHAB 23.6.1883), hereinafter referred to as PIC. The factory was about 1.5 to 2 km away from the city of Basel, its main sales area, and had, like the younger AZA (see below), no rail connection. In the early hours of Monday, August 11, 1881, a fire destroyed the ring kiln and the drying facilities (NZZ 8.11.1881). The plant was immediately rebuilt. The company advertised at the 1883 National exhibition in Zürich with bricks and tiles of all kinds as well as many stoneware products (Fig. 8.3). PIC employed at that time 200 workers and was the only stoneware factory in Switzerland [HAR83, 111]. A heated debate about the interlocking roof tile designed by PIC took place in 1884 [PAT84, RÜH84a, RÜH84b, RÜH84c]. On November 29, 1884, the Basler Stadtbuch reported from the 1884 exposition of the «Union centrale des arts dêcoratifs» in Paris that «Die Thonwaarenfabrik Allschwyl (Hans Franz Passavant) hat in Paris einen antiken Ofen ausgestellt, ... wofür sie mit der bronzenen Medaille ausgezeichnet wird» (The Thonwaarenfabrik Allschwyl (Hans Franz Passavant) exhibited an antique stove in Paris, ... for which it was awarded the bronze medal).

In 1885, the company had four ring kilns. In 1891 PIC took part in the first «Gewerbe- und Industrieausstellung» of the canton Baselland (LNS 5.9.1891). The company patented in 1896 several closet types under the Latin designations «NON OLET», «ARGO», «PROFUNDUM», «VORAX» and « TARGED CLOSET » (SHAB 26.3.1896). These names show the patron's fine sense of humor and his High-school Latin. PIC changed its name in 1898 to «Thonwaarenfabrik Allschwil Passavant-Iselin & Cie» (SHAB 14.3.1898). PIC was busy advertising early on, for example in the German Thonindustrie-Zeitung (1884, 416) or in several Swiss newspapers (NZZ 27.10.1882, FAN 26.5.1883, LBP 11.10.1884, LJ and BN 16.2.1892). In 1890, PIC advertised itself as the only brick factory with full winter operations and an annual production of 10 million pieces (NZZ 3.11.1890). Due to the poor construction situation, brick and tile production had to be reduced by half to two thirds at the beginning of the 20th century. In 1901 only 11 to 12 million pieces could be manufactured and sold (NZZ 31.1.1902). At the time, PIC was probably the most important factory in western Switzerland. A fire destroyed the factory completely in 1903. It was quickly rebuilt and modernized. The company was converted into a joint-stock company in 1920 and took the name «Passavant-Iselin & Cie. Aktiengesellschaft» (SHAB 8.5.1920). A new tunnel kiln, which was put into operation in the 1960s, caused serious damage to the fruit trees and the death of 35 cows of the nearby «Paradies» farm due to high fluorine emissions (BT 10.4.1980, DB 11.4.1980). The foreseeable exhaustion of the clay pits and the falling demand for building ceramics led to the closure of the factory in December 1975, after almost 100 years of activity. Already in 1974 sales

1435. Thonwaarenfabrik Allschwil (B.-L.), Passavant-Iselin, Basel.
Backsteine — Ziegel — Bauverzierungen — Steinzeugröhren — Flur- und Trottoir-Platten im Park — Chemische Gefässe — Glasirte und unglasirte Steinzeug- und Thon-Waaren im Gebäude.
Thonwaarenfabrik gegr. 1878. — Dampfm. 100 Pfd. — 200 Arbeiter. — Spezialität: Sehr harte Blend- und Hohl-Steine, weiss und roth — Glasirte Ziegel, Production 6,000,000. — Einzige Steinzeugfabrik der Schweiz — Steinzeugartikel für Wasserleitungen, Canalisationen, Abtritte, chemische Gefässe und Hahnen — Steinzeug-, Flur- und Trottoir-Platten — Extra feuerfeste Steine. Siehe Gr. 18 *c*, 19 *f*.

Figure 8.3: *Advertisement in* Hardmeyer-Jenny *[HAR83, 111].*

fell by 15% and for 1975 another 15% had been expected (DB 21.9.1975). At that time, 75 people were still employed in the factory.

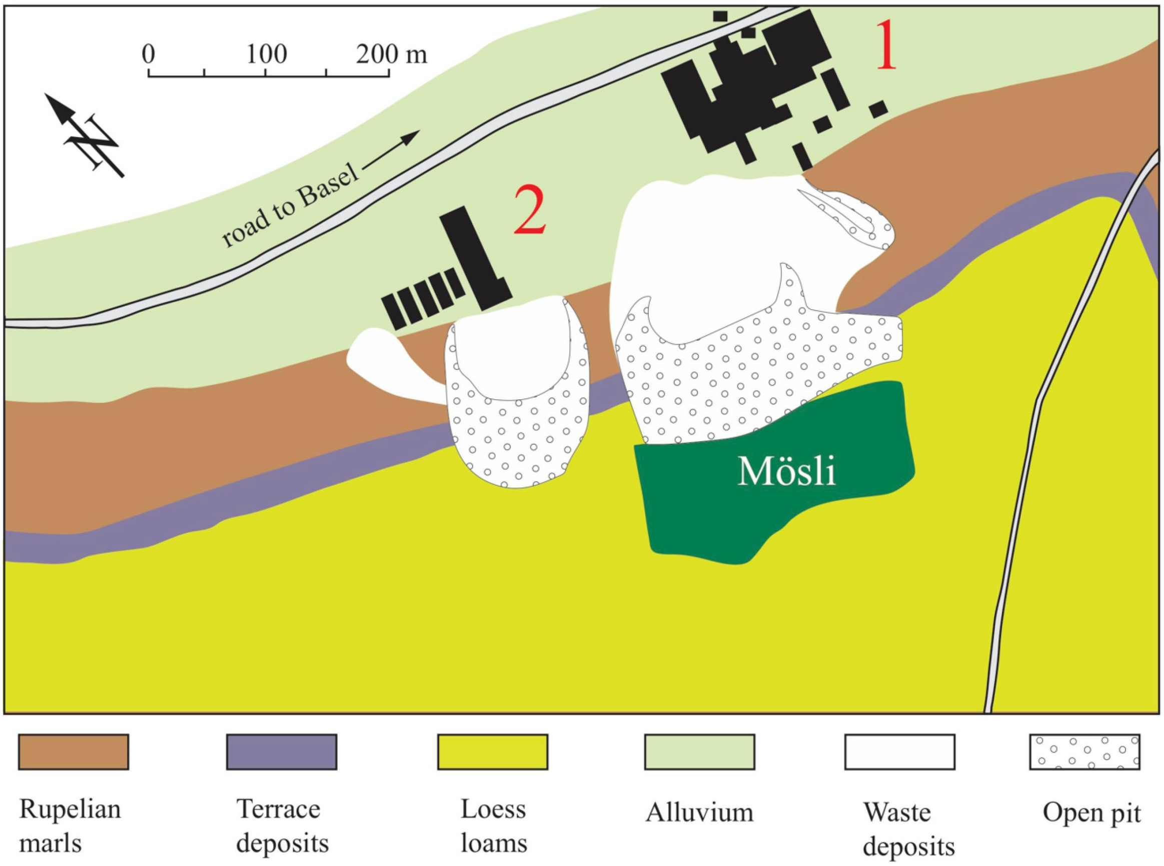

Figure 8.4: *Simplified geological map from* SCHMIDT/HINDEN *[SCH07, Fig.33]. Dark green = «Mösli» grove. 1 = PIC, 2 = AZA tileworks. Drawing* MARINO MAGGETTI.

Short history of the AZA factory

The founding year of the mechanical factory «Mechanische Ziegelei Allschwil F. Rothpletz» is unclear: 1897 [FÄS93, 55] or 1899 (NZZ 7.12.1902; [ROL07, 80]). On november 26, 1902, it became a stock corporation, took the name «Aktienziegelei Allschwil» (AZA) and had its registered office in Allschwil (SHAB 20, 425, 2.12.1902, p. 1697). In 1905, the first double tunnel kiln in Switzerland was installed. The company had repeatedly serious arguments with the staff (GR 19.1.1909; 18.2.1910). In 1912, the subsidiary factory «Kaminwerk Allschwil» (chimney factory) was affiliated, in which brick and tile waste was used to make chimney bricks (Fig. 8.2). 1918, both plants were taken over by the «Ceramic Holding Laufen». Up to this date, tiles were only made in the summer months. In 1921 the factory employed 200 people and had an annual output of 18 million tiles. Production ceased in 1975.

Geology

The local geology is well known thanks to the brick/tile open pits [GUTZ94, ROL07, SCH07, STR07, BAU28, HES55, FIS64], [PET69, fig.1], [ZOL91], [MUM97, 47-48], the geological mapping [SCH07, WIT70, FIS71, BIT84, BIT88] and the boreholes [CHR24] [FIS71, 41-44] [BIT88, 58-61] [SCH24] [HOT28].

The factories exploited two raw materials in their open pits, namely Rupelian marls and loess loams (Fig. 8.4). The former, known as Septarian clays, Meletta marls or «Blaue Letten» (Blue loams) were deposited in the Upper Oligocene (Late Rupelian) and form the substructure of the pits (Fig. 8.5). According to the drillings, these marls reach a thickness of 350-400m [FIS71, 16-17]. Above this marine sediment lies the continental fluviatile Pleistocene «Jüngerer Terrassenschotter» (Younger Terrace Gravel). It consists of a conglomerate with crystalline elements from the Alps and the Black Forest. Finally, several meters thick Pleistocene Loess marls and loams crop out on top. GOUDA [GOU62, 183-195] distinguished an older (Riss II glaciation) and a younger (Würm glaciation) layer.

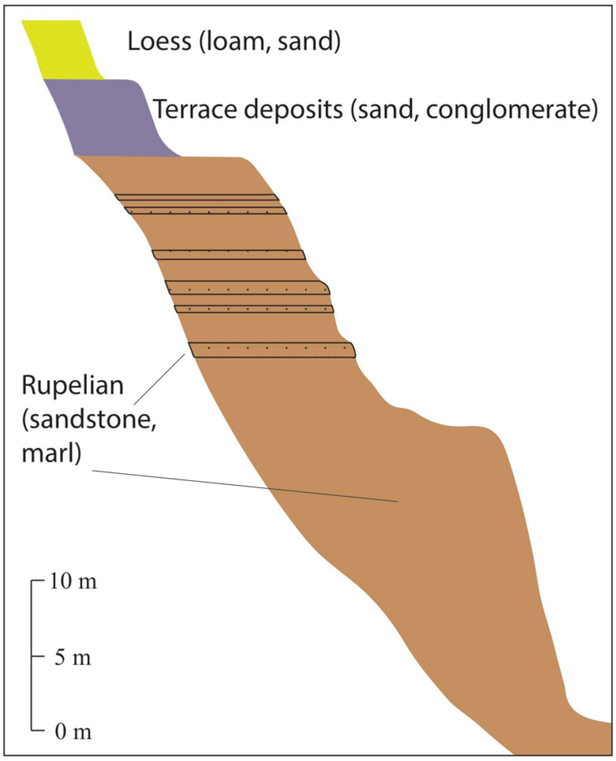

Figure 8.5: *Simplified geological profile of the Allschwil open pits after FISCHER [FIS64, Fig.1]. Drawing* MARINO MAGGETTI.

The marine Rupelian marls contain 25-35% Ca-carbonate [SCH07, 55], while the Loess has layers with low (ca. 1 wt.% = Loess loam) or high (28-35 wt.% = Loess marl) $CaCO_3$ [GUTZ94, 638-639] [SCH07, 54].

According to GUTZWILLER [GUTZ94, 637-639], SCHMIDT / HINDEN [SCH07, 53], STRÜBIN [STR07], ROLLIER [ROL07] and PETERS [PET69, 392], the PIC and AZA factories mixed the Rupelian marls with the Loess loams. The Ca-rich Loess marls were not used. A striking feature of the Loess loams, especially of the lowermost 4 m thick layer, is the abundance of up to hazelnut-sized iron- and manganese-rich concretions [GUTZ94, 637-638]. These loams are very rich in quartz (48-50 wt.%, [PET69, 397]) and practically free of carbonates. Table 8.6 shows the mineralogical, granulometric and chemical compositions of the PIC roof tile pastes DZ and DZU. Unfortunately, in the case of paste DZ, the author [PET69] did not state whether it is the traditional 1 : 1 mixture [SCH07, 56] or whether it has been changed since then. The younger paste DZU, on the other hand, is a blend of 42 wt.% Loess loam, 26 wt.% Rupelian marl and 12 wt.% Opalinus clay [MEY84, tab.3].

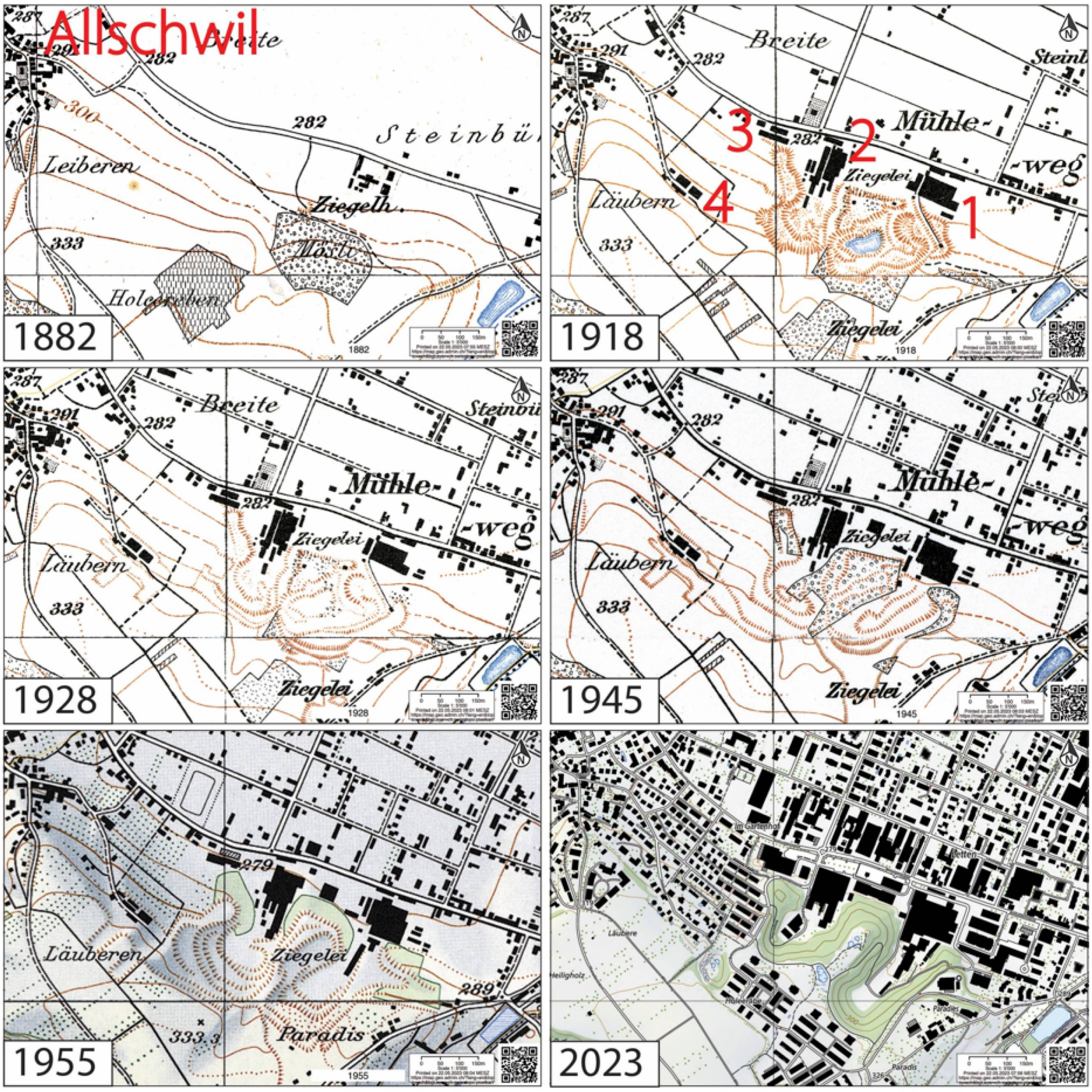

Figure 8.6: *Factory buildings and open pits on the 1882, 1918, 1928 and 1945 editions of the "Topographic Atlas of Switzerland to the scale of the original mappings" (so-called SIEGFRIED atlas) map* 1 : 25′000 *(sheets 1 Basel-Allschwil and 7 Therwil), and the 1955 and 2023 editions of the National map of Switzerland* 1 : 25′000 *(sheets 1057 Basel and 1067 Arlesheim). Numbers as in Fig. 8.2. © swisstopo. Graphic editing* MARINO MAGGETTI.

Extraction of the raw materials

The evolution of the extraction over time in the Allschwil region can be followed very nicely using the various editions of the so-called SIEGFRIED map (Fig. 8.6). According to the first edition in 1882, the pit was opened on the north-eastern edge of the small «Mösli» grove and was made accessible by a small road. The second edition of 1894 differs insignificantly from the first, while the third edition of 1898 shows a much larger open pit. Surprisingly, the AZA is missing from this edition, a sign that it cannot have been founded as early as 1897 – provided that the topographer/cartographer has done his job correctly. In 1918 two neighbouring pits can be seen, namely that of the PIC (1), which was newly built after the fire of 1903, and that of the AZA (2). The «Kaminwerk Allschwil» (3) and the «Tranzer» factories (4) are also mapped. In 1928 the original «Mösli» grove had completely disappeared. In 1945, the vegetation conquered the abandoned pit areas, and gone again in 1955. In 2023 the disused pits lie as a green island between the houses.

Laufen (Canton Basel-Landschaft)

Laufen belonged to the canton of Bern until 1994 when it became a part of the canton of Basel-Landschaft due to the formation of the new canton of Jura.

History of the Laufen factory

On July 4, 1892, three gentlemen founded, together with a Basel shareholder group, the mechanical brick and tile company «Thonwaarenfabrik Laufen» based in Laufen (SHAB 19.7.1892). The location of the new plant was well chosen, for it was very close to the railway, i. e. the Basel-Delémont line, opened 1875 [MAT42, 9], to water ressources (Birs river) and to excellent and extensive clay deposits that had long been known [GUT94a, GUT94b, DES95, STÖ96]. The development of this company is well documented [BÜH39, AN43, GER92]. Therefore, the following short informations are limited to the coarse ceramic aspects, i. e. the roof tile production.

