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Myths of the Origins of Modern Concrete

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Myths of origin have their moments. An origins myth that suits one epoch cannot be relied upon to serve another. No better demonstration is there of the time-bound nature of myths of origin than those attaching to concrete.

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When we talk about concrete, we need first of all to distinguish between the substance invented by the Romans, using naturally occurring pozzolana as a binding agent, the art of which was partially lost sometime after the fall of the empire, and the modern stuff, made with manufactured cements, invented in the early nineteenth century. But whether we are referring to the ancient or the modern material, it has been a notoriously myth-attracting substance—myths of all kinds, not only of origins, stick to it like flies to flypaper. Even before the modern reinvention of concrete in the nineteenth century, there were stories of the existence of artificial concretes in ancient, even prehistoric times: the myth *preceded* the substance. In the sixteenth and seventeenth centuries, the great works of antiquity and of prehistory—the Pyramids, Stonehenge, Egyptian obelisks, objects such as Pompey's Pillar in Alexandria, a monolithic 29-meter column—were widely thought to have been formed in situ out of an artificial stone, the secret of which was known only to the ancients: for how else could such large pieces of stone have been quarried and transported? Even after these myths were refuted in the eighteenth century, they continued to be repeated, if only to be denied. A residual credence in the *pierre fondue* of the ancients became an incentive to discover a modern equivalent, as was to happen in the early nineteenth century. [1] Modern concrete was, therefore, in part a rediscovery of a material that had never existed other than in people's minds.

Origin myths did not cease with the modern invention of cement. On the contrary, they multiplied, and the new concrete of the nineteenth century gave rise to successive versions of who invented it, where, and when—each of which is as inconclusive as the other. What makes the existence of so many versions of the story surprising is that, for most of its short history, it has generally been more important for concrete *not* to have a history than it has been for it to have one. Concrete is an *anti*-historical medium. Compared to, say, stone, which is a *historical* medium, concrete has been valued precisely because it is *not* encumbered by a history. Concrete has often been talked about as a medium whose full potential has not yet been realized, a medium that belongs to the future rather than to the past. The attention has tended to be on its *destiny*, on what it is yet to become, and in this is

1 Roberto Gargiani, *Concrete—From Archeology to Invention, 1700–1769: The Renaissance of Pozzolana and Roman Construction Techniques*, trans. Stephen Piccolo (Lausanne: EPFL Press, 2013), ch. 1, esp. 12–18; Adrian Forty, "Pompey's Pillar," in *Images of Egypt*, eds. Mari Lending, Eirik Arff Gulseth Bøhn, and Tim Anstey (Oslo: Pax, 2018), 156–57.

seen its value as a "modern" material. [2] In these circumstances, to admit that concrete has a past—and thus draw attention to its origins—amounts to something of a betrayal.

An event so recent as the invention of concrete might not be thought to pose much difficulty of historical explanation—but the matter turns out to be far from straightforward. We have to bargain with the tendency of concrete to throw all certainties to the wind. Broadly speaking, during the twentieth century there have been three versions of the story of the origin of modern concrete. Although they overlap chronologically and more than one has been current at a time, they are roughly sequential, with each bearing the marks of the time of its making. The oldest identifies the origins of synthetic cement, concrete, and the addition of steel reinforcement, with a cast of named individuals. The second, which dates from the 1960s, shifts the origins to anonymous craft procedures and processes. The third emerged in the 1990s in the shadow of Michel Foucault's thinking about the sciences, and may, given Foucault's resistance to all notions of origins, mythical or otherwise, be considered something of a paradox.

