Rolf Snethlage

**History and production sites of Roman Cement in Germany**

**Introduction**

The history of cement production covers a range of roughly 100 years. After Smeaton’s discovery (1724-1792) of hydraulic reaction of burnt clay-containing limestone and its use for the erection of Eddystone lighthouse in 1774 (Meyers Konversationslexikon 1885-1892), about 20 years later a patent has been issued to James Parker in 1796 for the production and sale of a natural cement which he had called Roman Cement to recall reference to Roman opus caementitium (British patent No 2120/1796).

Also the early Portland Cement for the first time produced by Joseph Aspdin (1778-1855) by mixing limestone and clay in an appropriate ratio has been burned at temperatures below sintering temperature and did not reach the strength necessary to be classified as “Portland Cement” according to present standard. Later in 1834, the son of Joseph Aspdin, William Aspdin started the production of Portland Cement in a new factory in London. This product had much better quality than the first Portland Cement of his father because it probably contained large quantities of sintered matter. It is, however, difficult to assess whether William Aspdin’s Portland Cement already can be already be classified as real Portland Cement because the decisive importance of the sintering process for “real” cement production was not known until Isaac Charles Johnson (1811-1911) description of cement burning until sintering temperature in 1844 (Brunsch 2007).

For these reasons Locher (2000) concludes that until 1844 the factories in England produced only high hydraulic lime, in principle Roman Cement but not real cement. The same conclusion is also valid for the situation in Germany. The first German Portland Cement factories according to English examples have been erected in Buxtehude (1850), Züllchow near Stettin (1855) and in Oberkassel near Bonn (1858).

However, during 19th century separation of highly hydraulic lime, Roman Cement and real Portland Cement has not been strict because of the lack of knowledge and defined standards. In Germany, only by the work of Wilhelm Michaelis (1868) who for the first time made clear prescriptions for the best composition of the raw material and also proposed 17 tests for testing Portland Cement (www.vdz-online.de/316.html), the clear separation between Roman Cement and Portland Cement was possible.

Nevertheless in Germany Roman Cement and Portland Cement were produced likewise until end of World War I. Decorative elements for buildings therefore were made with either materials so that today assessment whether a building element is made from Roman Cement or Portland Cement can only be made by analytical proof because any archival documents and historic product descriptions are not reliable.

The examples of building ornamental elements reported here can either consist of Roman Cement or of Portland Cement because in neither case a analytical proof is available. Like in
other European main cities numerous buildings from Gründerzeit and Historismus in Germany document the vast use of quick hardening cement materials for building purposes.

History of Roman Cement Production in Germany
Brunschi (2007) gives an account of first Roman Cement production in Munich by E. Panzer in 1832, however, without identifying the source of information. Regarding the situation in Munich, raw material for Roman Cement production must have been either transported by rafts down Isar river from Bad Tölz or directly collected from marl pebbles of the Isar valley in Munich, probably reddish coloured marl from Upper Creatceous (Grundmann & Scholz 2006). For the reason of transport problems the quantities produced must have been rather small.

Around 1835 Gustav Leube published a treaty about the geological situation in the surrounding of Ulm situated at Danube river (Baden-Württemberg). The results of his investigation laid the foundation for the erection of a cement factory in Ehrenstein in 1838. The marl for cement fabrication has been broken in Gerhausen near Blaubeuren (Haegemann, Huberti & Möll 1964). This fist cement factory formed a nucleus for concrete and prefabricated compounds production in this area which in principle is still existing today.

In 1845 A. Kroher founded a factory for cementitious roof tiles in Staudach near Wangen (Allgäu/Bavaria).

Meyers Konversationslexikon (1885-1892) lists some occurrences of marl in Germany which are assessed appropriate for cement production:
Upper Cretaceous marl layers along the edge of the Alps which stretch from west near Bodensee lake to east near Salzburg. Consequently one of the first production sites for Roman Cement has been erected in Kufstein where Franz Kink for the first time produced Roman Cement in 1847.

Furthermore marl occurrences near Altdorf (near Nürnberg), Kulmbach, county Glatz in Silesia and Horb (Baden-Württemberg) are mentioned.

In general, marl layers which may be appropriate for Roman Cement production are mainly connected with the Lias formation in the Jurassic. The main occurrences of Lias in Germany are found in southern Germany (Baden-Württemberg and Bavaria). Smaller occurrences are found the northern edge of Weserbergland in Lower Saxonia and on the edge of Harz mountains in Thuringia. Roman Cement and cement production are therefore highly linked to these occurrences.