The factory building, the connection to the railway, the cable car over the railway line to the open pit and the hydroelectric plant on the Birs were put into operation at the end of April 1893. On the 1893 first edition of the Siegfried map, the river Birs (1), the Birs canal (2) and the tile factory (3) as well as the clay pit (4) are clearly visible, but the cable car is missing (Fig. 8.7 left). With plant 2, built in 1898, the production of other types of tiles and of drainage pipes was started. The company was present at the KABA 1899 (Bernese cantonal industrial and commercial exhibition) with a pavilion (DB 9.9.1899, TATBO 10.8.1899). The cable car (5) appears together with plant 2 (6) and a large pit in the second edition of 1904 of the SIEGFRIED map (Fig. 8.7 left). The third edition from 1916 shows the extent of the main pit and a new smaller pit on the west slope of the «Rebacker» (Fig. 8.7 left). In 1918, the AZA and the Tranzer factories were acquired, and in 1919 the «Kaminwerk Allschwil» (see previous chapter). Roman roof tiles have been found in the clay pits, possibly suggesting a Roman tile manufacure (GOTB

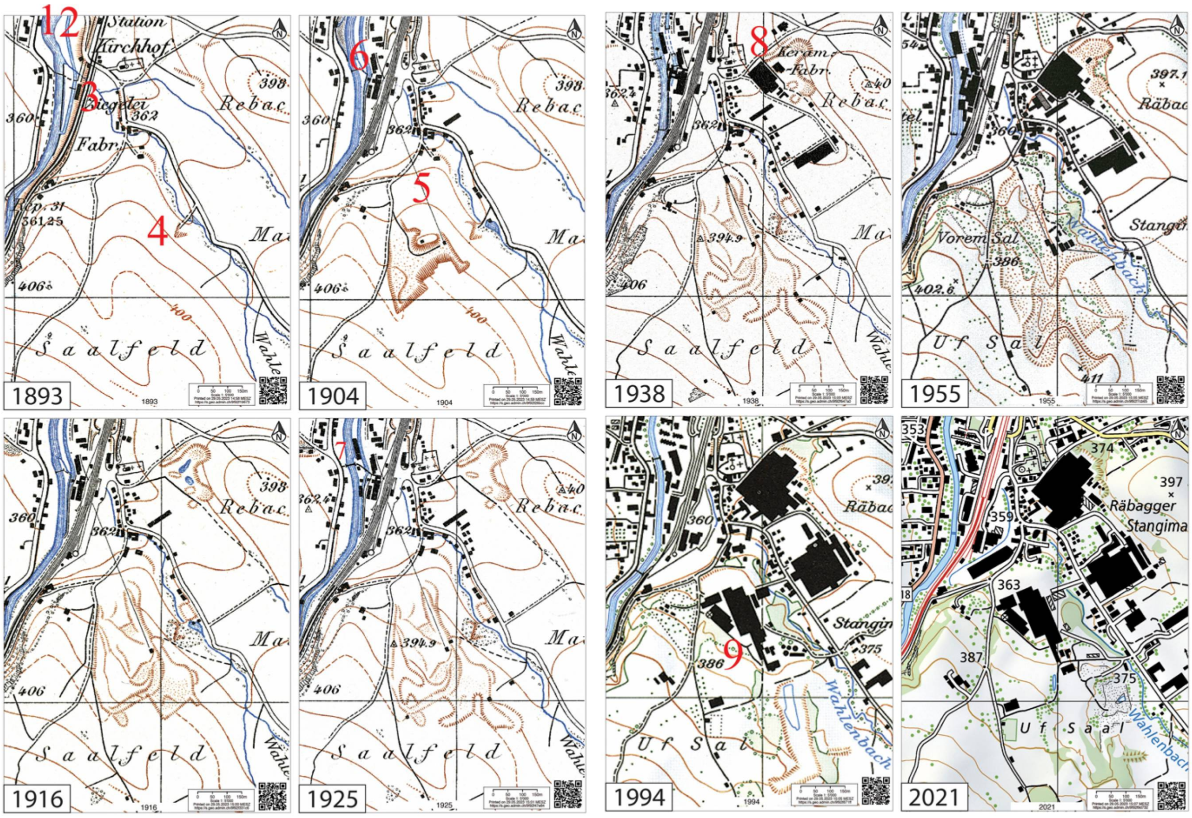

Figure 8.7: *Location of the factory buildings and changes at the extracting sites on the 1893, 1904, 1916, 1925, 1938 and 1955 editions of the SIEGFRIED map* 1 : 25′000 *(sheet No. 96 Laufen), and the 1994 and 2021 editions of the National Map of Switzerland* 1 : 25′000 *(sheet No. 1087 Passwang).* © *swisstopo. Graphic editing MARINO MAGGETTI.*

13.5.1908). The company name was changed to «Thonwarenfabrik Laufen A. G. / Tuilerie mécanique de Laufon S. A.)» on February 26, 1920 (SHAB 26.5.1920). In 1924, Plant 3 was built for the manufacture of interlocking tiles, making the company the largest manufacturer in Switzerland in this sector (Fig. 8.7 left, 1925, no. 7). At that time it sold an average of 5.5 million interlocking tiles per year. A subsidiary compagny «AG für keramische Industrie Laufen (SA pour l'industrie céramique Laufon)» was founded on November 26, 1925 (SHAB 18.1.1926;[GER92, 129]) to alleviate the consequences of the overproduction of bricks and tiles that was emerging throughout Switzerland. Fine ceramic objects, such as wash and rubble basins, were manufactured in the new factory. In 1930, the tile company patented the JURA roof tile (SHAB 30.3.1930). The building of the new company appears on the 5th edition (1938) of the SIEGFRIED map as a large edifice (8) in the former «Rebacker» pit area (Fig. 8.7 right). The last SIEGFRIED edition (1955) shows its enormous enlargement (Fig. 8.7 right).

On January 9, 1942, the government of the canton of Bern granted the company, together with the «Sandoz A.-G. Basel» and the «Aktienziegelei Allschwil», a mining concession for the exploitation of coal deposits in the Simmental, canton of Berne. During the wartime the brick- and tilewoks were obviously looking for a substitute for foreign coal. The joint concession was granted on April 1, 1942 by the «Bergbau Schwarzenmatt A.G.», a newly founded mining company based in Boltigen im Simmental (SHAB 23.4.1942).

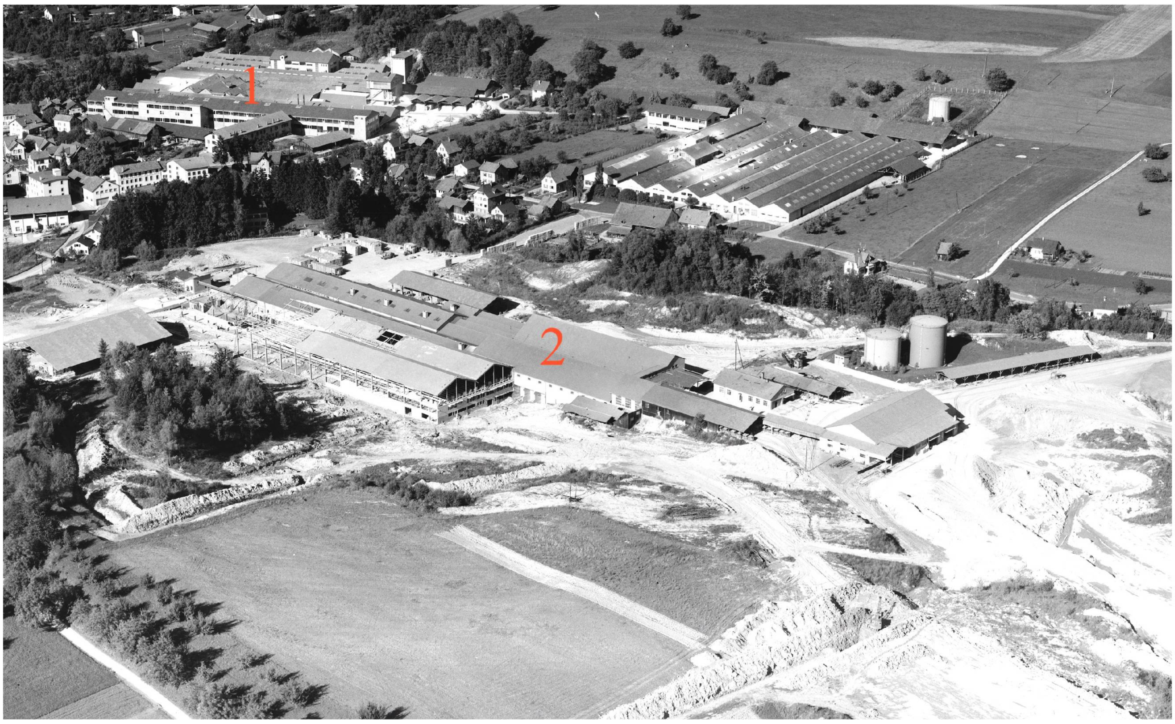

Figure 8.8: *Detail from the aerial view of the «Keramik Laufen AG» (1) and the brick-and tileworks Laufen (2) buildings (10.09.1964). © ETH Zürich Library, image archive, Photograph: Comet Photo AG (Zurich) / Com_F64-03998 / CC BY-SA 4.0. Public Domain Mark.* http://doi.org/10.3932/ethz-a-000055744.

In 1949, the «AG für keramische Industrie Laufen» put a new production line in operation for porcelain isolators. In 1966, the old plants 1-2 were demolished and a new brick and tile factory was built southeast of the railwas line. Plant 3 was demolished in 1978 (Fig. 8.7 right, 1994). The Birs canal has vanished, the old buildings were put down and replaced by residential buildings, the new brick factory (9) was installed in the main pit and the building of the «AG für keramische Industrie Laufen (SA pour l'industrie céramique Laufon)» has expanded again (Fig. 8.8). The current situation (2021) with a still producing tile factory belonging today to the «Zürcher Ziegeleien AG» is shown in Fig. 8.7 right.

Geology

The local geology has been studied by many scholars [ZEL07], [KOC23, 8-11], [BUX36, KOC36]. The extracted raw material in the «Saalfeld» pits south of Laufen are the Rupelian «Meletta» layers.

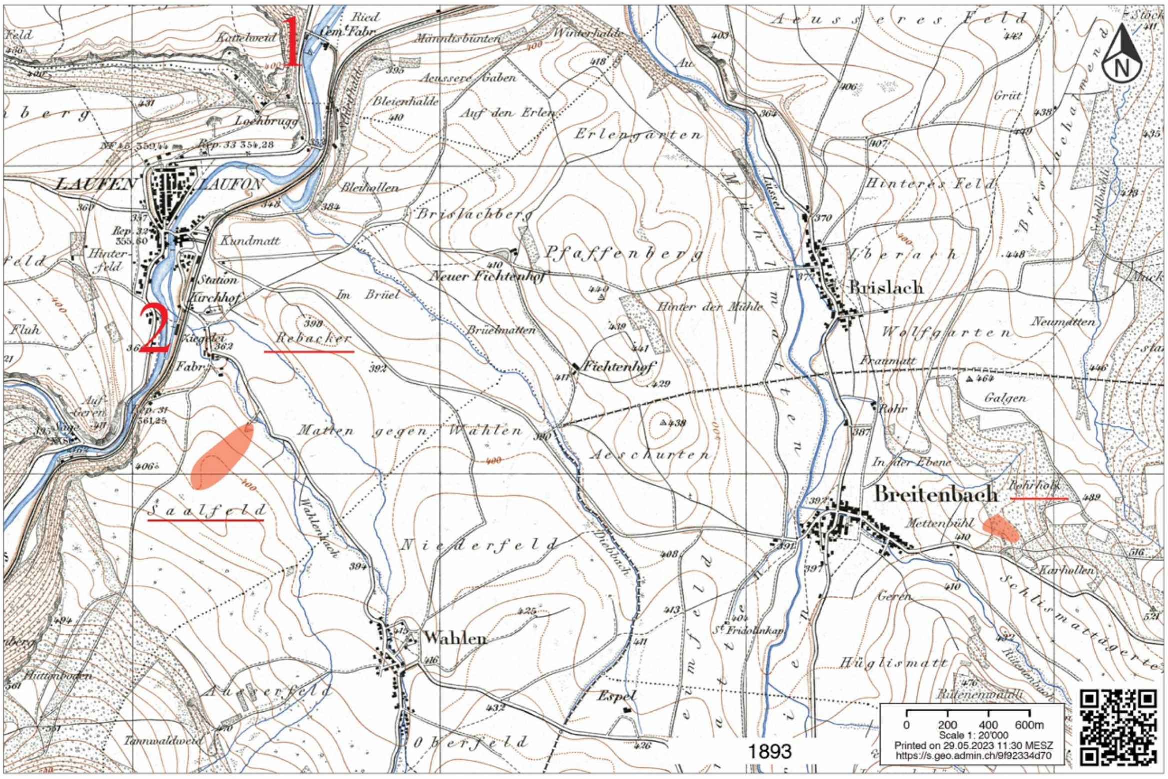

Figure 8.9: *Location of the Laufen cement (1) and the tile (2) factories. Light red areas are the locations of the small open pits south of Laufen (Saalfeld) and east of Breitenbach (Rohrholz). Edition 1893 of the* Siegfried *map* 1 : 25′000 *(sheet No. 96 Laufen).* © *swisstopo. Graphic editing* Marino Maggetti.

Raw materials: extraction and treatment

The first clay prospecting took place in 1892 [ZEL07]. In the same year, tiles produced with a yellow material were fired (Tab. 8.7, analysis 280). Unfortunately, the author does not reveal whether this material was blended with other ingredients and in which factory the firing occurred. The main pit of the tileworks has been since the beginning on the «Saalfeld», about 1 km south of Laufen (Fig. 8.7 left, 1893). A second, smaller pit existed in the «Rohrholz» near the village of Breitenbach, about 3 km to the East (Fig. 8.9). The large pit also supplied the material for the cement factory Laufen, which before 1907 still exploited another pit at the «Rebacker» [ZEL07]. In 1900, daily excavations of 45 m^3 for the cement and 70 m^3 for the tile factories were reported, which corresponds at that time to an annual total of about 35 000 m^3 [ZEL07].

A detailed profile of the pit from the early days of the factory, according to which a blue, very fatty marl (Tab. 8.7, analysis 276) and an underlying yellow, fatty marl (Tab. 8.7, analysis 277) were mined after removing the overburden, was published [ZEL07]. As table 8.7 shows, sample 276 is very rich in CaO, whereas sample 277 and 279 show less calcium oxide. Other samples from the pit and the neighbourhood are calcium-poor layers and were used, such as the sandy sample 281, as temper materials [ZEL07]. The firing colour of such tiles was whitish. Mixing with other samples resulted in reddish to red-yellow tiles. Clays from the Breitenbach pit (sample 282) were sand tempered before forming. A modern chemical, mineralogical and granulometrical analysis of a clay sample was published by Mumenthaler Et Al. [MUM95, tab.3.12, no.8, p.60], see table 8.6 (no. 8).

Samples, analytical methods and aims of the research

Samples

During his hikes, the first author often came across broken roof tiles that were used to pave waterlogged country lanes. He couldn't help but pick up marked pieces, i.e. those showing a company name and, if possible, also dates. Nine tiles (ZZ 195, 294-296, 298-302) were given to the first author by MYRIAM WITTWER, which she had collected on her hikes. Thus, over time, a total of 95 pieces from the brick- and tileworks PIC (43 pieces), AZA (17) and Laufen (35) were collected, which, it should be emphasized, do not correspond to a targeted prospection, but to a random survey (Tab. 8.5).

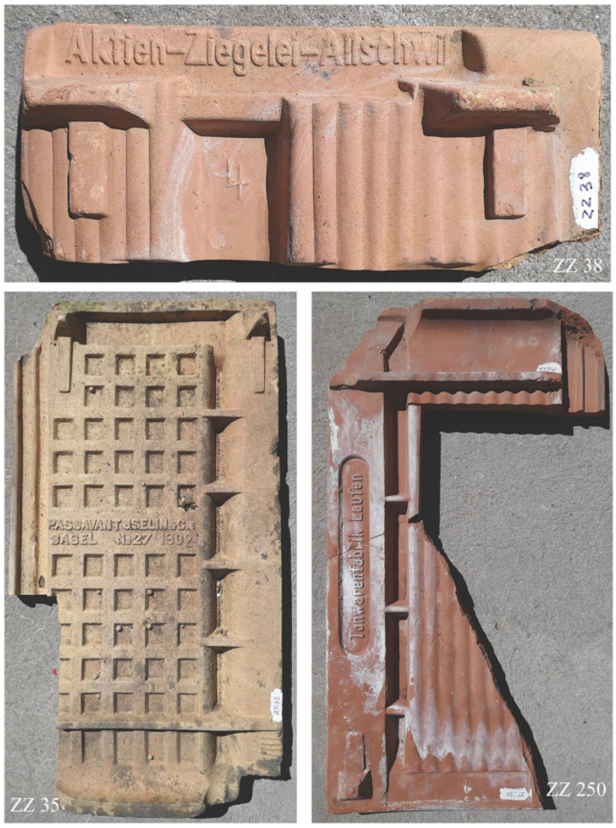

Figure 8.10: *The three possible positions of the stamped marks on the undersides of the studied roof tiles. ZZ 38 (AZA)* 20 × 8.5 cm *; ZZ 35 (PIC)* 42 × 23 cm*; ZZ 250 (Laufen)* 42.5 × 17.5/24 cm. *Photos* MARINO MAGGETTI.

The factory names can only be seen on the protected underside of the tile, normally on the narrow side, rarely on the long side or in the centre (Fig. 8.10). Since the collected objects to be examined are broken, most of them show incompletely preserved factory names. However, they could be clearly assigned to a specific brick- and tilework based on the recognizable letters. A production date, if present, is usually placed on the outside (top), more rarely on the underside of a tile.

Different company names were found for each of the three factories. On the basis of various criteria, such as the spelling of the name and the production dates, an attempt was made to chronologically classify the various naming typologies (Tab. 8.8). However, the variety documented in this way can only be an image of the much more complex reality, because the number of samples is far too low and we do not know to what extent the sampled material reflects the entire production period.

Figure 8.11: *PIC 1: Unterside of ZZ 35, showing the mark (Image width* 13.5 cm*; height (H) of the letters* 0.9 cm*). PIC 2: Underside of ZZ 418* (24.5 × 23 cm) *with enlarged view of the mark (Image width* 15.5 cm*; H letters* 1.6 cm*). Photos* MARINO MAGGETTI.

Figure 8.12: *PIC 3: Under- and outsides of ZZ 12 with the mark and the production date (Image width* 19.5 cm*; H letters* 0.8 cm*; H numbers* 1.2 cm*). Outside of ZZ 30 with badly readable production date (Image width* 16 cm*). Underside of ZZ 34 with the mark (Image width* 20 cm*; H letters* 0.8 cm*; H numbers on the right* 1.2 cm*). Photos* MARINO MAGGETTI.

Seven different names were found for the PIC factory (Tab. 8.5,8.8; Fig. 8.11-8.17). The writing is raised and always in capital letters. The underside of the PIC 1 specimen shows a patterned structure with the inscription in the middle of the tile (Fig. 8.10, ZZ 35), the only one of this type for all Allschwil tiles found. On PIC 1 and PIC 3, «Iselin» is written with a «J» and separated from «PASSAVANT» without a hyphen, but on the others with an «I» and, for PIC 5 to PIC 7, with a hyphen to «PASSAVANT». Unfortunately, the first part of the designation is missing in the only fragment of PIC 2 that was collected, but due to the early date of manufacture it can be assumed that the company name was the same as for PIC 1. The numbers visible after the company name, the abbreviations of which are presented differently, most likely refer to a typology of tile products that, after so many years, cannot be identified. The year of PIC 1 and PIC 2 shows a last digit which is written significantly differently than the previous three numbers. These are obviously single numbers inserted into the plaster mould by hand. Whether this also applies to the PIC 3 samples cannot be answered conclusively based on the appearance. With the exception of PIC 1 and PIC 2 tiles, all other types have Arabic and Roman numbers on the outside. In the case of PIC 3, the first Arabic number could indicate the day and the second the month of the production. However, the meaning of the Roman numerals remains unclear. An example: According to the inscriptions on the out- and underside, sample ZZ 30 must have been made on September 18, 1918. As usual in other tileworks [MAG20, MAG22], the production data was scratched into the plaster mould by hand every day, before starting work, probably with a pointed object such as a nail. This is easy to recognize from the awkward design of the numbers. There are two variants of PIC 4: an older one, in the tradition of PIC 3 in terms of date, but with a different factory designation (ZZ 403, Fig. 8.13 & 8.14) and a younger one with the same designation, but without the year. The outside of these tiles shows the day, month and year of manufacture with hand-carved Arabic numerals (ZZ 287, Fig. 8.14). From both linear impressions it can be concluded that a helpful upper and lower limit was drawn with a ruler. PIC 5 differs from the previous inscriptions only in that the abbreviation of the Company is spelled differently, namely «CIE» instead of «C°». In PIC 6 and PIC 7, the municipality of Allschwil appears in the company name. One can only speculate about the reasons: political pressure from the community? Distinction from the AZA? The years have diasppeared. However, the exact date of manufacture can be found on the outside (top) of the tile in Arabic numerals. The meaning of the Roman numerals, on the other hand, remains an open question. The raised Arabic numerals that can be seen under the company name in PIC 7 must indicate the tiles type, which is missing above. But the situation is probably more complex, because the number 40 can be separated from the signature with bars of different thicknesses (Fig. 8.16 & 8.17, compare ZZ 336 and ZZ 258).