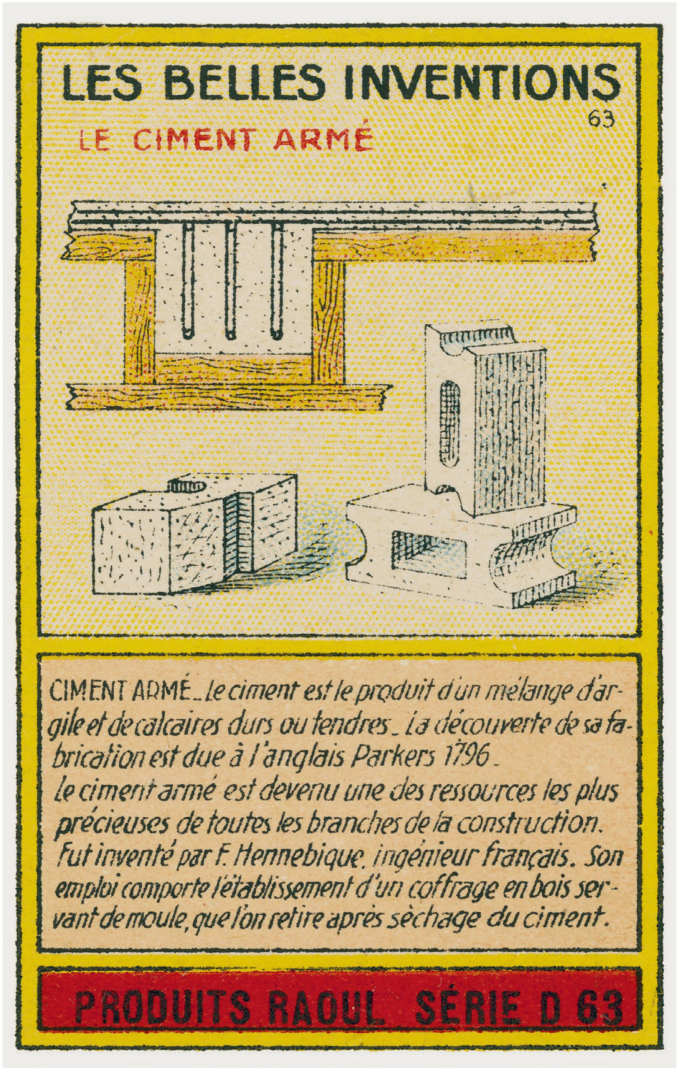


fig. 1 Origins in individuals. Early twentieth century French advertising card citing François Hennebique as the inventor of reinforced concrete.

For most of the twentieth century the customary story (and it is still often repeated) was that concrete came into being through the inventions of several individuals whose discoveries followed a progressive sequence. First, we have the discovery of hard, hydraulic-setting cement by chemists, principally Joseph Vicat in France, followed by the development of industrial manufacture of cement by an English entrepreneur, Joseph Aspdin. Then comes the application of cement to building and other kinds of construction by a diverse cast of characters such as François Coignet in France, James Pulham in Britain, and Thomas

2 See Adrian Forty, *Concrete and Culture: A Material History* (London: Reaktion Books, 2012), ch. 3.

Edison in the United States—but the list is extendable. Finally comes the development of steel reinforcement, attributed to yet another cast of characters, starting with Joseph Lambot's iron-reinforced boat exhibited in 1849 and including the Frenchman Joseph Monier's patent for iron-reinforced flowerpots; the English engineer James Wilkinson's use of steel cables as reinforcement; the American William Ward, who first identified the need to place metal bars in the lower part of beams to increase their tensile strength; and another American, Thaddeus Hyatt, who showed that cement and steel have the same coefficients of expansion. For the first reinforced concrete buildings there are other contenders: the German Gustav Adolf Wayss, who bought Monier's patent; the Belgian contractor François Hennebique; or Ernest Ransome in the United States. These are just some of the names that are said to have pioneered concrete construction. The choice of "the inventor" depends to some extent on nationality: the French tend to favor Vicat, Coignet, and Lambot; the Germans, Monier and Wayss; the British, Aspdin and Wilkinson; and the Americans, Ward, Hyatt, or Ransome. The cast list expands or contracts depending on the story to be told. In the most extreme cases, it is simplified to just one character—as with the French advertisement card that claimed Hennebique as the sole inventor of reinforced concrete, wrongly stating him to be French and an engineer, neither of which was true. **fig.1**