Haegemann, Huberti & Möll (1964) report that from 1842 onwards the cement factories in northern Germany produced Roman Cement according to English example with raw material directly imported from England.

In Berlin, for more than 750 years Rüdersdorfer Limestone, a pure limestone from geological Shell Limestone formation has been used for making burnt lime. However, Roman Cement for the production of decorative façade elements has been imported either directly from England or from factories situated in northern Germany on the coastline. Still in 1853 the Hamburg harbour imported 125.346 Zentner (1 Zentner = 50 kg) of various cement and Trass, among it 51.854 Zentner from England (Becker 1869).
One of the best known production sites is Marienstein near Tegernsee lake in southern Bavaria (Timm 2003). In 1850/1851 two kilns and a grinding unit have been erected. The raw material, grey-green marl, has been quarried in galleries and later in two quarries (Am Kessel and Hotzeralm). In 1852 Mr. Deuringer obtained the permission for mining coal in the direct vicinity of the marl quarries. This way the site Marienstein owned not only the marl for the Roman Cement but also coal as an energy source for the burning process.

Until 1901 mining and Roman Cement production have been run by Gewerkschaft Marienstein (Marienstein Union) and Bayerische Portland Cement Factory Marienstein AG. In 1901 the Portland Cementwerke Heidelberg Mannheim AG acquire a 75% investment of Marienstein Cement Factory. In 1931 Portland Cementwerke Heidelberg Mannheim completely take over Marienstein Cement Factory, however, sell the company to the State of Bavaria in 1946. In 1950ies Süd Bayerische Zementwerke Rohrdorf (near Rosenheim Bavaria) acquires a 50% investment, some time later the full investment of the Marienstein Zementwerke. Up to 300 people have been employed. The production in Marienstein continues until 1998 when the whole factory is closed. The products produced in Marienstein have been Mariensteiner Roman Cement, Mariensteiner Roman Lime and Mariensteiner Zement.

For Thuringia and Lower Saxony I have currently no information available.

Examples of Roman Cement in Germany
As pointed out in the introduction there has been extensive use of prefabricated decorative elements for building facades in Germany during the second half of 19th century. Decorative elements of this kind have been produced with real Roman Cement or with Portland Cement and precursors of it. However, because of the inexplicit labelling or description of the materials and due to the lack of analytical proofs it is nearly impossible to verify which one of the materials really has been used.

The examples presented below therefore do not confirm the use of Roman Cement but rather present examples where Roman Cement could be used for the repair or the cast of new decorative elements.

The use of cast decorative elements made with Roman Cement mainly refer to the architecture of Gründerzeit and Classicism which prevails in the new quarters which have been erected around the old historic city centres. At that time, Roman Cement had to compete with cast decorative elements made with Zink, terracotta or natural stone.

Huge quarters of Gründerzeit buildings can be found in nearly every German town, for instance in Munich, Berlin, Leipzig, Dresden, Frankfurt, Hamburg and so on. A very spectacular example of Gründerzeit buildings is the city of Görlitz (Saxonia Germany), in particular because it has not been destroyed in World War II so that the entire city forms a excellent ensemble of historic architecture.

The map of Munich demonstrates that the new town quarters of the 19th century can have very remarkable size; by far they exceed the size of the historic centre.
In many of streets of the new quarters classicistic buildings with prefabricated decorative elements can be found. The ensembles of Ludwigstraße and Maximilianstraße provide an interesting sight on the developments in architectural design.
The Siegestor has been erected 1843-1852 by architect Friedrich von Gärtner. The brick construction of the gate is clad with massive 60cm thick stone blocks of limestone from Kelheim (Bavaria). Also the columns its capitals consist of the same limestone. The reliefs are made from Carrara and Laas marble. The whole gate is in the tradition of Roman victory gates and is therefore completely made from natural stone.

The buildings along Ludwigstraße provide excellent examples of classicistic design. Most facades are decorated with prefabricated elements. The facades of the University building (finished 1840) are made with plaster into which joints of virtual stone blocks are imprinted. The typical shrinking cracks within the plaster seem to indicate Roman Cement. A proof for this is, however, not available. It has also been taken into account that many of the buildings including the University building have been destroyed during World War II so that original plasters are quite rare.