Figure 8.13: *PIC 3: Under-* (36 × 24 cm) *and outside (Image width* 22 cm) *of ZZ 262 with the mark (H letters* 0.9 cm) *and the production date (H numbers 1 cm). Photos* Marino Maggetti.

Figure 8.14: *PIC 4: Under- and outside (Image widths* 20 cm) *of ZZ 403 and ZZ 287 (Image widths* 14 cm) *with the mark and the production date. Height of the letters and numbers* 1.5 cm. *Photos* Marino Maggetti.

The tile fragments found from the AZA company in Allschwil can be assigned to three types of factory inscriptions (Tab. 8.58.8; Fig.8.18-8.19). The course of the grooves of the AZA 1 tiles shows that the inscription must have been on the long side. Unfortunately, the lettering is only partially present on the two fragments found. It is an indented press mark with the company name and the location, all in capital letters in a longitudinal, rounded-edged and raised cartouche. Informations on the production dates are missing. The latter were perhaps, as in the case of AZA 2, present on the complementary pieces. Whether «Allschwil» was written with a «Y», as in AZA 2, or an «I», as in AZA 3, cannot be determined. AZA 2 is on the long side of the roof tile (Fig. 8.18). The capital letters are now raised and no cartouche can be observed. The date, with Arabic numerals for the day, month and abbreviated year, has been scored by hand on the inside of the plaster mould, next to the company's inscription (ZZ 39). AZA 3 is located on the short side and shows raised capital letters (Fig. 8.19). It combines the name of the company and «Allschwil» in one line. Some specimens show the date of manufacture on the outside of the tile, while others have it on the underside, just below the factory name. These are tightly written Arabic numerals for the day and the abbreviated year, and Roman numerals for the month. The three digits are usually separated by a prominent dot. Very often, to ensure the alignment of the numbers, a baseline was scored with the ruler and grooving tool into the plaster mould. The meanings of the other Arabic and Roman numerals remain unclear.

Figure 8.15: *PIC 5: Under- and outside (Image widths* 12 cm*) of ZZ 296 (H letters and numbers* 0.8 cm*; outside: H numbers* 1.2 cm*) and ZZ 299 (Image widths* 13.3 cm*) with the mark (H letters* 0.8 cm*; year numbers* 1.1 cm*) and the production date (H numbers* 1.2 cm*). Photos Marino Maggetti.*

Figure 8.16: *PIC 6: ZZ 256 with mark (Image width* 17 cm*; H letters* 1.3 cm*) and production date (Image width* 16 cm*; H numbers* 1.2 cm*). PIC 7: Under- and outside (Image widths* 25 cm*) of ZZ 336. Mark on the underside (H letters* 1.3 cm*; «40»* 1.6 cm*) and the production date on the outside (H numbers* 1.5 cm*). Photos* Marino Maggetti*.*

Figure 8.17: *PIC 7: Under- and outside (Image widths* 10.5 cm*) of ZZ 258 with mark on the underside (H letters* 1.3 cm*; «40»* 1.5 cm*) and production date on the outside (H numbers* 1.1 cm*). ZZ 298 (*40 × 24 cm*) with the marked underside (H letters* 1.3 cm*; «38»* 1.4 cm*) and the outside with the production date (H numbers* 1.1 cm*), see also the cutout. Photos* Marino Maggetti*.*

Five different factory inscriptions were identified for the Laufen tiles (Tab. 8.5, 8.8; Fig. 8.20-8.22). ZZ 250 is the only roof tile fragment from the Laufen company whose raised inscription is visible on the side. It can therefore be assumed that it belongs to the oldest forms, even if the date of manufacture «4 IV 1929» (Fig. 8.20, insert) is not one of the very youngest of the pieces found. For this reason it was classified as LAU 1. Its inscription shows upper and lower case. Contrary to the previous one, a French company name appears in LAU 2, in raised capital letters, emphasizing that it is a mechanical tile factory. The Arabic numerals below the company name, one of which obviously scratched by hand, could refer to the tile variants. The production date is visible on the outside (top) of the roof tile: in Arabic numerals the day and the abbreviated year, in Roman the month, all three separated by distinctive dots. ZZ 251 carries the oldest date «7.V.1917» and ZZ 176 the youngest «[?].II.50». For type LAU 3, the same inscription was adopted as for LAU 2, but applied to a different tile variant (Fig. 8.21). A hand-carved number appears in the inscription, the meaning of which still needs to be clarified. On the outside appear hand-carved Arabic numerals, combined into a triple and a double, separated by a hyphen. Similar to the numbers discussed so far, this could be the production date. However, the number sequence could not be interpreted. For example: does «16» in ZZ 154 mean the year 1916? If so, how is «942» to be resolved? LAU 4 shows a raised factory inscription in capital letters and in German. Below the inscription, Arabic and Roman numerals can be seen in the groove, the meaning of which we do not know. As with LAU 3, Arabic numerals can be seen on the outside (top) of the roof tile, which would have to be interpreted accordingly.

LAU 5, a special type, was found on ZZ 288. The inscription does not differ from that of LAU 2 and LAU 3, but is placed on a distinctly different variant of roof tile, which may be indicated by the «9» that can be read next to the inscription (Fig. 8.22).

Figure 8.18: *AZA 1: Underside of ZZ 398 with incomplete mark in a cartouche (Image width* 7.4 cm*; H letters* 1 cm*; H cartouche* 2.8 cm*). AZA 2: ZZ 283 (*35 × 24 cm*) with mark on the underside (First row: H letters* 1.0 cm*; of the first letter* 1.1 cm*; 2d row* 1.1 cm*), no production date. Enlarged mark of ZZ 39 (Image width* 15.1 cm*). Photos* MARINO MAGGETTI.

Figure 8.19: *AZA 3: ZZ 229 (*22 × 20 cm*) with mark on the underside (H first letters* 1.2 cm*) and production date on the outside (H numbers* 1.7 cm*). Underside of ZZ 195 (image width* 17.4 cm*) with mark (H first letters* 1.2 cm*; H numbers* 1.4 cm*). ZZ 38 (Image widths* 20 cm*) with mark and production date (H letters* 1.2 cm*; H numbers* 1.3 cm*). Photos* MARINO MAGGETTI.

Figure 8.20: *LAU 1: Underside of ZZ 250 (*42.5 × 17.5/24 cm*) with mark in a cartouche (*16.8 × 2.6 cm*; H first letter* 1.3 cm*) and production date in the insert (Cutout of the outside: image width* 7.8 cm*; H numbers* 1.7 cm*). LAU 2: ZZ 155 with mark on the underside (Image width* 20 cm*; H letters* 1.0 cm*; H numbers* 1.5 *and* 1.7 cm*) and a cutout of the outside with the production date (Image width* 16.2 cm*; H numbers* 1.7 cm*). Photos* Marino Maggetti.

Figure 8.21: *LAU 3: ZZ 154 (Image widths* 16.7 cm*) with mark on the underside (H letters* 1.0 cm*) and production date on the outside (H numbers* 1.2 cm*). LAU 4: ZZ 414 with mark (Image width* 18.3 cm*; H letters* 0.8 cm*; H numbers* 0.9 cm*) and production date on the outside (Image width* 18.6 cm*; H numbers* 1.1–1.3 cm*). Photos* Marino Maggetti.

Figure 8.22: *LAU 5: ZZ 388 (Image widths* 15.6 cm*) with mark on the underside (H letters* 1.0 cm*; «9»* 1.4 cm*) and production date on the outside (H numbers* 1.6 cm*). Photos* Marino Maggetti.

Analytical methods

Milling

For the chemical analyses, the possibly contaminated outer millimeters of the samples were ground off. The cleaned and dried samples were then finely ground in a tungsten carbide mill. The powders obtained in this way weighed 20 to 100 grams.

Microscopical analysis

A thin section was prepared from mostly all samples. The first author examined them under a polarization microscope. Since these samples proved to be homogeneous, no thin sections were produced from ZZ 397-398, 400, 402, 406, 407, 410, 411, 414-417, 419, 421-424, 426-228. For the terminology, see Maggetti [MAG89, MAG09].

Chemical analysis by X-ray fluorescence (XRF)

The analyses were carried out in the geochemical laboratory of the Department of Geosciences at the University of Friborg (Switzerland) by the second author. 2 grams of powder per sample were calcined in an electric furnace under oxidizing conditions at 900 °C to determine the loss on ignition (LOI). Then 0.700 g of the calcined powder was mixed with 6.650 g of MERCK Spectromelt A10 ($Li_2B_4O_7$) and 0.350 g of MERCK lithium fluoride (LiF), and melted in a platinum crucible for 10 minutes at 1050 °C in a PHILIPS PERL X-2 device to form a glass pill. The main, secondary and trace elements were measured on these pills using a wavelength-dispersive X-ray fluorescence device PHILIPS PW 1400 (Rhodium cathode, 60 kV and 30 mA). The calibration was carried out with 40 internationally certified standard samples. Accuracy (accuracy) and scatter (precision) were checked with internal laboratory reference samples. The errors are below 5% for all elements.

Statistical treatment

The treatment of the chemical analyses was carried out by the first author with the help of the program SPSS (Statistical Package for Social Sciences), especially for the construction of the binary diagrams.

Aim of the investigation

The research tried to clarify the following questions: (1) Are the roof tiles from the three factories materially, i. e. chemically and mineralogically - petrographically similar or different? (2) Can the roof tiles of the three factories be differentiated? (3) Are there differences to the tiles examined so far [MAG20, MAG22]?

Since the present work deals with the chemical composition of roof tiles, the colour of the fired products is not considered. There is a wealth of literature on this subject, such as Kreimeyer [KRE85], Nöller/Knoll [NOL88] and Meyer [MEY03]. A phase analysis by means of the powder X-ray diffractometry was not carried out, since the optical microscopic examination revealed an optically isotropic matrix in practically all samples, from which it can be concluded that the firing temperatures and conditions were very similar in all factories (Assumed firing temperatures: around 1000 °C; oxidizing furnace atmosphere). There are countless articles on the mineralogical reactions during the firing of ceramic pastes, see the summary by Heimann/Maggetti [HEI14, 70-102]. With regard to the Swiss brick and tile bodies, reference is also made to the detailed work of Iberg [IBE71], Iberg/Peters/Mumenthaler [IBE72], Peters/Jenni [PET73], Peters/Iberg [PET78], Meyer Et Al. [MEY84], Fürst [FÜR93, FÜR98], Mumenthaler Et Al [MUM95], and Cuanoud [CUA00], which contain some chemical analyses. The seminal paper of Mumenthaler Et Al. [MUM97] provides a comprehensive overview of the raw materials used in the Swiss brick and tile industry.

Results and Discussion

Visual differentiation

The aspect of many roof tiles is macroscopically and microscopically heterogeneous. Most striking are the light-beige rounded to streaky inclusions or pellets. Such a colour indicates a calcium (Ca)-rich composition. The sawn body is either red, yellow or yellowish reddish (Tab. 8.5). Clustered cracks parallel to the roof outlines are common. The matrix, i. e. the former clay substance of all tiles appears optically isotropic under the microscope with crossed polarizers, indicating a good firing process.

On the cross-sections of the PIC and AZA roof tiles, red to black iron-rich clay nodules and beige, equant to distorted calcium-rich pellets can be seen (Fig. 8.23, 8.24). The maximum grain size for the former is 0.3 cm and up to 0.7 cm for the elongated types of the latter. They correspond to the iron- and manganese-rich grains of the Loess loams (see previous subchapter). Under the polarizing microscope, the ceramic body proves to be meagre and very fine-grained. The maximum grain size of the siliceous non-plastic inclusions is in most cases below 0.16 mm and rarely reaches 0.24 mm. The non-plastic inclusions are mostly rounded-edge quartz, with some kalifeldspar and plagioclase. These appear macroscopically as rare white dots. Tiny flakes of white micas are abundant, while dark micas (red under the microscope) are rather rare. These grains are from the Loess loams, while the admixed Rupelian marls have been preserved in the beige pellets. The latter are extremely fine-grained and show a sharp border to the surrounding red matrix. In addition to a few tiny quartzes, Fe-flakes and secondary carbonate crystals, probably calcite, can be observed in them. In conclusion, the macroscopic and microscopic picture shows that a Ca-poor material was mixed with a Ca-rich one, as was traditionally done in both factories. The light coloured pellets would therefore be interpreted as relics of the Rupelian marls.

All Laufen roof tiles have a meagre ceramic body. Apart from the Fe- (diameter up to 1.6 cm) and Ca- (up to 1.7 cm long) nodules, pellets or lenses, the non plastic inclusions are much coarser as in the PIC and AZA tiles, and their amount is significantly higher (Fig. 8.25). In the macrophoto of ZZ 43 these grains can be seen as white, and the small iron- and manganese-rich concretions as dark points. The non plastics are, according to microscopic evidence, roundish grains of minerals and magmatic to sedimentary rocks. Quartz is much abundant, followed by kalifeldspar, plagioclase, micas of both varieties and some titanite. Most of these grains reach sizes of 0.4 to 0.6 mm, rarely up to 1.2 mm. The rock grains (up to 1.8 cm) are mostly granites, along with a few sandstones (up to 3 cm) with a carbonate matrix. The latter appear in ZZ 43 as larger round white inclusions. Some small areas stand out from the surrounding body due to their significantly redder colouring (R in ZZ 43). Since they suffered the same firing temperatures as the surroundings, they must be poorer in calcium as these. It cannot be grog (crushed tiles) because marginal shrinkage cracks are missing and the shape is not angular, but rounded [WHI86, CUO93]. It could be relics of the low-Ca material that has been mixed with the high-Ca, even if an interpretation as ARF's (argillaceous rock fragment [WHI86]) would also be possible. The visual analysis shows that materials with different Ca contents were also mixed in Laufen. The Ca-rich addition can be recognized in the light-coloured pellets.

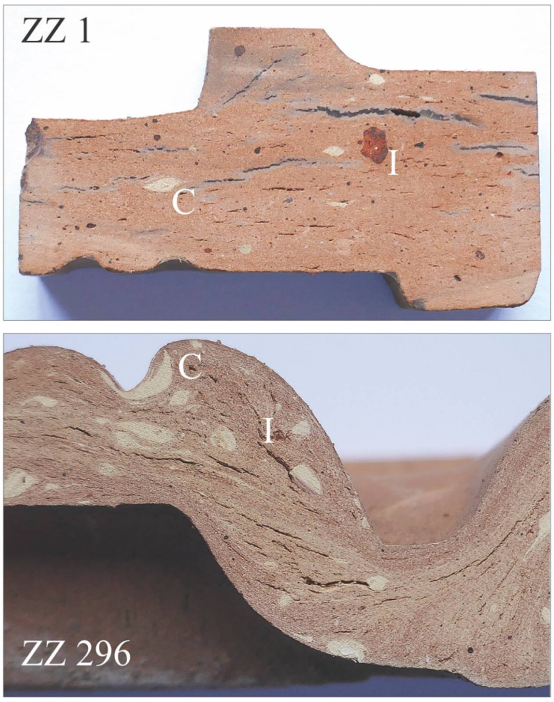

Figure 8.23: *Macroscopic aspects of typical roof tiles from Allschwil, PIC factory. ZZ 1 = texture I, ZZ 296 = texture II. Sawn sample area, image widths* 4 cm. *C = carbonate grain, I = iron-rich clay nodule. Photos* Marino Maggetti.

The frequent occurrence of Ca-rich inclusions in the Allschwil and Laufen tiles, visible as large rounded to distorted, lenticular pellets calls for an explanation. There are tiles with very little or no (texture I) and those with many (texture II) of such inclusions. The frequency of both types differs from factory to factory, as 72% of the analyzed PIC, 18% of the AZA and 40%

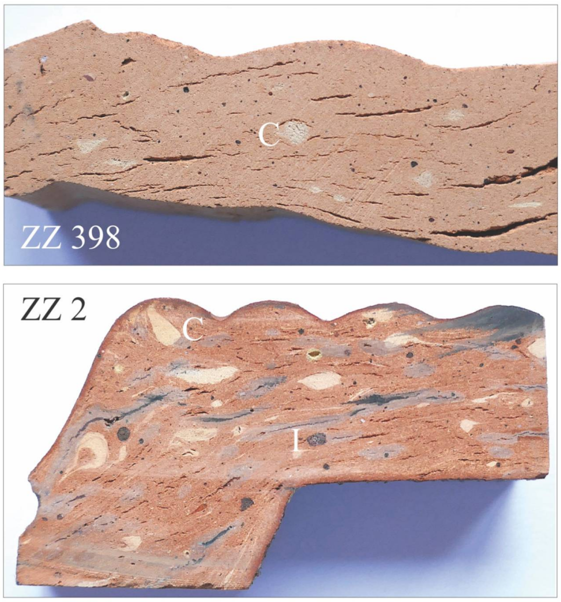

Figure 8.24: *Macroscopic aspects of typical roof tiles from Allschwil, AZA factory. ZZ 398 = texture I, ZZ 2 = texture II. Sawn sample area, image widths* 4 cm. *C = carbonate grain, I = iron-rich clay nodule. Photos* MARINO MAGGETTI.

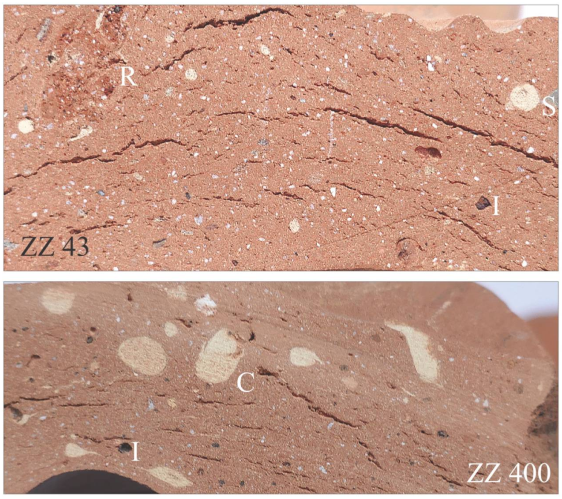

Figure 8.25: *Macroscopic aspects of typical roof tiles from Laufen. ZZ 43 = texture I, ZZ 400 = texture II. Sawn sample area, image widths* 4 cm. *C = carbonate grain, I = iron-rich clay nodule, R = relic of the Ca-poorer raw material, S =sandstone grain. Photos* MARINO MAGGETTI.

of the LAU tiles belong to the texture I with little to no Ca-rich inclusions (Tab. 8.5). For the PIC factory, texture II is restricted to PIC 4 and PIC 5. However, the small number of samples does not allow any sounded technological time-related conclusions to be drawn. This also applies to the data sets of the other tileworks with an insufficient number of analyses. Texture II is, apart of both AZA 1 tiles, very frequent in the AZA products. In Laufen, texture II occurs primarily on LAU 4 roof tiles. Visibly, texture II is an incomplete mixture of two raw materials, one poorer and one richer in calcium, while texture I corresponds to a more homogeneous mixture. Figure 8.26 illustrates the transition from texture II to I. Some rounded and beige Ca-rich inclusions can be seen in ZZ 427 (texture II), with sharp borders to the red sherd. In ZZ 296 (texture II, yellowish reddish), these yellow inclusions are thinned out to form streaky lenses. With even greater mixing, the originally homogeneous red sherd appears in some areas as a thin-layered sequence of red, Ca-poorer, and yellow, Ca-richer streaks. With even better mixing, a homogeneous, yellow texture I body (ZZ 224) is produced. Accordingly, the paste seems to have been mixed much better in the PIC factory than in the other two. In conclusion, the macroscopic and microscopic aspect agrees well with the traditional way of working, according to which (at least) two raw materials were mixed.

