CALOFRIG: THE MIRACULOUS BUILDING MATERIAL OF INTERWAR CZECHOSLOVAKIA

ALEXANDER KURIC

Czech Technical University in Prague, Faculty of architecture, Department of theory and history of architecture, Zelená 10, 16000 Prague, Czech Republic
Tutor: prof. Ing. arch. Matúš Dulla, DrSc.
ORCiD: 0000-0002-5456-2848
akuric@email.cz

ABSTRACT: During the first post WW1 decade, several new building materials sought to secure a place on the turbulent market. One of them was Calofrig, made out of diatomaceous earth from a deposit in South Bohemia. It gained favour with the Modernists, who viewed it as a lighter, faster and more efficient building material for the new era. Although its production continued into the late 20th century, its high popularity quickly peaked, and soon it was eclipsed by other materials perceived as more suitable.

KEY WORDS: Calofrig, Isostone, Borovany, Modernism, insulation, diatomite

Introduction

During the early 20th century, architecture underwent a period of intense experimentation and efforts to establish new ways of building that would match construction with the possibilities allowed by industrial production (Witzanyová-Kroftová K., 2004). The call for this was coming strongest from the camp of the avant-garde Modernists, who saw it as one of their missions to see architecture transformed from a craft-based endeavour to one based on industry. One of the important topics of the building related discussion of the era was thermal insulation, where great potential for rationalisation and economisation was anticipated (Koula, 1931). Thus many
construction innovations were related to keeping heat in or out of buildings in novel ways, for which a myriad of material solutions emerged. The main distinction was either their organic or inorganic origin, with the latter being seen as more desirable in terms of durability (Dahl and Wedebrunn, 2006).

Czechoslovakia, as a country with a strongly developed industry, had the potential to add its own contributions to this development. Indeed, several insulation materials of domestic origin appeared during the interwar era. Of these, perhaps the most unique as well as one of the first to reach great heights of popularity was Calofrig. This material depended on mineral deposits that were not commonly found in sufficient quantity (Cukr et al., 2020); thus, the fact that the country possessed these deposits in this particular era provided an unique opportunity. The history of the mining activity and the growth of the Calofrig company has been recently researched (Cukr et al., 2020). This paper aims to explore in more detail the development of Calofrig as a building material, and the way it interacted with the turbulent architectural development of the interwar era. This history is reconstructed primarily through the architectural publications of the era, as well as archival sources related to the Calofrig company.

**From Southern Bohemia towards the world**

The Calofrig company officially came into being in 1921 as a fusion of several pre-existing factories. The one with which the Calofrig brand came to be chiefly identified was located near the (then) village of Borovany, South Bohemia. In the area, large deposits of diatomite had been exploited since the late 19th century. However, more intensive operations dated only from 1907 onwards, with the economic hardships of WW1 causing a break in production. With the formation of the new Czechoslovak state, the operations resumed as the disjointed pre-war enterprises fused into the new Calofrig company (Cukr et al., 2020).

Diatomite is a type of rock composed mainly of shell remains of single-celled organisms called diatoms. What makes them interesting for construction is the fact that these silica-based shells are highly porous. [Fig. 1] Thus, combined with a suitable binding agent, they make a good material for thermal insulation. Calofrig used lime and cement for binding with chemically treated sawdust as additional filling. The mixture was then pressed using steam and, once dried, the material was ready for use (Skrbek, 1933). The very fact that the company chose to use the same name for itself and the material hints at the perceived importance for its business operation. The name (*calorie, calor + frigus, frigid*) clearly carries a reference to heat, energy and insulation. [Fig. 2]
The stated thermal conductivity value of Calofrig was $\lambda = 0.11-0.27$ kcal/m/h/°C \(^1\) (Skrbek, 1933), between $\frac{1}{6}$ to $\frac{1}{3}$ of the $\lambda$ of a fired brick. The value could vary depending on the particular composition of the mixture, though, unsurprisingly, in its marketing the company only ever presented the lower end of the value (Calofrig, 1931). At first, Calofrig was offered in boards of 2-8 cm thickness. In 1925, another key product was added: a hollow block made of the same material named Isostone (Cukr et al., 2020). It had a rectangular shape, with dimensions of 25×49×24 cm and two vertical cavities separated by a partition in the middle. [Fig. 3] The larger dimensions and light weight were meant to speed up construction and save building costs. The cavities served as additional insulation, and to that end, every 3\(^{rd}\) or 4\(^{th}\) row a barrier (tar paper or blocks with a closed bottom) was inserted so that air couldn’t circulate inside, which would worsen thermal properties (Stavby z tvárnic Isostone, undated; Skrbek, 1933). Alternatively, the cavities could be left without the barriers and filled with reinforced concrete, creating a unique skeleton solution that eliminated the need for formwork.\(^2\)