The names of the potential discoverers of concrete construction grew steadily during the twentieth century, and the list was much augmented by the research of the architectural historian Peter Collins, whose 1959 book *Concrete—The Vision of a New Architecture* also marked the foundation of the second myth, with a new origins story. Collins saw the beginnings of concrete as lying in eighteenth- and early nineteenth-century experiments by artisanal builders in France using pisé construction. **fig.2** Employing various combinations of materials, and sometimes lime mortars, the decisive feature for Collins of this process was that the building was *molded*. Collins saw the presence of formwork, and the fact that the building was shaped within a mold, as the precondition for concrete. This argument served his purposes well, for the aim of his book was to legitimate the work of Auguste Perret as the "true" course of concrete—and Perret, in whose work trabeation was key, made no secret of his belief in the importance of wooden formwork in the formal definition of reinforced concrete. According to Perret, "It is the use of wooden formwork that gives reinforced concrete the appearance of a great timber frame and makes it resemble antique architecture; antique architecture was an imitation of timber construction and, since reinforced concrete

also makes use of wood, there is a family resemblance due especially to the repeated use of the straight lines that wood imposes." [3] Collins's shifting of the origins of concrete away from technical inventions by named individuals and toward a *process*—pisé construction—carried out by anonymous builders coincided with the growing interest of the 1950s and 1960s in vernacular architecture. Whether in Western or non-Western contexts, attention to what Bernard Rudofsky called "non-pedigree architecture"—and others labeled "vernacular," "anonymous," "spontaneous," or "indigenous architecture"—stressed the importance of building traditions as against the role of the individual creative genius in determining the history of the built environment. [4] Collins's privileging of the anonymous builders of eighteenth-century rural France in the invention of concrete was, whether he intended it or not, a new myth that suited the times in which he was writing.

Our third myth starts with a debunking of the previous two myths. Cyrille Simonnet's 2005 book *Le Béton* is the most recent study to address the question of where modern concrete began. According to Simonnet, at "the middle of the nineteenth century, the economic, cultural and social environment is 'ready' for concrete to be invented. In fact, it will be invented many times, and in multiple places, without its originality in terms of mechanical effectiveness always being perceived." [5] At a stroke, Simonnet disposes of all the myths that attached the origin of concrete to particular people or places; furthermore, he dismisses assumptions that the "inventors," whoever they were, knew where their inventions might lead. Instead, he presents a version of concrete's origins that draws its authority from notions about the development of scientific knowledge put forward by Foucault in his 1969 book *The Archeology of Knowledge*. While Simonnet makes only one explicit reference to Foucault, that is not the point. [6] For an invention to be said to have happened many times, in multiple places, without the people concerned knowing what it was they were inventing, is a claim credible only in a post-Foucauldian world.

Foucault's *The Archeology of Knowledge* was full of warnings about origins—the whole book was an attack on searches for origins, mythical origins in particular. "We must renounce ... a wish ... that beyond any apparent beginning, there is always a secret origin." [7] In proceeding, "one may be compelled to dissociate certain *oeuvres*, ignore influences and traditions, abandon definitively the question of origin, allow the commanding presence of authors to fade into the background." [8] Foucault was concerned with the development of scientific theories, but concrete provides an analogue equivalent in its formation to the discourses Foucault

3 Auguste Perret, "L'Architecture," *Revue d'art et d'esthétique* 1–2 (1935): 41–50, cited by Réjean Légault, "Introduction," in Peter Collins, *Concrete: The Vison of a New Architecture*, 2nd ed. (Montreal: McGill-Queen's University Press, 2004), xxi–lix, here xxxv.

4 Bernard Rudofsky, preface to *Architecture without Architects: A Short Introduction to Non-pedigreed Architecture* (New York: Museum of Modern Art, 1964), n.p.