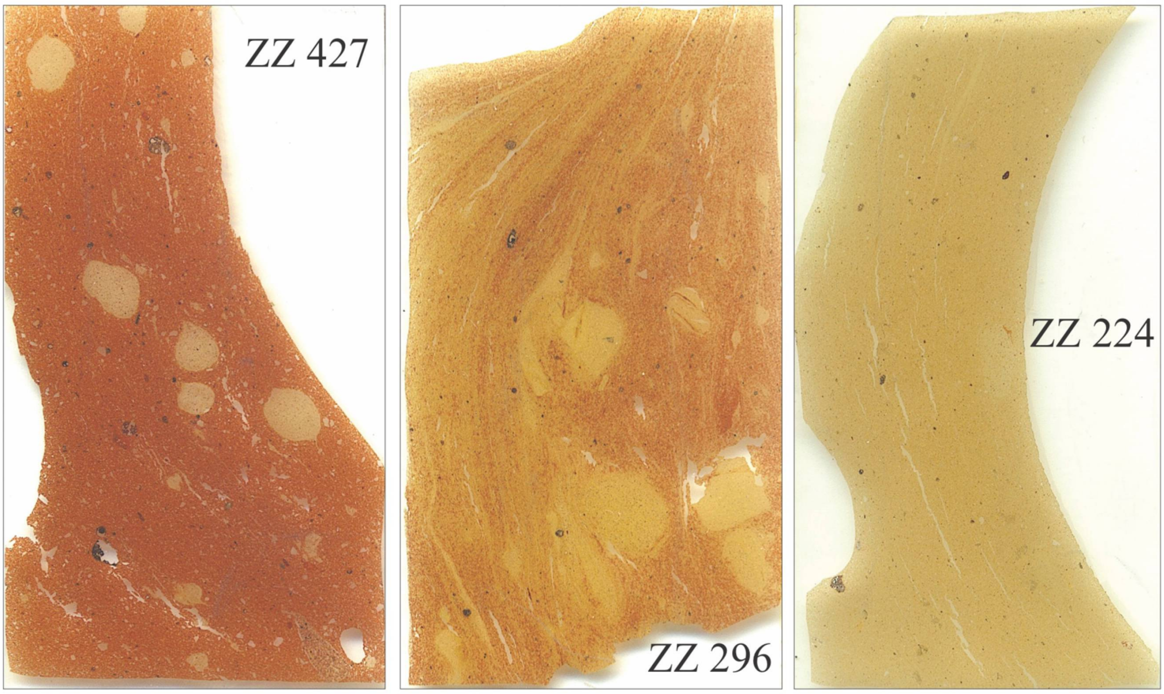

Figure 8.26: *Scans of three typical thin sections with the transition from a heterogeneous texture II (ZZ 427) via a streaky texture II (ZZ 296) to a homogeneous texture I (ZZ 224). Respective image width:* 2 cm. *Scans Marino Maggetti.*

Chemical differentiation

Based on 95 chemical analyses (Tab. 8.9) it was checked whether the roof tiles of the individual factories differed and to what extent technological conclusions can be drawn. According to table 8.9, there are some outliers in the trace elements, the causes of which are unclear. The high to very high levels of barium (Ba) for ZZ 38, ZZ 154 and ZZ 308, of copper (Cu) for ZZ 298 and ZZ 398, and of zinc (Zn) for ZZ 2 and ZZ 15 may be mentioned as examples.

In the magnesium oxide (MgO) – calcium oxide (CaO) binary diagram, most of the AZA and LAU analyses lie along an imaginary correlation line, while for the PIC tiles, because of their scattering, a similar correlation line is less pronounced (Fig. 8.27). A strong positive correlation of both oxides proves the presence of the mineral dolomite [$Ca,Mg(CO_3)_2$] in the raw materials (Tab. 8.6), while the deviations to CaO-richer compositions testifies increased calcite [$CaCO_3$] levels. Such a correlation was to be expected since the raw materials contain dolomite. A relationship to the factory mark only seems to emerge for the AZA factory, where both AZA 1 samples differ from the others

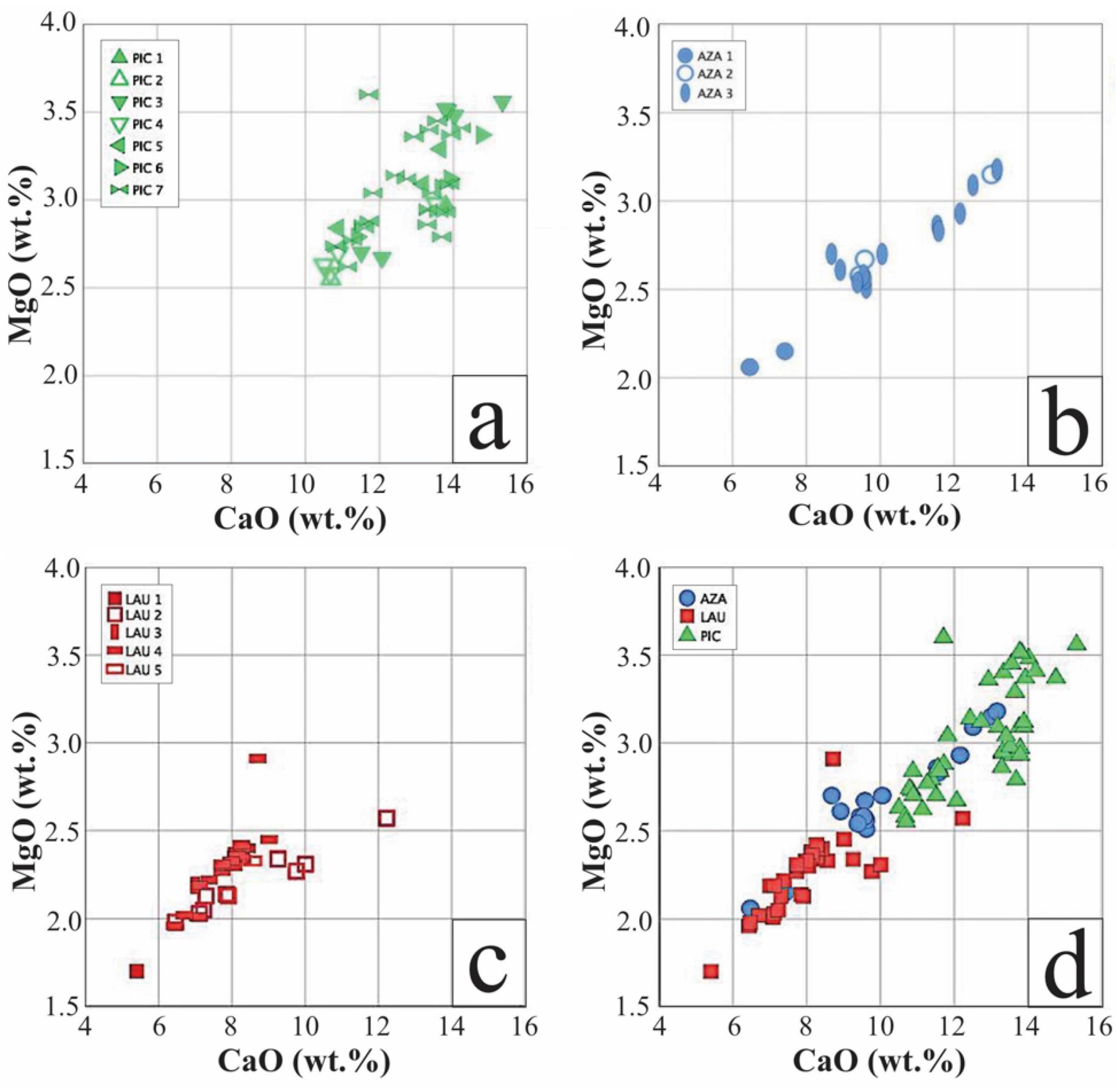

Figure 8.27: *Location of the 95 roof tiles analyzed in the MgO-CaO binary correlation diagram. Signatures according to Tables 8.5 and 8.8. Drawings* Marino Maggetti.

with low MgO and CaO contents. However, the small number of samples prohibits further conclusions. In the combined diagram, the Laufen samples differ significantly from the other two populations as exemplified by their lower MgO and CaO (Fig.8.27 d). The products of both Allschwil factories occupy the same areas. This is not surprising since they are said to be made from the same raw materials. Against this background, it should be noted, however, that the PIC tiles form a narrower group than those of the AZA factory which suggest a much better mixing technique in the PIC factory.

In the SiO_2 – MgO & CaO plot, the Laufen tiles are richer in silica (SiO_2) than those of the PIC factory, while the AZA tiles again are more scattered

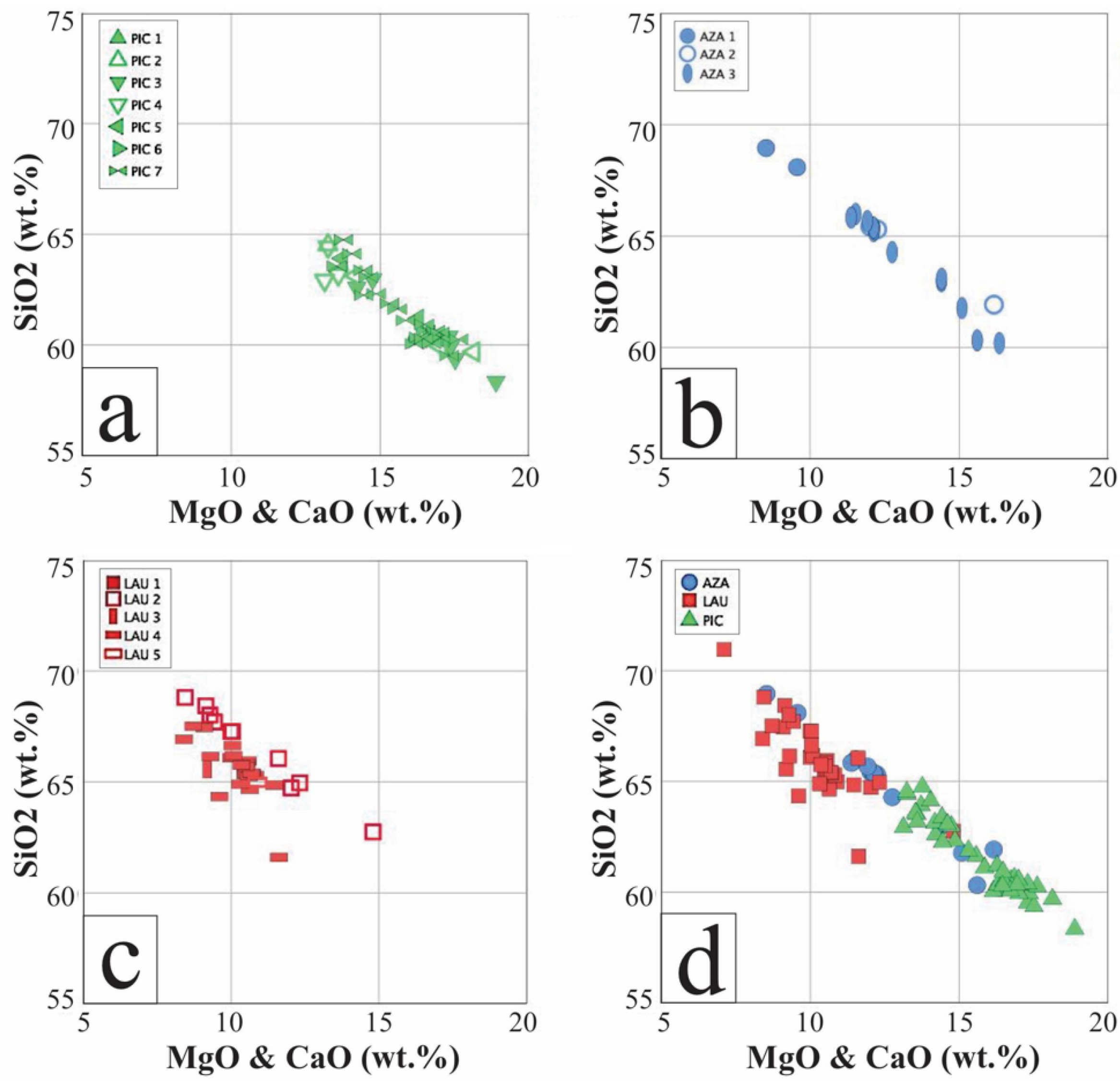

Figure 8.28: *Location of the 95 roof tiles analyzed in the SiO2-MgO & CaO binary correlation diagram. Signatures according to Tables 8.5 and 8.8. Drawings* Marino Maggetti.

(Fig. 8.28). Since the silicon (Si) mainly comes from the mineral quartz (SiO_2), there is good agreement here with the microscopic analysis, according to which the Laufen tiles contain significantly more non-plastic inclusions, mostly in the form of tiny quartz grains. The undisputable arrangement of all analyses along negative correlation lines with MgO & CaO fits very well with the technological tradition, according to which two raw materials, one richer in SiO_2 and poorer in CaO, with one containing less SiO_2 but more CaO, were mixed.

In the CaO – Sr diagram, too, the analyses are grouped close to imaginary correlation lines, apart from a few outliers (Fig. 8.29). The diagram shows

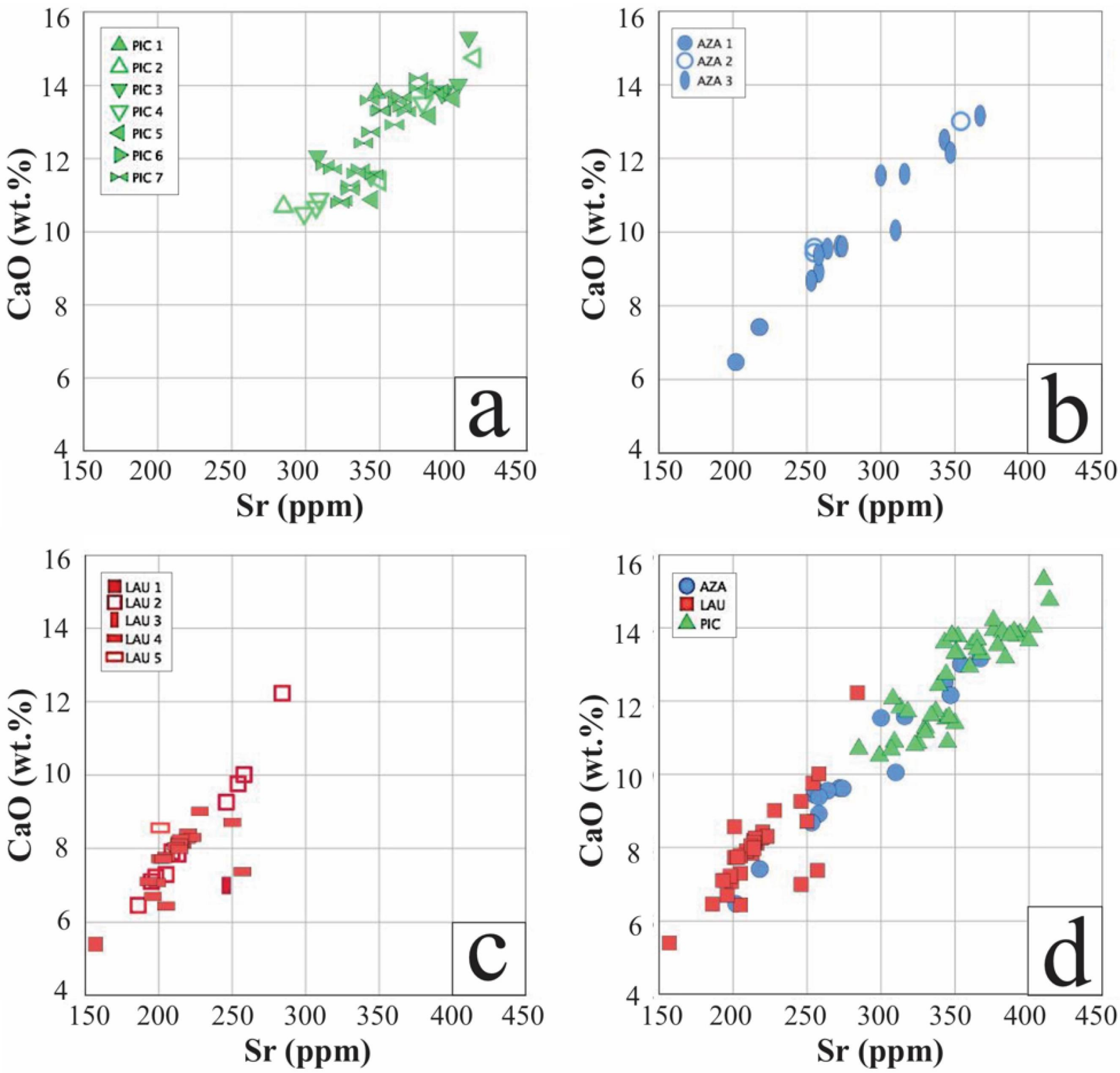

Figure 8.29: *Location of the 95 roof tiles analyzed in the CaO-Sr binary correlation diagram. Signatures according to Tables 8.5 and 8.8. Drawings* Marino Maggetti.

again that the Laufen products contain significantly less CaO than those from the PIC factory. The AZA tiles, on the other hand, scatter widely and are therefore similar to both other factories in terms of their CaO levels. On closer inspection, both Allschwil & Laufen imaginary correlation lines turn out to be slightly different (Fig. 8.29 d). How is this to be explained? The main supplier of calcium in sediments is the mineral calcite. In its lattice, Ca can be replaced by the trace element strontium (Sr). The extent of this replacement depends on the geological history of the mineral respectively its origin. In the present case, the assumed correlation line of the Laufen tiles would have to differ from the other two, because the Laufen factory used only one geological deposit (mixing of different Rupelian layers), while in Allschwil marine Rupelian marl was mixed with continental Loess loam.