1920s: The Golden Era

As discussed above, the introduction of Calofrig was perfectly timed to meet a demand for new ways of building. The centerpiece of the discussion was the “problem of the thick wall”: the idea that traditional load-bearing brick walls were built unnecessarily large due to insulation requirements, which could be fulfilled more efficiently, with less weight and thickness, using materials of a higher thermal resistance. The perceived solutions were twofold: either to completely separate the structure into a load-bearing skeleton with an insulating infill, or to at least design the load-bearing walls with the minimal structurally possible thickness and provide thermal resistance with an insulating layer (Koula, 1931).

The Calofrig products could do both, and its inorganic origin and being fireproof were seen as additional benefits. Thus, as the inhabitants reported positive experiences with the first Calofrig houses in Borovany (Cukr et al., 2020), the material quickly caught the attention of the Modernists, who were eager to finally abandon what they saw as medieval building methods. In the late 1920s, there seemed to be an explosion of interest in the new product. [Fig. 4] Calofrig boards were used for insulating roofs, walls, as well as for inner partitions, while Isostone was used as an infill for skeletal frames or, in smaller buildings, as structural formwork. An ad in a 1929 newspaper boasted that 6,2 million square metres of Calofrig had already been installed in Czechoslovakia (Technika a průmysl, 1929), and even after the Depression hit, the company reported a profit of almost half a million crowns and a demand which it couldn’t keep up with (‘První dividenda akc. spol. Calofrig’, 1929).
Among the more famous examples where Calofrig was used around this time was the 1928 New House exhibition in Brno, where the majority of the houses were built with Isostone (Chatrný et al., 2018). The houses of Josef Havlíček and Oldřich Starý, built inside the Brno exhibition grounds, used the same system, with Starý noting that he had originally considered ceramic blocks but in the end opted for Isostone (Starý, 1928) [Fig. 5]. Solely as an infill for load bearing brick pillars, Isostone was also used on Pavel Janák’s pavilion (Janák, 1928) in the same exhibition. A while later, Bohuslav Fuchs used Isostone in the Masaryk Student Housing building. In Prague, some of the more prominent examples of its use include the Chicago palace by Jaroslav Polívka, the Ferra palace, the Kotva palace and Karel Hannauer’s Arosa pension. [Fig. 6] Examples could also be found in towns such as Kutná Hora and Česká Třebová.

Besides the projects actually built, there were also many unbuilt designs which involved Calofrig. For example, Karel Honzík used Isostone in his 1928 proposal for a minimum apartment unit. Many more were presented in the journal Stavební rádce, which often published project designs by young architects seeking to establish their name: in the 1928 and 1929 volumes, 14 different projects for family houses with Isostone appeared, some of them by Modernists who later became famous such as J. Štursa and J. Hrubý. Thus, for a time, it appeared that Calofrig had secured a definitive position as the material of choice for Modern architecture. Some even went as far as to include Calofrig along with concrete and glass as the core indispensable tool of modern construction (Bloch, 1928). Advertisements for Calofrig were printed in the most prominent avant-garde architecture publications, such as Karel Teige’s Moderní soudobá architektura (1930) [Fig. 7] and Jan E. Koula’s Obytný dům dneška (1931). Calofrig also participated in the construction exhibitions in Prague and Brno in 1932 and 1933, and ads for its products appeared in both resulting catalogs.

1930s: The End of the Reign

Soon however, it turned out the position of Calofrig wasn’t as invincible as the company hoped. First, there was the Depression, which hit the entire construction industry in one way or another; while in 1929 the company could still enjoy profits and even export abroad, by 1932 there was a reported deficit of almost 5 million crowns (Cukr et al., 2020). More importantly, as enough experience could be gathered over time, it appeared there were problems with the material that were not initially apparent. As more awareness began to spread of the problem of thermal bridges in skeletal construction, attention was raised to the fact that the concrete pillars poured inside the Isostone blocks created thermal weak points (Kuric, 2022), and the large 18 cm cavities may have begun to appear as insufficient insulation as the development led towards creating more and smaller insulation chambers in building blocks (Dahl & Wedebrunn, 2004). Further
ther, the material was sensitive to humidity, and could degrade quickly if exposed to it excessively (Dovrtěl, 1940).