The virtual stone blocks on the pediment of the Staatsbibliothek (State Library) erected 1832-1843 by Friedrich von Gärtner are clearly prefabricated elements. They consist of a strong and coarse mortar in the interior which is covered with two layers of fine mortar. The consistency of these mortars, however, is very soft so that the use of Roman Cement is rather unlikely.

The building of the Akademie der Schönen Künste (Academy of Fine Arts) has been erected 1876-1885 by architect Gottfried von Neureuther. The building is around 150 m long and 25 m high. Its facades are decorated with many various classicistic elements. Of particular impression are the consoles under the roof and the friezes of mythical figures and vegetable decorations. In contrast to the Siegestor, also the capitals of the columns are cast and hollow prefabricated elements. The strong material of the friezes is of grey colour. Its hardness clearly reaches the strength of Roman Cement Products. A analytical proof for the kind of material the friezes is made from is, however, missing.
The ensemble of Maximilianstraße provides interesting examples of the materials which were concurring with Roman Cement during this time: terracotta and Zink. The building of the Regierung von Oberbayern (Government of district Oberbayern) was erected 1856-1864 by architect Friedrich Bürklein. The facades of the 180m long and 29 m high building are completely clad with terracotta tiles and prefabricated decorative elements. The inner side of the arches in the ground floor are decorated with rosettes which are also made from terracotta.

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<tr>
<th>Munich. Academy of Fine Arts. View of the central part of the building.</th>
<th>Detail of the fries which is probably made with Roman Cement.</th>
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Munich. Building of the government of district Oberbayern in the Maximilianstraße
Opposite to the Regierung von Oberbayern in the Maximilianstraße the Völkerkundemuseum (Ethnological Museum) is situated. It has been erected 1859-1865 by architect Eduard Riedel and has been first intended the Bayerisches Nationalmuseum (Bavarian National Museum). It turned, however, out that the building was too small to hold the quickly growing stock of the National Museum. For this reason a new National Museum Building has been erected in the Prinzregentenstraße and the building in the Maximilianstraße has been decided to hold the collection of ethnology.

The facades present an interesting mixture of design. The main entrance gate is made from coarse grained sandstone from geological formation Rät which quarried in northern Bavaria. The sculptures and the canopies as well as the crowning figure on top of the façade are made from Zink the surface of which if painted with yellow oil paint to resemble sandstone. On the other hand the decorative elements below the windows consist of prefabricated cast material the nature of which is, however, unknown. It may be possible that they are made from Roman Cement.

**Current production sites and suppliers for Roman Cement in Germany**

There is no current production of Roman Cement in Germany.

Suppliers for Roman Cement in Germany are:

Oswald Sakowski GmbH
Riedstraße 14
71691 Freiburg
Germany
Phone: 0049-(0)7141-688759-0
Fax: 0049(0)7141-707478
Kremer Pigmente
Hauptstraße 41-47
88317 Aichstetten
Germany
Phone: 0049-(0)7565-9112-0
Fax: 0049-(0)7565-651606
info@kremer-pigmente.de, www.kremer-pigmente.de
Kremer Pigmente supplies Roman Cement from Grenoble (probably also Vicat Prompt)

Mariensteiner Kalk currently supplied by Rohrdorfer Zementwerke is no Roman Cement any more but corresponds to a HL 5.

**Economic perspectives for the use of Roman Cement**

The facades of classicistic buildings in German main cities probably total to several hundred kilometres. Therefore the potential for Roman Cement use should be very high. However, it has to be taken into account that by far most of the facades have been recently renovated so that the potential for Roman Cement dramatically diminishes. Statistics about the methods of restoration and the materials used are completely missing. It can, however, realistically assumed that besides minor repair by new decorative elements for filling obvious gaps the greater part of the Roman Cement elements has been repaired with cement mortars and afterwards painted.

While at the time of the fall of Berlin Wall in the former DDR about 98% of the buildings were neglected, today may be only 2-5% of buildings and facades need immediate repair. An elucidating example is the city of Görlitz. Its 19th century quarters with overwhelmingly beautiful classicistic buildings have been perfectly restored in recent years in a kind of preventive conservation for the future. Nevertheless the apartments are empty because population of Görlitz has strongly reduced since reunification.

In an overall view the potential for Roman Cement use for restoration seems rather limited. In relation to the present production capacities of Roman Cement its application seems a promising niche.

It is the task of ROCARE to make Roman Cement known to relevant stakeholder groups like architects, restorers, building authorities in government and communities.

**References**