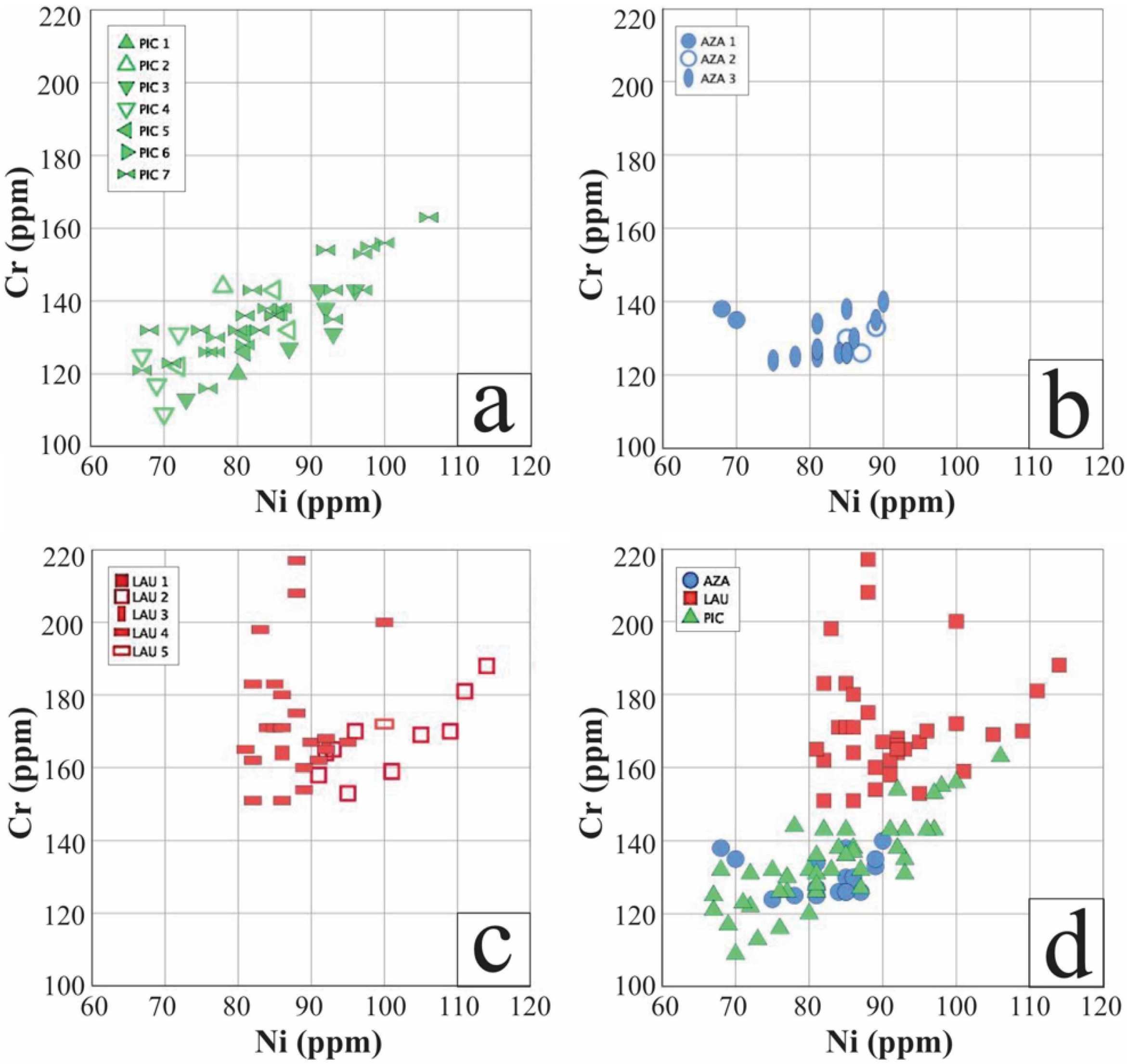

Figure 8.30: *Location of the 95 roof tiles analyzed in the Cr-Ni binary correlation diagram. Signatures according to Tables 8.5 and 8.8. Drawings* Marino Maggetti.

Finally, the Laufen tiles are richer in chromium (Cr) than those from the Allschwil factories (Fig. 8.30). The range of variation is visibly higher for the former. LAU 2 tiles appear to group along a broad positive correlation line. A similar correlation with nickel (Ni) is also the case for the PIC, but not for the AZA tiles. No Cr-rich minerals, such as chromite ($FeCr_2O_4$), could be identified under the polarizing microscope. Where these high Cr values come from remains therefore an open question.

Chemical arguments for raw material mixing

In the previous subchapter, the chemical variability of the tiles of the three factories examined was discussed. In the following, the question will be addressed to what extent the chemical variability of the roof tiles can be reconciled with a mixture of Allschwil and Laufen raw materials as claimed by several scholars (see previous subchapters).

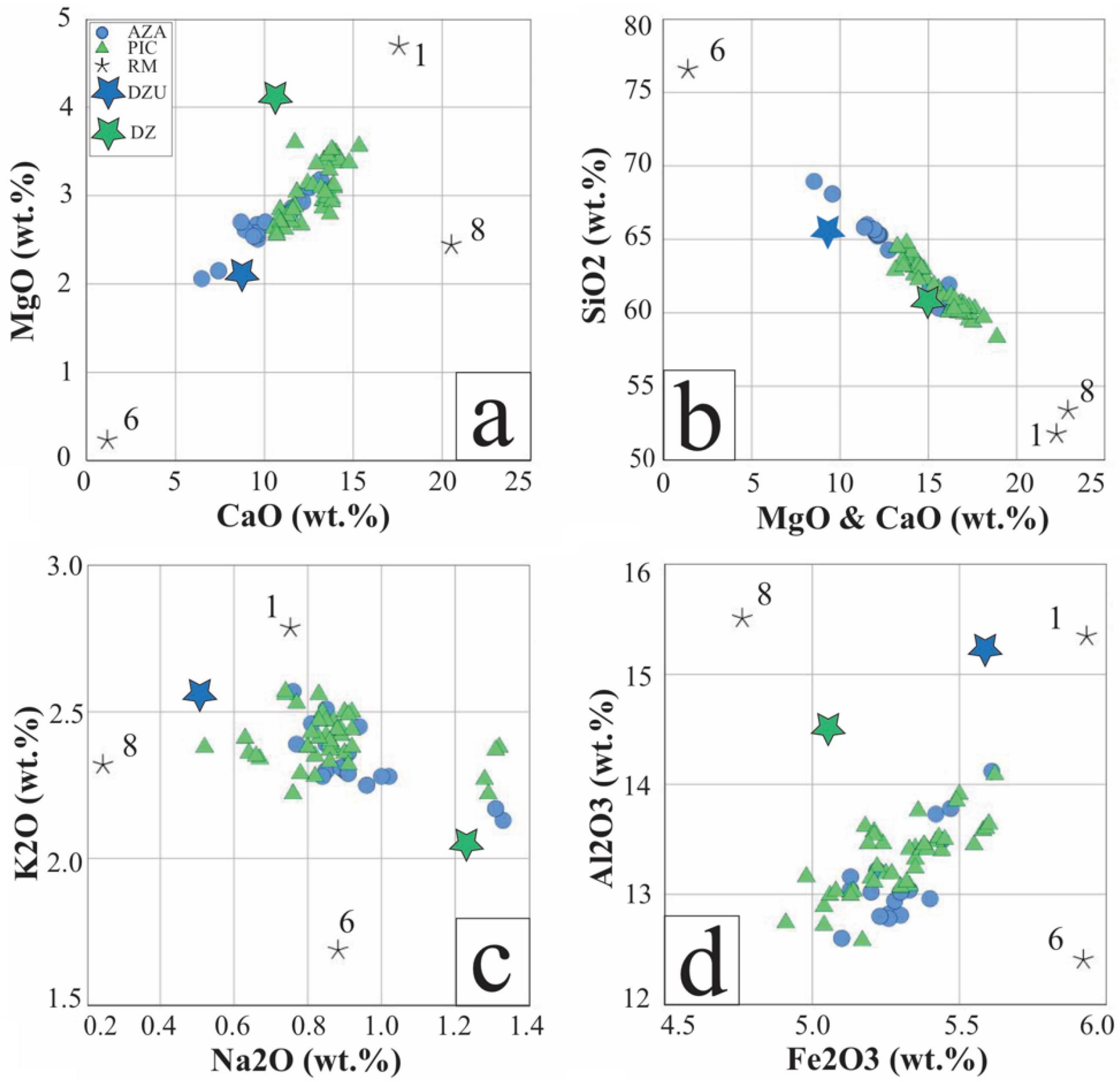

Figure 8.31: *Roof tiles from Allschwil (AZA and PIC factories) with three raw materials (RM) and the factory tile pastes DZ (PIC) and DZU (AZA), see table 8.6, in four selected binary diagrams. 1, 8 = Rupelian marl, 6 = Loess loam.*

Allschwil

In the MgO – CaO diagram, the representing points of the tiles are, as to be expected for a mixture, on a correlation line whose end points are occupied by the Rupelian marl (1) and the Loess loam (6), see figure 8.31 a. Both factory pastes DZ (PIC) and DZU (AZA) lie on or very close to the correlation line. Contrasting, the Rupelian marl from Laufen (8) can be clearly differentiated. Also in the SiO_2 – MgO & CaO plot nothing speaks against a blend of Rupelian marl and Loess loam. DZ und DZU factory pastes are almost on the inferred correlation line (Fig. 8.31 b). In the K_2O – Na_2O diagram, on the other hand, a broad scatter and no correlation line are to be seen (Fig. 8.31 c). The factory pastes also do not fit well with the plotted tile analyses. In the Al_2O_3 – Fe_2O_3 diagram (Fig. 8.31 d) the tiles lie on a correlation line, albeit broader than in Fig. 8.31 a and b, whose ends are not formed by the Rupelian marl and the Loess loam. The factory blends DZ and DZU are far away, as is the Rupelian marl from Laufen. In conclusion: the four existing chemical analyses of the Allschwil raw materials support a mixture only when considering the main oxides SiO_2, MgO and CaO. The number of raw material samples must therefore be increased significantly in order to record the chemical variability of both types of sediments.

Laufen

As pointed out by Zeller [ZEL07], the Laufen factory mixed only Rupelian sediments of sandy to marly compositions (Tab. 8.7). In the MgO – CaO diagram, the yellow and blue fatty layers 276, 277, 279 group on one side of the inferred correlation line. However, the sandy sample 281 is not on the opposite end of the line. Marl 282 from Breitenbach is sligthly apart (Fig. 8.32 a). On the other hand, a possible mixture can be hypothezised based on figure 8.32 b, because the sandy and marly layers occupy the opposite ends of an assumed correlation line. In the Al_2O_3 – Fe_2O_3 plot (Fig. 8.32 c), the five raw materials appear to be aligned along a linear correlation, in contrast to the analyses of the tiles, which form a point cloud. The sandy layer has too much alumina and iron and can therefore not be considered as an end member of the factory's blend. These only partially satisfactory results can have several causes. On the one hand, as in Allschwil, the number of analyses is very small. On the other hand, the reliability of analytical results that were published more than 100 years ago must be addressed.

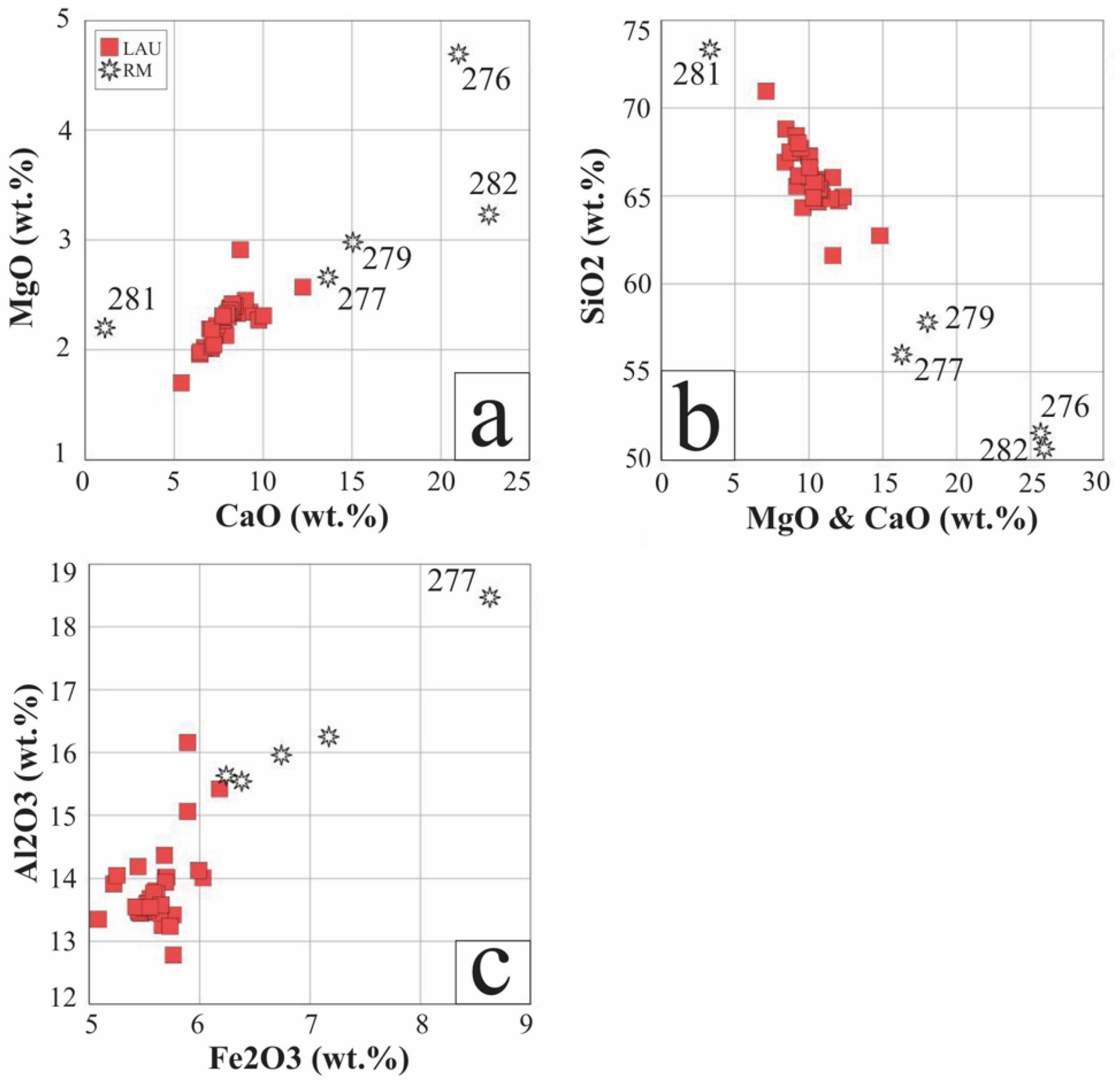

Figure 8.32: *Roof tiles from Laufen with five raw materials (RM, tab. 8.7) in three selected binary diagrams.*

A specific chemical composition

We have studied so far 12 Swiss tileworks. They exploited raw materials belonging either to the Quaternary (Holocene and Upper Pleistocene), to the Miocene lower freshwater molasse (Aquitanian), or to the Oligocene (Rupelian), see figure 8.33. In this context it should be noted that only the Allschwil factories mixed raw materials of different geological ages (Rupelian marl & Holocene Loess). Based on this large data set, it seemed attractive to investigate the extent to which the roof tiles of these three raw materials types can be chemically differentiated. Large overlaps are to be seen between the roof tiles from the Miocene and Holocene/Pleistocene deposits (Fig. 8.34). The former are generally richer in MgO, K_2O, Rb, Al_2O_3 and Fe_2O_3, and

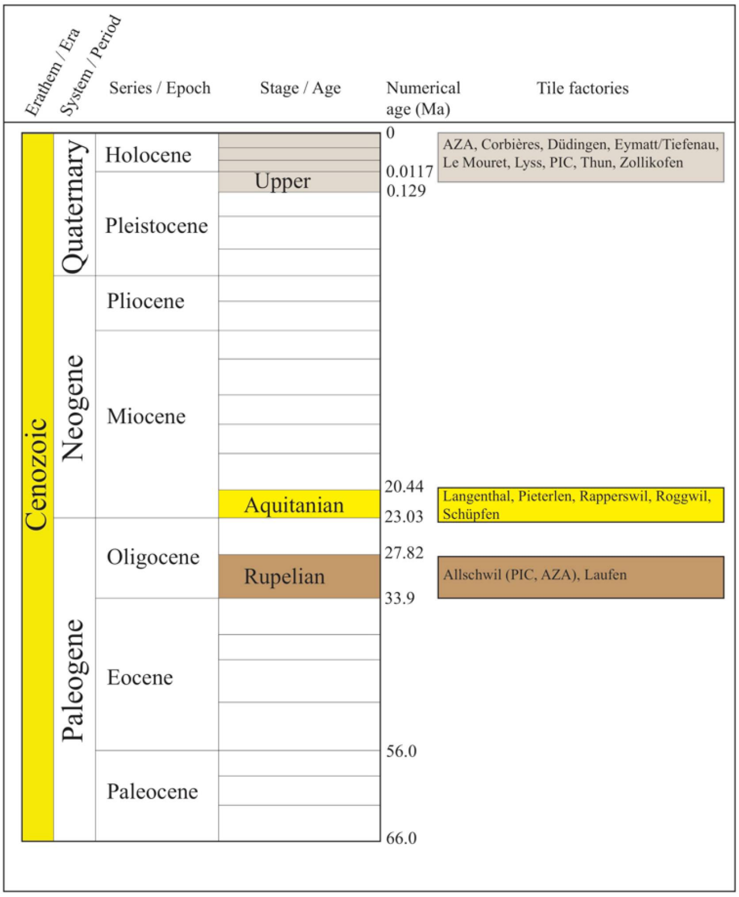

Figure 8.33: *Stratigraphic position of the raw materials from Swiss tileworks whose products were chemically analysed as part of this ongoing project. Simplified from* Cohen/Harper/Gibbard *[COH22]. Drawing* Marino Maggetti.

poorer in SiO_2. Contrasting, the Allschwil and Laufen tiles are clearly different. Unlike the other groups, their plotted points show a positive correlation in the MgO – CaO diagram (Fig. 8.34 a). In addition, the Allschwil tiles are richer in CaO and Sr (Fig. 8.34 b), but, along with the Laufen tiles, poorer in potassia (K_2O; Fig. 8.34 c, d) and alumina (Al_2O_3; Fig. 8.34 e). From this it can be concluded that their clay fraction must have been lower compared to the other two groups, since alumina, as is well known, in such raw materials is mainly fixed in the clay fraction $< 2\,\mu m$. In figure 8.34 c, the Allschwil and Laufen tiles are divided into several subgroups, which, however, reveal no relationship to the factory marks or the texture. As far as the chromium and nickel content is concerned, the Laufen tiles have the highest values of all 372 analyses (Fig. 8.34 f). Obviously, the geological history of the Allschwil and Laufen raw materials resulted in a very special and differentiable chemical composition that has been preserved in their roof tiles.