5 Cyrille Simonnet, *Le Béton: Histoire d'un matériau* (Marseilles: Parenthèses, 2005), 39.

6 Ibid., 111.

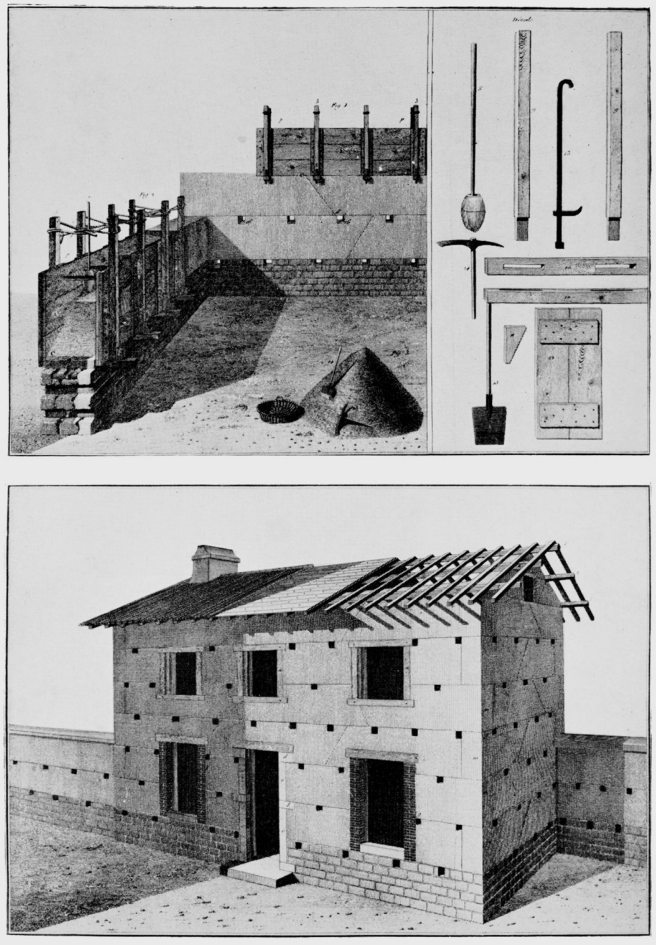
7 Michel Foucault, *The Archeology of Knowledge*, trans. A. M. Sheridan Smith (London: Routledge, 1994), 25.

8 Ibid., 38.

was interested in. Concrete exists as much as idea, as "discursive practice" (to borrow Foucault's terminology), as it does as substance or material. Simonnet recognizes this: "At bottom, reinforced concrete has no intrinsic, necessary, essential rationality, other than the discourses to which it is joined. ... The 'birth' of reinforced concrete is in part the formation of discourses which describe it, carry it to the diverse settings where it is put on show, exposed, and end up proposing two apparently antagonistic tectonic solutions, either as a monolith, or as a composite." [9]

If concrete is a discursive practice, as Simonnet suggests, the task, according to Foucault, is to discover not its origins but the system of rules that brought it into action: "the system of rules that must be put into operation if such and such an object is to be transformed, such and such a new enumeration appear, such and such a concept be developed." [10] Where, then, might we find such a system of rules for concrete?

Simonnet's answer lies in the period of latency, between the 1820s and 1850s, when, despite the invention of cement by Vicat and the existence of patents for the manufacture of Portland cement, nothing much happens. Concrete exists, but no one knows what to do with it. During this period, he writes, "concrete is not yet a demonstrable material—it is buried, immersed." [11] Simonnet is especially interested in the fact that—while hundreds of patents for the manufacture and application of cement were taken out in Britain, France, and the United States during the nineteenth century, and many more experiments weren't reported or patented—the results were negligible. Like Lambot's boat, which was exhibited in 1849 but then disappeared to the bottom of a lake, where it remained until the 1930s, these inventions went nowhere. Simonnet's telling



THE ORIGINS OF MODERN CONCRETE
1. The Technique of Pisé Construction
(From Rondelet: *Traité de l'Art de Bâtir* (1812), Vol. I, article 12, Plates V and VI)

fig. 2 Origins in a process. "The Origins of Modern Concrete," illustration from Peter Collins's *Concrete* (1959).