But ultimately, it wasn’t a single flaw or event that dethroned Calofrig. What happened is that new types of blocks and insulation materials appeared on the market – and some of them simply offered more. What we see in the architectural journals of the 1930s is references to Calofrig appearing with ever less frequency, their place being taken by increasingly sophisticated ceramic blocks (which had always been a strong competitor) or various types of aerated concrete, which offered better thermal resistance. The process took place quietly, but so quickly that in 1938 one building contractor remarked that nobody really builds with Calofrig anymore (Tůma, 1938). Calofrig didn’t disappear: the boards and blocks were produced into the 1990s, and the factory grew under the socialist regime (Cukr et al., 2020). But its focus shifted more towards industrial-use insulation (which had always been an important part of the company’s portfolio); as a building material, Calofrig never again reached the prominence that it held among forward-thinking architects in the late 1920s.

**Discussion**

It was the fate of many of the construction innovations of the period that their experimental nature led only to a limited lifespan. This can certainly be applied to Calofrig to a certain degree: its widespread popularity lasted no more than ten years, after which better solutions largely replaced it. However, to call the material a short-lived experiment would be to ignore more than 70 years of its active production. A fair assessment would need to include the fact that, for a while, Calofrig filled a much appreciated niche to a degree that was deemed satisfactory at the time, playing a key role in the architectural development of the period; and even though not flawless, its flaws were not severe enough to completely negate the positives it offered. Thus, it eludes a one-sided conclusion.

We could conclude that the decline of Calofrig came about as a result of its material properties, and was thus inevitable. But other questions can be raised, such as what was the role of marketing in which interwar innovations succeeded and which did not, or on the other hand, what developments could have taken place had the later communist government not put such a restrictive emphasis on concrete prefabrication. The other interwar domestic materials that were competitors, such as the many types of ceramic blocks, aerated and pumice concrete or wooden fibre boards, would similarly deserve a closer look for a fuller comparison – especially given that, unlike Calofrig, some of them are being used in construction to this day.
Conclusions

The paper deals with the development of Calofrig, a diatomite-based insulation produced in inter- and post-war Czechoslovakia, as a material of choice for the nascent Modernist architecture. After its introduction on the market, it saw an explosive growth of popularity, reaching a peak in the late 1920s. Afterwards, it began to decline, eventually being overshadowed by other materials seen as more advantageous. The paper discusses the importance of the material for the avant-garde, who briefly considered it a material of the future for the entirety of Modern architecture, but just as quickly abandoned it once better solutions appeared. This story illustrates how the industry of the era attempted to answer the calls for the modernisation of building methods, and how rapidly the criteria for success could change.

Figure 1. Microscopic image of diatom shells. Source: Třeboň state archive, České Budějovice department.
Figure 2. An undated advertisement for Calofrig products. Source: Třeboň state archive, České Budějovice department.
Figure 3. An ad for Isostone blocks showing their shape. The side grooves help the fixation of plaster. Source: Třeboň state archive, České Budějovice department.
Figure 4. An apartment house in an undisclosed location being built with Isostone blocks. Source: Třeboň state archive, České Budějovice department.

Figure 5. A drawing detailing the construction of Oldřich Starý’s exhibition house. The way the concrete frame is inserted into the Isostone blocks is shown. Source: Výtvarné snahy, 1928.
Figure 6. Another way of using Isostone blocks, where they function as infill for a separate concrete frame. Source: Třeboň state archive, České Budějovice department.
Figure 7. “Modern architects design frame construction with light insulation walls Isostone.” A Calofrig advertisement. Source: Moderní soudobá architektura, 1930.

Footnotes

[1] Roughly 0,13-0,31 W/mK.
[2] This is what contrasted Isostone with the competing diatomite “Petráš” blocks, which had a thermally more advantageous T shape with more chambers, but didn’t allow for the inner concrete frame.
[3] The journal also published more conservative projects, which relied on the traditional brick.
[4] Also, subsections of the factory made other products, such as cork and glass wool.

Reference list


Stavby z tvárníce Isostone. Calofrig a.s., carton 1, Třeboň state archive, České Budějovice department.

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