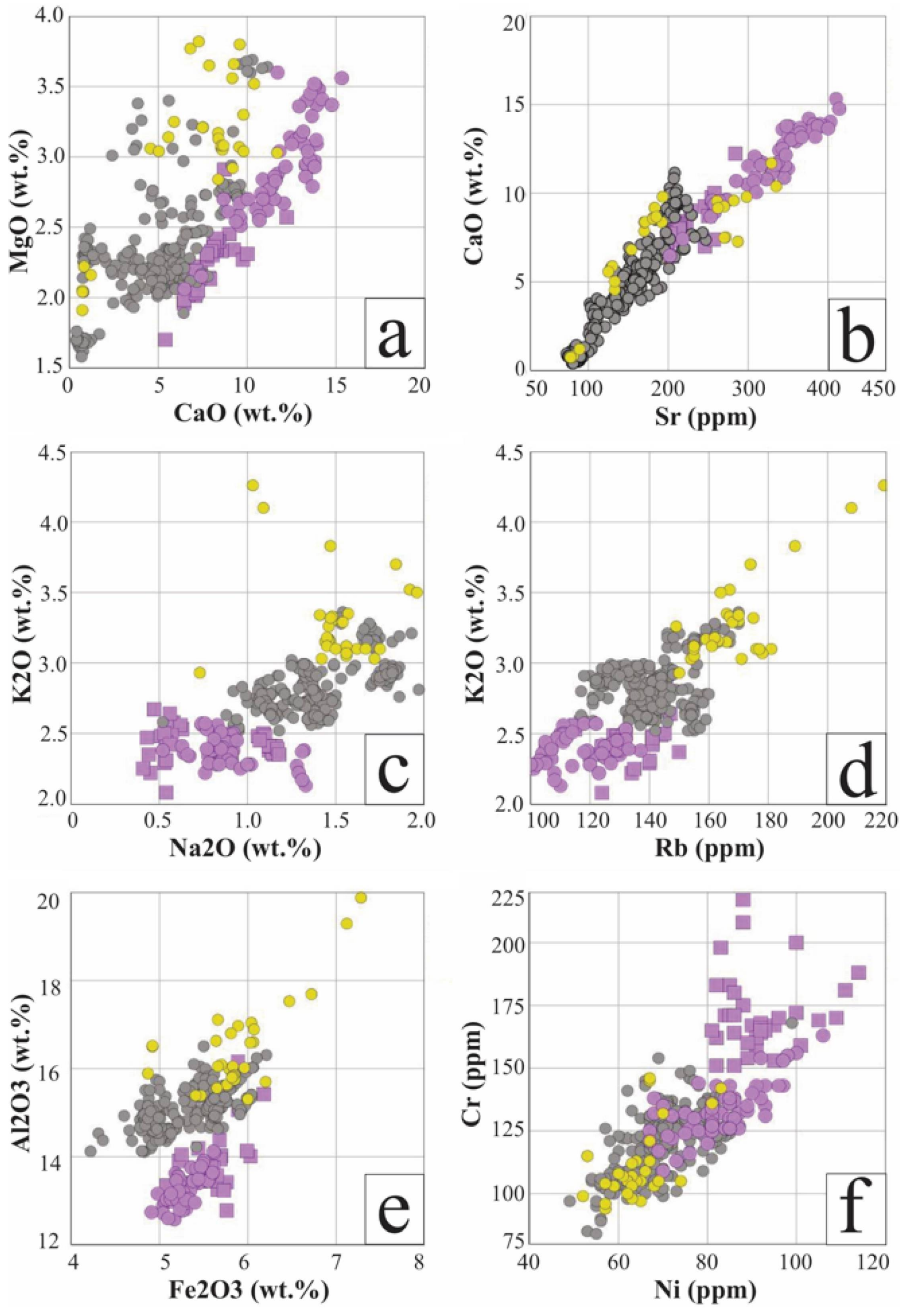

Figure 8.34: *Comparison of 95 roof tiles (this study) with 277 previously analysed Swiss roof tiles. Symbols (raw materials): brownish black = Quaternary, violet = Oligocene, yellow = Miocene. Rectangles = Laufen tiles. The Allschwil factories (circles) admixed Quaternary Loess loam to the Oligocene marls. Drawings* Marino Maggetti.

Conclusion

The 95 Allschwil and Laufen analytical results complete the analyses published to date [MAG20, MAG22], summing up in a total of 372 chemical analyses. Chemically, the new data can be easily differentiated from the 277 tiles analysed so far. Distinguishing between the Allschwil and the Laufen products is not a problem, since the latter, for example, have a much higher chromium content. Unfortunately, this only works to a limited extent for the Allschwil PIC and AZA tiles, which is not surprising since both factories obtained their raw materials from the same area. The macroscopic and microscopic examination shows that at least two raw materials were used in the three tileworks. One was Ca-poor, the other Ca-rich. The mixing process was not perfect and mostly resulted in a heterogeneous texture. However, the PIC factory must have used a much better mixing technique, because their tiles are more homogeneous. Unfortunately, there are not enough chemical analyses of raw materials available to better document or quantify the mixing technique.

Acknowledgements

This work was printed with the genereous financial support of the Ceramica - Stiftung (Basel) and the Zürcher Ziegeleien AG (Regensdorf), for which we are very grateful. We would further like to thank Myriam Maggetti (Münsingen) for her significant help in the tile prospection, Odette Marbacher (Fribourg) for the exemplary production of the XRF glass pills, and Jean Charrière, Paul Bourqui and Patrick Dietsche (Fribourg) for the perfect manufacturing of the thin sections.

Abbreviations

- **BN** BÜNDNER NACHRICHTEN
- **BT** BIELER TAGBLATT
- **DB** DER BUND
- **FAN** FEUILLE D'AVIS DE NEUCHÂTEL
- **GOTB** GESCHÄFTSBLATT FÜR DEN OBEREN TEIL DES KANTONS BERN
- **GR** GRÜTLIANER
- **ISB** INTELLIGENZBLATT DER STADT BERN
- **LBP** LE BIEN PUBLIC
- **LJ** LE JURA
- **LNS** LE NATIONAL SUISSE
- **OT** OBERLÄNDER TAGBLATT
- **SB** SEELÄNDER BOTE
- **SHAB** SCHWEIZERISCHES HANDELSAMTSBLATT

- **TATBO** TÄGLICHER ANZEIGER FÜR THUN UND DAS BERNER OBERLAND
- **TSB** TAGBLATT DER STADT BIEL
- **TT** THUNER TAGBLATT
- **TWB** THUNER WOCHENBLATT

Published sources

- AKTIV (1930-1998).
- ALMANACH DE FRIBOURG (1813-1824).
- ALMANACH OU CALENDRIER NOUVEAU POUR L'ANNÉE COMMUNE (1825-1836).
- BIELER TAGBLATT (1904-1995).
- DER BUND (1850-1994).
- DER LANDBOTE DES FREIBURGISCHEN SEEBEZIRKS (1909-1914).
- FEUILLE D'AVIS DE LA VILLE ET CANTON DE FRIBOURG (1832-1835).
- FREIBURGER-ZEITUNG UND ANZEIGER FÜR DIE WESTLICHE SCHWEIZ (1863-1903).
- FREIBURGER NACHRICHTEN UND ANZEIGER FÜR DIE WESTLICHE SCHWEIZ (1904-2006).
- GAZETTE DE BERNE (1692-1797).
- GESCHÄFTSBLATT FÜR DEN OBEREN TEIL DES KANTONS BERN (1897-1938).
- INTELLIGENZBLATT FÜR DIE STADT BERN (1834-1922).
- JOURNAL DU CANTON DE FRIBOURG (1830-1833).
- JOURNAL DU JURA (1876-1995).
- LA GRUYÈRE: LE JOURNAL DU SUD FRIBOURGEOIS (1882-1930).
- LA LIBERTÉ (1871-2012).
- LA LUTTE SYNDICALE (1906-1998).
- LA TRIBUNE DE FRIBOURG (1905).
- LE BIEN PUBLIC (1879-1888), LE BIEN PUBLIC-CHRONIQUEUR SUISSE (1882-1888).
- LE CHRONIQUEUR: FEUILLE POLITIQUE, SCIENTIFIQUE, ET LITTÉRAIRE (1854).
- LE CHRONIQUEUR, GAZETTE DE FRIBOURG (1855-1858).
- LE CHRONIQUEUR DE FRIBOURG (1858-1863).
- LE CHRONIQUEUR SUISSE, JOURNAL POLITIQUE ET LITTÉRAIRE DE LA SUISSE ROMANDE (1864-1881).
- LE CONFÉDÉRÉ DE FRIBOURG (1848-1851).
- LE CONFÉDÉRÉ: JOURNAL DÉMOCRATIQUE FRIBOURGEOIS (1852-1885).
- LE CONFÉDÉRÉ DE FRIBOURG (1886-1907).
- LE COURRIER FRIBOURGEOIS (1829-1830).
- LE NARRATEUR FRIBOURGEOIS (1840-1855).
- LE VÉRIDIQUE (1831-1833).
- OBERLÄNDER TAGBLATT (1909-1961).
- SCHWEIZERISCHES HANDELSAMTSBLATT (1883-2001).
- SEELÄNDER BOTE (1850-1904).
- SMUV-ZEITUNG (1902-2001).
- SOLIDARITÉ HORLOGÈRE (1893-1914).
- TAGBLATT DER STADT BIEL (1865-1900).
- TAGBLATT DER STADT THUN (1908-1920).
- TÄGLICHER ANZEIGER FÜR THUN UND DAS BERNER OBERLAND (1877-1907).
- THUNER TAGBLATT (1962-1999).
- THUNER WOCHENBLATT (1838-1907).
- VOLKSKALENDER FÜR FREIBURG UND WALLIS (1910-1950).
- FREIBURGER UND WALLISER VOLKSKALENDER (1951-1982).
- FREIBURGER VOLKSKALENDER (1983-2018).

Bibliographie

[AN43] ANONYMUS (1943): Die Laufener Ton-Industrie. Neue Zürcher Zeitung 164, 28 (28.2.1943).

[BAU28] BAUMBERGER, ERNST (1928): Die Tongruben bei Allschwil. Eclogae geol. Helv. 21, 1, 96–101.

[BIR97] BIRKHÄUSER, KASPAR (1997): Das Personenlexikon des Kantons Basel-Landschaft. Liestal.

[BIT88] BITTERLI-BRUNNER, PETER/FISCHER, HERMANN (1988): Blatt 1067 Arlesheim. Geol. Atlas Schweiz 1 : 25000, Erläut. 80.

[BUX36] BUXTORF, AUGUST/CHRIST, PETER, unter Benützung eines Entwurfs von R. ELBER (1936): Blätter 96 Laufen / 97 Bretzwil / 98 Erschwil / 99 Mümliswil. Geol. Atlas Schweiz 1: 25 000, Erläut. 3.

[BÜH39] BÜHLER, FRITZ (1939): 50 Jahre Laufener Tonindustrie. Gassmann, Solothurn.

[CHR24] CHRIST, PETER (1924): Die Bohrung von Allschwil bei Basel. Beitr. z. Geologie d. Schweiz, geotechn. Serie 10, 31–54.

[COH22] COHEN, KIM M./HARPER, DAVID A. T./GIBBARD, PHILIP L. (2022): ICS International Chronostratigraphic Chart 2002/10. International Commission on Stratigraphy, IUGS, `www.stratigraphy.org` (visited 2023/08/12).

[CUA00] CUANOUD, BORIS (2000): Stabilisation et valorisation de boues galvaniques riches en chrome dans une argile par cuisson à haute température. Unpublished diploma Thesis. Institute of Mineralogy and Petrography, University of Freiburg, Switzerland.

[CUO93] CUOMO DI CAPRIO, NINA/VAUGHAN, SARAH (1993): An experimental study in distingusihing grog (chamotte) from argillaceous inclusions in ceramic thin sections. Archaeomaterials 7, 1, 21-40.

[QUE69] DE QUERVAIN, FRANCIS/JENNY, VERA (1969): Die nutzbaren Gesteine der Schweiz. 3d edition. Zürich.

[DES95] DESCOEUDRES, GEORGES (1995): Brennöfen am Birsufer: Ein archäologischer Beitrag zur Frühgeschichte der Laufener Ziegelherstellung. In: HAGMANN, DANIEL/HELLINGER, PETER (Eds), 700 Jahre Stadt Laufen. Basel, 101–110.

[FÄS93] FÄSSLER, SILVAN (1993): Zur Ziegelentwicklung in der Region Basel. Ziegelei-Museum 10, 45–58.

[FIS64] FISCHER, HERMANN (1964/65): Oberes Rupélien (Septarienton) des südlichen Rheintalgrabens: Tongruben von Allschwil bei Basel. Bulletin der Vereinigung Schweiz. Petroleum-Geologen und -Ingenieure 31, 81, 7–16.

[FIS71] FISCHER, HERMANN/HAUBER, LUKAS/WITTMANN, OTTO (1971): Blatt 1047 Basel. Geol. Atlas Schweiz 1:25 000, Erläut. 59.

[FÜR93] FÜRST, DANIEL (1993): Ziegeleirohstoffe und Phonolithzusatz. Unpublished diploma Thesis. Institute of Mineralogy and Petrography, University of Freiburg, Switzerland.

[FÜR98] FÜRST, DANIEL (1998): Verwertung von wenig belasteten, anorganischen Abfallstoffen in grobkeramischen Baustoffen. Unpublished PhD Thesis. Institute of Mineralogy and Petrography, University of Freiburg, Switzerland.

[GER92] GERSTER, GIUSEPPE (1992): 100 Jahre Keramik Laufen: Tonprodukte sind tägliche Begleiter aller Menschen. Jurablätter: Monatsschrift für Heimat- und Volkskunde 54, 9, 129–139.

[GOU62] GOUDA HASSANEIN (1962): Untersuchungen an Lössen der Nordschweiz. Geographica Helvetica 17, 3, 137–221.

[GUT94a] GUTSCHER, DANIEL (1994a): Archäologische Untersuchungen in der ehemaligen Ziegelscheune in Laufen. Jurablätter: Monatsschrift für Heimat- und Volkskunde 56, 4, 56–62.

[GUT94b] GUTSCHER, DANIEL (1994b): Archäologische Untersuchungen in der ehemaligen Ziegelscheune in Laufen. Laufenthaler Jahrbuch 9, 59–66.

[GUTZ94] GUTZWILLER ANDREAS (1894): Die Diluvialbildungen der Umgebung von Basel. Verhandlungen der naturforschenden Gesellschaft in Basel X, 3, 512–690.

[HAR83] HARDMEYER-JENNY, JAKOB (1883): Officieller Katalog der vierten schweizerischen Landesausstellung Zürich 1883. 2. Auflage. Zürich.

[HEI14] HEIMANN, ROBERT B./MAGGETTI, MARINO (2014): Ancient and Historical Ceramics: Materials, Technology, Art, and Culinary Traditions. Schweizerbart Science Publishers, Stuttgart.

[HES55] HESS, HANS/WEILER WILHELM (1955): Untersuchungen an Fischen aus dem Alttertiär der Umgebung von Basel. Eclogae geol. Helv. 48, 2, 427–447.

[HOT28] HOTZ, WALTER (1928): Das Profil der neuen Bohrung von Allschwil bei Basel. Eclogae geol. Helv. 21, 1, 90–92.

[IBE71] IBERG, ROLF (1971): Beitrag zur Thermochemie von Ziegelton. Tonindustrie-Zeitung 95, 3, 79-81.

[IBE72] IBERG, ROLF/PETERS TJERK/MUMENTHALER, THOMAS (1972): Beitrag zur Thermochemie von Ziegelton. Tonindustrie-Zeitung 96, 2, 34-37.

[KOC23] KOCH, RICHARD (1923): Geologische Beschreibung des Beckens von Laufen im Berner Jura. Beiträge zur geologischen Karte der Schweiz. NF 48.2, Geologische Kommission, Bern.

[KRE85] KREIMEYER, ROLF (1985): Zur Entstehung heller Brennfarben bei eisenhaltigen Ziegelrohstoffen. Geologisches Jahrbuch, D 75, 89-122.

[MAG89] MAGGETTI, MARINO (1989): Porosität, Magerungsbestandteile und Gefüge. In: SCHNEIDER, GERWULF (Red.) Naturwissenschaftliche Kriterien und Verfahren zur Beschreibung von Keramik. Acta Praehistorica et Archaeologica 21, 24-26.

[MAG09] MAGGETTI, MARINO (2009): Neolithic pottery from Switzerland: raw materials and manufacturing processes. In: SHORTLAND, ANDREW J./FREESTONE, IAN C./REHREN, THILO (eds.): From Mine to Microscope, Advances in the Study of Ancient Technology. Oxbow Books, 29-42.

[MAG20] MAGGETTI, MARINO/GALETTI, GIULIO (2020): Dachziegel der freiburgischen Ziegeleien Düdingen, Le Mouret und Corbières – chemische, geologische und historische Aspekte. Bulletin de la Société Fribourgeoise des Sciences Naturelles 109, 40-104.

[MAG22] MAGGETTI, MARINO/GALETTI, GIULIO (2022): Berner Ziegel in und um den Kanton Freiburg: eine geschichtliche und naturwissenschaftliche Untersuchung. Bulletin de la Société Fribourgeoise des Sciences Naturelles 111, 44–115.

[MAT42] MATHYS, ERNST (1942): Hundert Jahre Schweizerbahnen. Les chemins de fer suisses au cours d'un siècle, 1841–1941. Bern.

[MEY03] MEYER, CHRISTOPH (2003): Die Farben des Tons. Ziegelei-Museum 20, 23-32.

[MEY84] MEYER, CHRISTOPH/KAUFMANN, BEAT/KELLER, H. J. (1984): Das Mikrogefüge grobkeramischer Scherben. Beiträge zur Geologie der Schweiz, Geotechnische Serie 63, 1-136.

[MUM95] MUMENTHALER, THOMAS/SCHMITT, HERBERT/PETERS, TJERK/RAMSEYER, KARL/ZWEILI, FRED (1995): Verfolgung der Reaktionsvorgänge beim Brennen von karbonathaltigen Ziegelmischungen mit Hilfe der Kathodenlumineszenz. Ziegelindustrie International 48, 5, 307-318.

[MUM97] MUMENTHALER, THOMAS/MEYER, CHRISTOPH/SIGG, JEAN (1997): Rohstoffe für die Ziegelindustrie. In: KÜNDIG, RAINER/MUMENTHALER, THOMAS/ECKARDT, PETER/KEUSEN, HANS RUDOLF/ SCHINDLER, CONRAD/HOFMANN, FRANZ/ VOGLER, RUDOLF/GUNTLI, PETER, Die mineralischen Rohstoffe der Schweiz. Schweizerische Geotechnische Kommission, Zürich, 23–63.

[NOL88] NÖLLER, RENATE /KNOLL, HEINZ (1988): The yellow colouration of oxidized burned ceramics. Berliner Beiträge zur Archäometrie, 10, 107-112.

[PAT84] PATENTFALZZIEGELEI KONSTANZ (1884): Ueber Passavant-Ziegel. Thonindustrie-Zeitung, 291.

[PET69] PETERS, TJERK (1969): Mineralogische Untersuchungen an einigen schweizerischen Ziegeleirohstoffen. Schweizerische Mineralogische und Petrographische Mitteilungen 49, 2, 391-405.

[PET78] PETERS, TJERK/IBERG, ROLF (1978): Mineralogical changes during firing of calcium-rich clays. American Ceramic Society Bulletin 57, 5, 503-506.

[PET73] PETERS, TJERK/JENNI, JEAN-PIERRE (1973): Mineralogische Untersuchung über das Brennverhalten von Ziegeltonen. Beiträge zur Geologie der Schweiz, Geotechnische Serie 50, 1-59.

[ROL07] ROLLIER, LOUIS (1907): Allschwil. In: LETSCH, EMIL (Ed), Die Schweizerischen Tonlager, herausgegeben von der Schweiz. Geotechnischen Kommission. I. Geologischer Teil. III. Abschnitt. Die Tonlager in den Kantonen Baselstadt und Baselland. Beiträge zur Geologie der Schweiz, Geotechnische Serie, IV. Lieferung. Bern, Francke, 79–80.

[RÜH84a] RÜHNE, J. F. (1884a): Ueber Dachfalzziegel. Thonindustrie-Zeitung, 221, 251–255.

[RÜH84b] RÜHNE, J. F. (1884b): Ueber Passavant Falzziegel. Thonindustrie-Zeitung, 261.

[RÜH84c] RÜHNE, J. F. (1884c): Zum Passavant Ziegel. Thonindustrie-Zeitung, 311–312.

[SCH07] SCHMIDT, CARL/HINDEN, FR. (1907): Geologische und chemische Untersuchung der Tonlager bei Altkirch im Ober-Elsass und bei Allschwyl im Baselland. Zeitschrift für praktische Geologie 15, 2 (Februar), 53-56.

[SCH24] SCHMIDT, CARL/BRAUN, L./PALTZER, G./MÜHLBERG, MAX/CHRIST, PETER/JACOB, F. (1924): Die Bohrungen von Buix bei Pruntrut und Allschwil bei Basel. Beiträge zur Geologie der Schweiz, Geotechnische Serie 10.

[STÖ96] STÖCKLI, WERNER (1996): Ziegelbrennöfen in Laufen. Ziegelei-Museum 13, 25–34.

[STR07] STRÜBIN, KARL (1907): Allschwil. In: LETSCH, EMIL (Ed), Die Schweizerischen Tonlager, herausgegeben von der Schweiz. Geotechnischen Kommission. I. Geologischer Teil. III. Abschnitt. Die Tonlager in den Kantonen Baselstadt und Baselland. Beiträge zur Geologie der Schweiz, Geotechnische Serie, IV. Lieferung. Bern, Francke, 80–81.

[WHI86] WHITBREAD, IAN (1986): The characterisation of argillaceous inclusions in ceramic thin sections. Archaeometry 28, 1, 79-88.

[WUL31] WULLSCHLEGER, PETER (1931): Industrie und Volkswirtschaft 4, 20–21, 193–195 (quoted from FÄSSLER 1993).

[ZEL07] ZELLER, R. (1907): Laufen. In: LETSCH, EMIL (Ed), Die Schweizerischen Tonlager, herausgegeben von der Schweiz. Geotechnischen Kommission. I. Geologischer Teil. III. Abschnitt. Die Tonlager in den Kantonen Baselstadt und Baselland. Beiträge zur Geologie der Schweiz, Geotechnische Serie, IV. Lieferung. Bern, Francke, 138–140.

[ZOL91] ZOLLINGER, GABY (1991): Die Lössdeckschichten der Ziegelei in Allschwil (Kanton Basel-Landschaft/Schweiz). Ein Beitrag zur Quartärstratigraphie am südlichen Oberrheingraben. Ber. Naturf. Ges. Freiburg i. Br. 79, 165–176.

[ZSC07] ZSCHOKKE, B. (1907): Die schweizerischen Tonlager, II. Technologischer Teil. Technologische Untersuchung der schweiz. Tone ausgeführt in der Eidgenössischen Materialprüfungsanstalt am Schweiz. Polytechnikum. Beiträge zur Geologie der Schweiz, Geotechnische Serie, IV. Lieferung. Bern, Francke.

Maps

[BIT84] BITTERLI-BRUNNER, PETER/FISCHER, HERMANN/HERZOG PETER (1984): Blatt 1067 Arlesheim. Geologischer Atlas der Schweiz 1:25'000, Karte 80.

[KOC36] KOCH, RICHARD/LEHNER, ERNST/WAIBEL, ALFRED/MÜHLBERG, MAX (1936): Blätter 96-99 (Siegfriedkarte) Laufen – Bretzwil – Erschwil – Mümliswil. Geologischer Atlas der Schweiz 1 : 25′000, Karte 3.

[WIT70] WITTMANN, OTTO/HAUBER, LUKAS/FISCHER, HERMANN/RIESER, A./STAEHELIN, PETER, unter Mitbeteiligung des Geologischen Landesamtes Baden-Württemberg in Freiburg i. Br. (1970): Blatt 1047 Basel. Geologischer Atlas der Schweiz 1:25'000, Karte 59.

Internetressourcen

[BASnet] BASLER STADTBUCH: http://www.baslerstadtbuch.ch/chronik/1884/11/29/.

`https://www.e-newspaperarchives.ch`

`https://www.e-periodica.ch`

Appendices

Factory mark, An. No.	**Underside, year of fabrication, numbers**	**Outside, date of fabrication**	**Texture**	**Colour**	**Coordinates of the place of finding**
PIC 1					
ZZ 35	1902		II	y	2’507’650/1’174’350
PIC 2					
ZZ 418	1904		I	yr	2’619’600/1’161’500
PIC 3					
ZZ 11	1918	[?] 19. [?]	I	y	2’633’000/1’199’000 to 1’200’000
ZZ 12	1918	19 9 III	I	y	2’633’000/1’199’000 to 1’200’000
ZZ 16	1918	I . 9 . III	I	y	2’633’000/1’199’000 to 1’200’000
ZZ 30	1918	18 9 III	I	y	2’633’000/1’199’000 to 1’200’000
ZZ 34	1913		II	yr	2’507’650/1’174’350
ZZ 262	1922	9 11 I / III	II	r	2’619’650/1’175’500
PIC 4					
ZZ 287		20. 11. 25. III. (between two boundary lines)	II	y	
ZZ 401	1913	not lisible	II	yr	2’619’600/1’161’500
ZZ 403	1913	[?] 3 IIII	II	y	2’619’600/1’161’500
ZZ 405		17. 2. 22 (between two boundary lines)	II	yr	2’619’600/1’161’500
PIC 5					
ZZ 296	1922	20 [?] 26 (between two boundary lines)	II	r	
ZZ 299	1921	5 [?] 1	II	y	
ZZ 300	1922	20 [?] 2[?]	II	r	

Factory mark, An. No.	**Underside, year of fabrication, numbers**	**Outside, date of fabrication**	**Texture**	**Colour**	**Coordinates of the place of finding**
PIC 6					
ZZ 256		24.2.25. III (between two boundary lines)	I	yr	2’590’000/1’178’300
ZZ 294		10. 12. 9.0	I	y	
ZZ 295		[?]. 5. 28 (between two boundary lines)	II	r	
PIC 7					
ZZ 1	incomplete	7 . 8 . [?] (between two boundary lines)	I	r	2’633’000/1’199’000 to 1’200’000
ZZ 3			I	r	2’633’000/1’199’000 to 1’200’000
ZZ 4	**38**	26-II-59	I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 9	**40**	2 10 29 I[?]	I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 10		[?]. 34. III (between two boundary lines)	I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 17			I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 18		[?]7. 8. 51 (between two boundary lines)	I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 19	**38**	[?] IX [?]	I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 20		[?]	I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 21		34 . III [?] (between two boundary lines)	I	yr	2’633’000/1’199’000 to 1’200’000
ZZ 25		[?] . VII . 42. IV. (between two boundary lines)	I	r	2’633’000/1’199’000 to 1’200’000
ZZ 28		8 . 51. 1 (between two boundary lines)	I	y	2’633’000/1’199’000 to 1’200’000
ZZ 224			I	r	2’589 900/1’191 850

Factory mark, An. No.	**Underside, year of fabrication, numbers**	**Outside, date of fabrication**	**Texture**	**Colour**	**Coordinates of the place of finding**
ZZ 258	**40**	28. 4. 39 II. V. (between two boundary lines)	I	yr	2’619’650/1’175’500
ZZ 279		15...12. 18 I	I	yr	2’600’000 to 2’601’000/1’168’000 to 1’169’000
ZZ 298	**38**	18. 3. 37 .III. VII (between two boundary lines)	I	y	
ZZ 331		25.5.40. II.[?] (between two boundary lines)	I	yr	2’619’300/1’174’010
ZZ 335	**40**	4.4. 28. IV / II (between two boundary lines)	II	y	2’619’300/1’174’010
ZZ 336	**40**	19.4. 28. IV / III(between two boundary lines)	I	yr	2’619’300/1’174’010
ZZ 337	**40**	12.4.28. IV / II (between two boundary lines)	I	yr	2’619’300/1’174’010
ZZ 338	**40**	4. 4. 28. IV / III (between two boundary lines)	I	y	2’619’300/1’174’010
ZZ 339	**40**	20. 4. 28 IV / III (between two boundary lines)	I	yr	2’619’300/1’174’010
ZZ 340	**40**	2.4. 28 IV / = (between two boundary lines)	I	yr	2’619’300/1’174’010
ZZ 341		19. 6. 35 (between two boundary lines)	I	yr	2’619’300/1’174’010

Factory mark, An. No.	**Underside, year of fabrication, numbers**	**Outside, date of fabrication**	**Texture**	**Colour**	**Coordinates of the place of finding**
ZZ 342	**40**	24. 6. 35 / II (between two boundary lines)	I	yr	2'619'300/1'174'010
AZA 1					
ZZ 398, 417			I	yr, yr	2'619'600/1'161'500
AZA 2					
ZZ 37		8.4.10	II	yr	2'507'650/1'174'350
ZZ 39		6.4.10	II	yr	2'507'650/1'174'350
ZZ 283			I	yr	2'600'100/1'167'800
AZA 3					
ZZ 2		[?]	II	r	
ZZ 5		[?] III - [?]	II	yr	2'633'000/1'199'000 to 1'200'000
ZZ 6		[?] - III - 25	II	yr	2'633'000/1'199'000 to 1'200'000
ZZ 7		28.III.25	II	yr	2'633'000/1'199'000 to 1'200'000
ZZ 8		17.III.25	II	r	2'633'000/1'199'000 to 1'200'000
ZZ 15		1.IV.25	II	r	2'633'000/1'199'000 to 1'200'000
ZZ 26		25.III.25	II	yr	2'633'000/1'199'000to 1'200'000
ZZ 36		6.9.48	II	yr	2'607 650/1'174 350
ZZ 38	4	11.VIII.53 / II 1 (on one boundary line)	II	yr	2'607'650/1'174'350
ZZ 195	3.I 29		II	y	
ZZ 228		29.XII.20	II	r	2'613'300/1'177'600
ZZ 229		16.XII.25	II	yr	2'613'300/1'177'600
LAU 1					
ZZ 250	1	4 IV 1929	I	r	2'584'000/1'193'700
LAU 2					
ZZ 96	9	14 II 1918 / 6 or 9	I	yr	
ZZ 132	2 / 6	26. VII. 37.	I	r	2'591'050/1'180'810

Factory mark, An. No.	**Underside, year of fabrication, numbers**	**Outside, date of fabrication**	**Texture**	**Colour**	**Coordinates of the place of finding**
ZZ 155	2 / 2	26. VII. 37.	I	r	
ZZ 156	2 / 10	14. VII. 37.	I	r	
ZZ 157	9	16 VII 37 / 3	I	r	
ZZ 176	not lisible	[?] II. 50.	II	r	2’590’600/1’186’600
ZZ 251		7.V.1917 / 5	I	yr	2’584’000/1’193’700
ZZ 301	26	24. II. 32 /[]17	II	r	
ZZ 302	23	24. II. 32 / 14	I	r	
ZZ 343		18. X. 23 / 4.	I	yr	2’619’300/1’174’010
LAU 3					
ZZ 154	7	942 – 16	I	r	2’591’550/1’180’300
LAU 4					
ZZ 41	4	not lisible	II	r	2’585’700/1’187’900
ZZ 42		cut	I	r	2’585’700/1’187’900
ZZ 43		[?] . 2 – 14	I	r	2’585’700/1’187’900
ZZ 308	8	22 – 23	I	r	2’584’550/1’173’400
ZZ 397		512 – 12	II	yr	2’619’600/1’161’500
ZZ 400	19	5 1 2 – 8	II	yr	2’619’600/1’161’500
ZZ 402	12	512 – 17	II	yr	2’619’600/1’161’500
ZZ 406	12	[?] [?] – 12	II	yr	2’619’600/1’161’500
ZZ 407		512 – [?]	II	yr	2’619’600/1’161’500
ZZ 410	13	512 – 17	II	yr	2’619’600/1’161’500
ZZ 411	8	512 – 14 / X	II	yr	2’619’600/1’161’500
ZZ 414	X / 1	51 2 – 15	II	yr	2’619’600/1’161’500
ZZ 415	11	512 – 15	II	yr	2’619’600/1’161’500
ZZ 416		512 – 12	II	yr	2’619’600/1’161’500
ZZ 419	3	512 – 14 / X	II	yr	2’619’600/1’161’500
ZZ 421	1	512 – 16	II	yr	2’619’600/1’161’500
ZZ 422	not lisible	512 – 14	II	yr	2’619’600/1’161’500
ZZ 423	8	512 – 16	II	yr	2’619’600/1’161’500
ZZ 424	18	[5]12 – 16	II	yr	2’619’600/1’161’500
ZZ 426	3	512 – 16	II	yr	2’619’600/1’161’500
ZZ 427	15	512 – 15	II	yr	2’619’600/1’161’500
ZZ 428	19	512 – 18	II	yr	2’619’600/1’161’500
LAU 5					
ZZ 388	9	30 IX 41	I	r	

Table 8.5: *Sample list. Second column: number in bold font = press number, in normal font = scratch number. Texture type I = without or with only few Ca-rich inclusions; II = with many Ca-rich inclusions. Colour: r = red, y = yellow, yr = yellowish reddish.*

Analysis	**Sample no.**				
	1	**8**	**6**	**DZ**	**DZU**
Mineralogical analysis					
Illite		18		24.2	17
Montmorillonite		16		8.8	9
Kaolinite		7		4.4	11
Chlorite		4		6.6	9
Quartz		23		28	33
Calcite		20		16	9
Dolomite		8		4	2
Feldspars		2		8	10
Pyrite		0.3-0.7			
Total		98.3-98.7		100.0	100
Granulometric analysis					
Clay ($< 2\,\mu m$)		14			37.4
Silt ($2 - 20\,\mu m$)		38			36.6
Sand ($> 20\,\mu m$)		48			26.0
Chemical analysis (calculated on the fired sample)					
SiO_2	51.75	53.4	76.56	60.99	65.36
TiO_2	0.72	0.9	0.89	0.63	0.82
Al_2O_3	15.34	15.5	12.40	14.48	15.24
Fe_2O_3	5.93	4.8	5.92	5.09	5.64
MnO	0.11		0.14		
MgO	4.69	2.4	0.23	4.13	2.11
CaO	17.56	20.5	1.16	11.16	7.53
Na_2O	0.75	0.2	0.88	1.27	0.51
K_2O	2.79	2.3	1.69	2.13	2.60
P_2O_5	0.35		0.12	0.12	0.19
Total	100.00	100.0	100.00	100.00	100.00

Table 8.6: *Analytical results (wt.%) of two Rupelian marls (No. 1, 8), a Loess loam (no. 6), and the tile pastes DZ (PIC) and DZU (AZA). No. 1 & 6 (Allschwil open pit) from DE QUERVAIN [QUE69, tab. 8, p. 246], no. 8 (Laufen open pit) from MUMENTHALER ET AL. ([MUM97], tab. 3.12, p. 60), DZ from PETERS [PET69, mineralogy: tab.1] and PETERS/JENNI [PET73, chemistry: tab.3]. DZU (probably PIC), collected 1978/1979 [MEY84, granulometry: tab.21, mineralogy: annex I, chemistry: tab.24].*

Method	**Sample no.**								
	274	**275**	**276**	**277**	**278**	**279**	**280**	**281**	**282**
Mechanical analysis									
Clay substance	30.04	64.91	79.11	92.11	76.13	85.14	62.40	50.80	90.76
Temper	69.96	35.09	20.89	7.89	23.87	14.86	37.60	49.11	9.24
Rational analyis									
Quartz & Feldspar	78.12	54.50	40.81	26.86	40.57	27.71	58.22	59.53	23,38
$CaCO_3$		0.22	29.91	19.16	0.32	21.24	0.16	0.11	30.73
$MgCO_3$	0.04		3.09						
Clay substance	21.84	45.28	26.19	53.96	59.11	51.05	41.62	40.36	45.89
Chemical analysis (Calculated on the fired sample)									
SiO_2	85.09	74.07	51.52	55.98	67.79	57.82	75.05	73.33	50.61
Al_2O_3	8.70	14.73	15.63	18.47	17.81	16.25	14.61	15.54	15.96
Fe_2O_3	4.04	6.46	6.24	8.63	7.41	7.17	6.43	6.38	6.74
$CaSO_4$	0.76	1.06	1.73	1.31	1.08	1.23	1.09	1.11	1.44
CaO		0.64	20.19	12.84	1.30	14.55	1.30	0.62	22.02
MgO	1.41	2.20	4.69	2.66	3.76	2.98	1.52	2.20	3.23
Alkalis		0.84		0.14	0.86			0.82	
Total	100.00	100.00	100.00	100.03	100.01	100.00	100.00	100.00	100.00

Table 8.7: *Analytical results (wt.%) of raw material samples from Laufen [ZSC07, 116-117]. For the methodology, see ZSCHOKKE [ZSC07, 2-8]. 274 = red and yellow marl, similar to Bolus; 275 = Loess loam; 276 = very fatty blue marl; 277 = fatty, yellow marl, normally not used; 278 = very fatty yellow marl; 279 = fatty yellow marl; 280 = yellow superficial loam; 281 = yellow sandy loam; 282 = yellow fatty marl from Breitenbach [ZEL07, 138-140].*

Type	Inscriptions on the under- and outside of the roof tile	Year
	Allschwil (PIC)	
PIC 1	Raised, in the middle of the roof tile «PASSAVANT JSELIN& Cie / BASEL No 27 1902», the last number after «190» adjusted every year manually and scratched into the plaster mould by hand.	1902
PIC 2	Raised, on one side of the roof tile «[PASSAVANT JSELIN] & C$^{\underline{o}}$ BASEL N$^{\underline{o}}$ 29 1904», the last number after «190» scratched every year manually.	1904
PIC 3	Raised, «PASSAVANT-JSELIN & C$^{\underline{ie}}$ / BASEL / N$^{\underline{o}}$ 28 1918», the last number after «191» scratched every year manually.	1913, 1918, 1922
PIC 4	Raised, «PASSAVANT ISELIN & C$^{\underline{o}}$ / BASEL N$^{\underline{o}}$ 29 1902», or «PASSAVANT ISELIN & C$^{\underline{o}}$ / BASEL N$^{\underline{o}}$ 29 1913».	1922, 1925
PIC 5	Raised, «PASSAVANT ISELIN & Cie / BASEL No 27 1921», or «PASSAVANT ISELIN& Cie / BASEL No 27 1921».	1921, 1922, 1926
PIC 6	Raised, «PASSAVANT-ISELIN & C$^{\underline{IE}}$ / ALLSCHWIL-BASEL N$^{\underline{o}}$ 38».	1925, 1928
PIC 7	Raised, «PASSAVANT-ISELIN / ALLSCHWIL-BASEL», or «PASSAVANT-ISELIN / ALLSCHWIL-BASEL» with a raised number below.	1928, 1929, 1934, 1935, 1937, 1939, 1940, 1942, 1951, 1959
	Allschwil (AZA)	
AZA 1	On the long side a deep press mark «ACTIEN-[ZIEGELEI] / ALLSCH[WIL]» in a longitudinal and slightly higher cartouche with rounded edges.	No date
AZA 2	On the long side raised mark «ACTIEN ZIEGELEI / ALLSCHWYL». A manual date is possible.	Normally no date. 1910
AZA 3	Raised, «Aktien-Ziegelei-Allschwil». Date applied by hand on the under- or the outside. Day and year (abbreviated) in Arabic, month in Roman numerals. The date sequence can be underlined with a line.	1920, 1925, 1948, 1953

Type	**Inscriptions on the under- and outside of the roof tile**	**Year**
	Laufen	
LAU 1	On the long side a raised mark «Tonwarenfabrik Laufen» in a longitudinal cartouche with rounded edges. No numbers on the outside (top).	1929
LAU 2	Raised, «TUILERIE MEC / LAUFON». Underneath very often Arabic numerals, one raised from the plaster mould and the other raised and scratched into the plaster mold by hand. Day and year (Arabic numerals, year abbr.) and month (Roman numerals) scratched by hand on the outside (top) of the tile.	1917, 1918, 1923, 1932, 1937, 1950
LAU 3	Raised, «TUILERIE MEC / LAUFON» in a cartouche. On the left, at the same level as «LAUFON» an Arabic numeral scratched into the plaster mould by hand. On the outside (top) an Arabic numeral «912» raised by hand and the year (abbr.) [??] after a hyphen.	1916
LAU 4	Raised, «TONWARENFABRIK / LAUFEN». Below raised Arabic numerals and characters, manually incised. On the outside (top) a number sequence in Arabic numerals, mostly «512», raised and scratched by hand, and after a hyphen the year (abbr.) [??].	1908 – 1923
LAU 5	Raised, «TUILERIE MEC. / LAUFON» in a cartouche. On the right, at the same level as the inscription, an Arabic numeral, applied to the plaster mould using a template or by hand? On the outside raised and scratched by hand day (Arabic numerals), month (Roman numerals) and year (Arabic numerals, abbr).	1941

Table 8.8: *Compilation of the various inscriptions (marks) on the 95 roof tiles.*

An. No.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	**MnO**	**MgO**	**CaO**	Na_2O	K_2O	P_2O_5	**SUM**	**Ba**	**Cr**	**Cu**	**Nb**	**Ni**	**Pb**	**Rb**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**LOI**
Allschwil (PIC)																								
ZZ 01	62.31	0.69	13.40	5.44	0.13	3.04	11.82	0.89	2.42	0.14	100.28	300	143	23	12	97	33	105	313	92	38	62	76	2.19
ZZ 03	60.10	0.67	13.91	5.50	0.12	2.94	13.31	0.74	2.56	0.13	99.98	282	136	20	12	85	29	114	351	104	36	68	103	1.76
ZZ 04	61.62	0.65	13.42	5.35	0.12	3.14	12.43	0.84	2.50	0.13	100.20	380	143	9	10	93	36	110	339	97	36	64	117	0.44
ZZ 09	59.52	0.65	13.58	5.58	0.17	3.37	13.93	0.83	2.56	0.15	100.34	298	156	29	13	100	37	111	376	168	33	71	150	2.43
ZZ 10	61.11	0.68	13.41	5.33	0.12	3.12	12.73	0.87	2.47	0.13	99.97	293	135	14	11	93	30	109	344	89	36	94	80	0.63
ZZ 11	58.34	0.65	13.19	5.25	0.12	3.56	15.32	0.90	2.50	0.18	100.01	260	138	17	13	92	33	111	410	106	34	61	121	1.60
ZZ 12	59.36	0.65	13.32	5.35	0.12	3.48	14.03	0.92	2.50	0.17	99.90	267	143	14	11	96	33	111	403	95	36	168	90	0.38
ZZ 16	59.94	0.67	13.25	5.22	0.11	3.51	13.84	0.91	2.49	0.15	100.09	285	143	15	12	91	30	111	394	92	34	78	74	0.40
ZZ 17	61.88	0.67	13.08	5.33	0.13	3.60	11.71	0.87	2.38	0.13	99.78	292	154	25	11	92	31	106	318	137	35	59	82	3.10
ZZ 18	60.56	0.66	13.06	5.30	0.13	3.40	13.34	0.89	2.44	0.14	99.92	278	155	11	13	98	31	105	351	89	34	58	77	0.64
ZZ 19	60.65	0.66	13.15	5.20	0.12	3.09	13.76	0.86	2.39	0.13	100.01	290	132	19	12	83	35	107	352	82	36	59	82	1.28
ZZ 20	60.26	0.66	12.89	5.04	0.12	3.41	14.21	0.90	2.36	0.15	100.00	271	138	18	14	86	31	104	376	84	34	54	78	1.33
ZZ 21	60.66	0.67	13.46	5.24	0.11	2.93	13.60	0.85	2.47	0.14	100.13	293	116	14	13	76	28	109	343	96	37	62	84	1.31
ZZ 25	60.18	0.67	13.85	5.49	0.12	2.95	13.31	0.74	2.57	0.14	100.02	282	138	17	11	84	30	118	350	97	34	68	117	1.79
ZZ 28	60.34	0.66	13.07	5.30	0.13	3.45	13.56	0.88	2.44	0.14	99.97	290	153	15	13	97	29	111	362	87	36	123	79	0.38
ZZ 30	60.38	0.66	13.02	5.13	0.12	3.52	13.78	0.92	2.44	0.16	100.13	282	131	16	14	93	35	105	392	95	33	64	69	0.47
ZZ 34	62.97	0.67	12.99	5.06	0.11	2.67	12.07	0.91	2.32	0.16	99.93	278	113	14	11	73	35	107	308	90	37	60	91	1.19
ZZ 35	60.25	0.67	13.41	5.37	0.12	2.97	13.79	0.83	2.47	0.16	100.04	291	120	14	11	80	36	112	348	86	39	67	78	1.52
ZZ 224	60.57	0.64	13.11	5.21	0.12	3.09	13.90	0.82	2.35	0.14	100.11	277	132	37	15	80	19	125	390	95	35	160	258	1.57
ZZ 256	59.94	0.63	13.48	5.42	0.12	3.12	13.89	0.64	2.36	0.15	99.75	281	132	68	15	87	25	127	382	105	33	106	237	1.31
ZZ 258	60.05	0.65	14.09	5.62	0.12	2.86	13.29	0.52	2.38	0.13	99.72	294	136	40	17	81	21	137	368	99	35	100	247	0.69
ZZ 262	62.59	0.65	13.52	5.43	0.12	2.70	11.51	0.67	2.34	0.16	99.70	297	127	40	16	87	22	128	344	98	37	149	270	2.17
ZZ 279	60.34	0.63	13.60	5.59	0.12	3.36	12.93	0.63	2.41	0.15	99.77	290	163	34	14	106	22	129	360	99	37	92	234	1.00
ZZ 287	60.51	0.70	13.50	5.45	0.11	2.98	13.52	0.86	2.37	0.14	100.15	281	125	45	16	67	21	126	379	84	33	112	243	
ZZ 294	59.69	0.64	13.03	5.14	0.12	3.37	14.76	0.85	2.42	0.14	100.16	265	143	36	17	85		124	414	111	33	122	248	2.80

An. No.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SUM	Ba	Cr	Cu	Nb	Ni	Pb	Rb	Sr	V	Y	Zn	Zr	LOI
Allschwil (PIC)																								
ZZ 295	63.12	0.68	13.41	5.39	0.12	2.79	11.39	0.89	2.42	0.16	100.37	290	122	34	14	72		126	350	95	36	108	285	0.90
ZZ 296	63.91	0.67	13.11	5.32	0.12	2.84	10.88	0.92	2.38	0.17	100.32	291	126	34	15	81		127	345	97	37	104	293	0.53
ZZ 298	60.07	0.66	13.76	5.36	0.12	2.93	13.79	0.77	2.53	0.14	100.13	307	123	246	16	71		132	387	94	34	110	248	1.03
ZZ 299	60.33	0.65	13.24	5.35	0.12	3.29	13.65	0.88	2.44	0.17	100.12	291	137	45	14	86		128	400	92	34	91	253	1.25
ZZ 300	61.20	0.65	13.19	5.27	0.12	3.09	13.18	0.86	2.40	0.15	100.11	295	131	41	14	81		127	384	92	35	232	262	0.67
ZZ 331	60.93	0.65	13.45	5.38	0.12	2.79	13.68	0.66	2.35	0.13	100.14	276	132	33	15	68	18	130	365	107	34	167	257	1.67
ZZ 335	63.37	0.68	12.99	5.13	0.11	2.86	11.56	0.86	2.33	0.13	100.02	291	126	33	16	77	21	125	346	91	37	162	290	0.56
ZZ 336	64.12	0.69	12.72	5.04	0.11	2.77	11.27	0.82	2.28	0.13	99.95	285	128	31	14	81	15	120	330	106	36	188	290	1.91
ZZ 337	63.51	0.69	13.62	5.18	0.10	2.73	10.85	0.80	2.38	0.14	100.00	300	126	33	16	76	20	130	325	103	34	188	275	1.77
ZZ 338	64.75	0.70	12.74	4.91	0.10	2.62	11.14	0.76	2.22	0.11	100.06	287	121	28	16	67	17	123	330	96	35	173	301	0.75
ZZ 339	63.06	0.68	13.16	4.98	0.09	2.88	11.72	0.78	2.29	0.13	99.77	286	143	711	15	82	19	127	337	101	34	184	281	1.52
ZZ 340	63.57	0.69	13.57	5.21	0.10	2.74	10.79	0.80	2.38	0.15	100.00	295	132	44	15	75	20	129	323	95	37	196	276	0.64
ZZ 341	60.29	0.65	13.45	5.55	0.12	3.04	13.41	0.83	2.41	0.13	99.88	281	136	45	14	85	19	125	365	180	34	166	256	2.79
ZZ 342	62.25	0.67	13.64	5.60	0.12	2.84	11.60	0.81	2.43	0.13	100.09	299	130	39	14	77	17	131	334	94	36	196	270	0.28
ZZ 401	62.92	0.72	13.54	5.21	0.10	2.63	10.50	1.32	2.38	0.14	99.59	312	131	28	18	72	24	119	299	154	22	103	246	0.61
ZZ 403	63.17	0.70	13.46	5.19	0.10	2.70	10.89	1.31	2.37	0.14	100.19	330	117	28	15	69	29	118	309	201	25	118	247	0.54
ZZ 405	64.42	0.71	13.03	5.08	0.12	2.58	10.67	1.28	2.27	0.08	100.41	446	109	27	13	70	23	114	307	226	22	80	262	0.56
ZZ 418	64.52	0.67	12.58	5.17	0.14	2.55	10.69	1.29	2.22	0.11	100.11	487	144	26	16	78	26	108	285	152	21	85	246	1.76
Allschwil (AZA)																								
ZZ 02	65.22	0.71	13.04	5.13	0.12	2.51	9.62	0.85	2.30	0.14	99.64	275	125	12	14	78	31	104	272	80	36	464	111	0.36
ZZ 05	65.30	0.70	13.02	5.20	0.12	2.56	9.61	0.89	2.31	0.15	99.86	285	125	7	15	81	32	103	274	93	37	59	107	0.59
ZZ 06	65.38	0.71	12.94	5.28	0.13	2.58	9.55	0.91	2.29	0.15	99.92	293	126	9	11	84	31	105	264	97	38	61	127	0.50
ZZ 07	65.99	0.71	12.80	5.23	0.13	2.61	8.92	0.96	2.25	0.14	99.74	309	138	8	12	85	34	101	258	79	37	64	141	0.27
ZZ 08	65.67	0.70	13.02	5.30	0.13	2.54	9.38	0.84	2.28	0.14	100.00	296	126	12	11	85	33	102	258	88	38	65	104	0.40
ZZ 15	65.83	0.71	12.96	5.40	0.13	2.70	8.68	1.00	2.28	0.17	99.86	297	135	8	12	89	37	100	253	83	41	1587	131	0.38

An. No.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	**MnO**	**MgO**	**CaO**	Na_2O	K_2O	P_2O_5	**SUM**	**Ba**	**Cr**	**Cu**	**Nb**	**Ni**	**Pb**	**Rb**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**LOI**
Allschwil (AZA)																								
ZZ 26	62.98	0.67	13.22	5.22	0.11	2.86	11.54	0.85	2.39	0.15	99.99	280	130	16	12	86	32	107	300	92	36	64	87	0.84
ZZ 36	60.32	0.69	14.12	5.61	0.12	3.09	12.51	0.76	2.57	0.14	99.93	286	140	17	13	90	35	122	343	103	35	64	101	1.19
ZZ 37	65.42	0.71	13.04	5.33	0.12	2.58	9.44	0.90	2.30	0.16	100.00	293	130	11	13	85	33	105	255	90	41	61	136	0.41
ZZ 38	60.20	0.68	13.73	5.42	0.11	3.18	13.16	0.85	2.51	0.14	99.98	861	126	13	11	85	38	114	367	99	36	66	76	1.17
ZZ 39	65.30	0.69	12.82	5.26	0.13	2.67	9.58	1.02	2.28	0.16	99.91	287	126	11	13	87	31	102	255	89	40	67	129	0.35
ZZ 195	61.77	0.67	13.78	5.47	0.12	2.93	12.16	0.81	2.46	0.14	100.31	313	127	38	16	81		132	347	97	35	96	262	0.59
ZZ 228	64.28	0.70	13.49	5.44	0.12	2.70	10.05	0.77	2.39	0.15	100.26	302	134	32	15	81	22	133	310	92	36	217	305	0.52
ZZ 229	63.08	0.68	13.16	5.13	0.12	2.83	11.58	0.94	2.45	0.15	100.28	289	124	33	16	75	20	129	316	97	34	182	287	0.40
ZZ 283	61.92	0.66	12.81	5.30	0.12	3.15	13.01	0.91	2.36	0.16	100.40	302	133	40	14	89	21	124	354	95	36	92	266	1.37
ZZ 398	68.95	0.72	12.78	5.26	0.12	2.06	6.47	1.33	2.13	0.11	100.08	436	138	26	15	68	24	110	202	74	28	87	311	1.14
ZZ 417	68.09	0.72	12.60	5.10	0.12	2.15	7.42	1.31	2.17	0.13	99.98	486	135	27	14	70	20	108	218	151	25	97	324	1.02
Laufen																								
ZZ 41	67.45	0.76	13.91	5.22	0.10	2.01	7.08	0.63	2.53	0.16	99.85	1165	167	<5	12	90	29	115	199	98	35	59	81	1.38
ZZ 42	66.92	0.78	14.37	5.68	0.10	1.96	6.44	0.58	2.58	0.17	99.58	2185	167	<5	16	95	33	117	205	108	37	67	90	1.27
ZZ 43	67.51	0.77	14.05	5.25	0.10	2.02	6.70	0.62	2.56	0.17	99.75	1158	168	<5	16	92	38	115	196	109	37	60	82	1.35
ZZ 96	62.74	0.71	13.25	5.66	0.14	2.57	12.23	0.44	2.35	0.15	100.24	309	159	17	12	101	37	120	284	94	41	86	92	0.39
ZZ 132	68.80	0.66	13.61	5.53	0.13	1.98	6.46	0.57	2.49	0.13	100.36	372	188	28	15	114	25	144	186	92	34	88	232	0.41
ZZ 154	65.55	0.77	15.06	5.89	0.12	2.19	7.00	0.56	2.64	0.18	99.96	1668	166	29	16	92	28	147	246	104	38	106	253	0.95
ZZ 155	67.27	0.66	13.45	5.47	0.13	2.14	7.85	0.51	2.48	0.13	100.09	397	181	29	14	111	27	141	213	89	35	85	230	0.28
ZZ 156	67.26	0.68	13.45	5.46	0.12	2.13	7.91	0.54	2.44	0.13	100.12	352	169	30	15	105	29	141	209	116	35	86	254	1.38
ZZ 157	67.70	0.68	13.68	5.55	0.13	2.13	7.30	0.53	2.50	0.14	100.34	375	170	30	15	109	25	145	205	98	36	87	248	0.40
ZZ 176	66.05	0.70	13.35	5.08	0.12	2.34	9.26	0.56	2.42	0.16	100.04	350	170	30	16	96	20	141	246	93	38	88	267	1.34
ZZ 250	70.96	0.75	12.78	5.76	0.17	1.70	5.40	0.54	2.08	0.12	100.42	379	164	86	14	86	27	124	157	90	39	166	327	0.36
ZZ 251	64.72	0.72	13.42	5.76	0.13	2.27	9.76	0.45	2.22	0.15	99.75	329	153	32	15	95	22	134	254	99	41	177	281	0.44
ZZ 301	68.43	0.74	13.46	5.62	0.12	2.03	7.11	0.53	2.29	0.13	100.46	342	165	29	16	93		140	195	93	38	94	300	0.47
ZZ 302	68.01	0.73	13.45	5.64	0.13	2.05	7.23	0.54	2.31	0.13	100.22	351	164	24	16	92		140	198	92	37	177	288	0.43

An. No.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	**MnO**	**MgO**	**CaO**	Na_2O	K_2O	P_2O_5	**SUM**	**Ba**	**Cr**	**Cu**	**Nb**	**Ni**	**Pb**	**Rb**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**LOI**
Laufen																								
ZZ 308	64.34	0.81	15.42	6.18	0.10	2.22	7.38	0.47	2.67	0.19	99.78	1690	151	23	18	82		142	257	119	39	127	277	0.59
ZZ 343	64.95	0.71	13.24	5.73	0.14	2.31	10.01	0.41	2.25	0.15	99.90	317	158	31	15	91	37	135	258	95	37	186	280	0.39
ZZ 388	64.98	0.68	14.19	5.44	0.12	2.33	8.56	0.43	2.47	0.13	99.47	355	172	30	13	100	21	141	201	97	13	91	180	
ZZ 397	65.33	0.75	14.02	5.69	0.11	2.36	8.11	1.09	2.49	0.14	100.25	429	154	26	16	89	23	128	216	90	24	90	233	0.93
ZZ 400	64.65	0.76	14.01	6.03	0.12	2.34	8.29	1.06	2.48	0.16	100.04	362	175	24	14	88	24	129	220	136	23	89	234	0.68
ZZ 402	65.94	0.73	13.57	5.54	0.11	2.36	8.20	1.15	2.41	0.15	100.32	477	162	32	15	91	23	128	214	157	23	86	233	0.44
ZZ 406	65.35	0.74	14.02	5.70	0.11	2.38	8.15	1.09	2.50	0.14	100.35	482	165	24	15	92	24	132	215	175	23	88	235	0.70
ZZ 407	65.24	0.73	13.49	5.53	0.12	2.35	8.25	1.12	2.38	0.14	99.52	467	171	26	16	84	41	129	219	90	22	85	241	0.84
ZZ 410	64.84	0.72	13.46	5.45	0.12	2.45	9.01	1.14	2.36	0.15	99.86	585	183	25	14	85	24	128	228	134	22	84	238	0.76
ZZ 411	66.08	0.74	13.49	5.44	0.12	2.27	7.73	1.15	2.35	0.17	99.71	481	162	29	17	82	23	122	201	186	23	84	250	1.96
ZZ 414	65.28	0.76	13.80	5.60	0.12	2.40	8.42	1.12	2.41	0.17	100.23	530	180	29	14	86	20	124	220	71	24	85	237	0.89
ZZ 415	65.82	0.75	13.59	5.52	0.12	2.38	8.13	1.16	2.38	0.16	100.14	448	198	23	16	83	18	127	214		25	83	241	0.68
ZZ 416	65.38	0.75	13.94	5.69	0.11	2.40	8.30	1.10	2.48	0.15	100.47	405	208	27	15	88	26	131	223	215	25	88	234	0.55
ZZ 419	65.40	0.74	13.53	5.50	0.12	2.42	8.26	1.14	2.36	0.17	99.80	562	183	24	15	82	20	125	215	19	22	84	246	1.79
ZZ 421	65.69	0.75	13.75	5.61	0.12	2.36	8.14	1.13	2.41	0.17	100.26	457	165	25	15	81	23	128	214	55	24	84	247	0.70
ZZ 422	66.17	0.74	13.77	5.58	0.12	2.30	7.78	1.16	2.41	0.15	100.33	362	217	26	15	88	25	129	205	81	24	88	237	0.95
ZZ 423	66.14	0.74	13.58	5.65	0.12	2.19	7.11	1.12	2.41	0.17	99.38	355	171	26	15	85	26	127	193	92	24	87	248	3.29
ZZ 424	65.75	0.71	13.55	5.42	0.11	2.30	8.05	1.17	2.39	0.15	99.73	266	160	25	15	89	23	127	212	66	24	85	232	1.06
ZZ 426	64.89	0.76	14.13	5.99	0.12	2.33	7.98	1.07	2.45	0.14	100.04	541	171	25	17	86	22	129	214	136	25	88	238	0.76
ZZ 427	66.63	0.73	13.54	5.55	0.12	2.31	7.73	1.18	2.35	0.15	100.46	619	151	31	14	86	22	126	203	151	25	85	236	1.24
ZZ 428	61.61	0.76	16.16	5.89	0.13	2.91	8.71	0.78	2.37	0.22	99.32	500	200			100		150	250	250	<100	100	350	1.71

Table 8.9: *XRF analytical results of 95 roof tiles from the factories in Allschwil and Laufen. Oxides, total and loss on ignition (LOI) in wt.%, trace elements in ppm.*