9 Simonnet, *Béton* (see note 5), 111.

10 Foucault, *Archeology* (see note 7), 74.

11 Simonnet, *Béton* (see note 5), 33.

of the story between the invention of cements and the effective application of concrete to construction relies on the notion of the "technical imaginary"—that only once a process has been fully realized in the imagination can it actually happen. For much of this period, concrete, though it existed physically, had no place in builders' imagination as a constructional medium. No one had imagined what they could do with it other than to use it as a substitute for existing substances, either as a binding agent or as a surface render. "Matter" had yet to become "material." [12] The transition, Simonnet says, came about through the development of an idea of "compactness." "When, progressively, the craft of working it starts to be controlled, when it is subjected to experimental changes that can be modelled, it acquires then the potential status of a constructive category." Though concrete could not be *demonstrated*—for there was nothing much to show—it was the shift into the world of the scientist or engineer, and the gradual emergence of an idea of "compactness," that provided the "rules" for its formation and, for Simonnet, for its entire subsequent history. "The principle of compactness opens up conceptual and experimental configurations of resistance; within the mass, there is enclosed a dynamic potential, an internal articulation. Soon the idea of substance will no longer be antagonistic to structure, nor even to that of elasticity. That then would be the moment for the invention of reinforced concrete." [13] The "rules," then, are first of all, a transfer of knowledge to a class of people who are not themselves builders and, second, the development of an ability to think about matter as having dynamic, rather than purely inert, properties.

In Simonnet's account, one person in particular fulfills the role not of *inventor*, because all the inventions for making concrete were already in place, but is the one who seizes the opportunity of the conditions that might allow concrete to "take." That person is Coignet, and through him are condensed all the various preconditions and determining factors enabling concrete to become a demonstrable constructional medium. [14] But in no sense was Coignet the "inventor" of concrete—Simonnet is careful not to make that claim. Rather, Coignet drew out what was previously buried and immersed in a kind of constructional preconsciousness.

Coignet's significance for Simonnet is that he was not a builder but a businessman, an industrial chemist who in 1851 diversified into construction. Combining the technique of pisé using fixed shuttering with a slag mortar, both of which were already known, he did what no one before had done, which was to patent this as a process. No one before had considered such

12 Ibid.

13 Ibid., 33–34.

14 Ibid., 41.

commonplace, everyday site processes to be patentable. Coignet took well-known procedures, familiar to many builders, and turned them into a commercial product, from which he could exclude all competitors. Out of this, he created an extremely successful business, executing many contracts in the second half of the century—among them the spectacular Yonne viaduct that carried Georges-Eugène Haussmann's Parisian water supply. What marked Coignet out from his contemporaries was the appropriation of knowledge away from the building site and into the businessman's office. The shift in the location of knowledge, rather than any particular discovery regarding materials, is what, according to Simonnet, allowed concrete to happen.

Simonnet's story of concrete has another parallel, one that locates it more precisely with the period of the research and writing of his book. The parallel is with a further work in the history of science, Bruno Latour's *The Pasteurization of France*, first published in 1984. While there is no evidence that Latour's book had any direct influence upon Simonnet's account of concrete, the coincidences between them are such as to put Simonnet in tune with the then new thinking about the social consequences of scientific discoveries. Latour wanted to understand why Pasteur alone had gained all the credit for the extraordinary authority exercised by hygienists in almost every walk of life throughout France and its colonies by around 1900. His argument was that, before Pasteur and his fellow microbiologists came on the scene, a "contagion environment" already existed, a widely shared view attributing the spread of disease to contact between people, animals, and sometimes objects, but with no satisfactory explanation for the unpredictable variations in the virulence of epidemics. The microbiologists provided a scientifically verifiable answer to the question of how diseases spread—and in addition means of inoculation against some, though not all, of the diseases. "Pasteur was not the one who arrogantly claimed the new hygiene as his own work. It was the hygienists who needed to turn 'Pasteur' into the advocate of all their decisions." [15] Had it not been for the existence of the "contagion environment" and of experts on hygiene, epidemiology, social policy, city design, and so on all looking for justification for their arguments, Pasteur's discoveries would have gone nowhere. "Pasteur's work does not 'emerge in society' to 'influence' it. It was already in society; it never ceased to be so." [16] Latour's argument shifted the "discovery" of microbes away from Pasteur and onto the receptivity of powerful interest groups in French society.

15 Bruno Latour, *The Pasteurization of France*, trans. Alan Sheridan and John Law (Cambridge, Mass.: Harvard University Press, 1988), *55*.

16 Ibid., 91.

The parallel between Latour's account of the discovery of microbes and Simonnet's of the discovery of concrete lies in the way they both diffuse invention into a wider field that provides the precondition for its subsequent discovery to "take." For Latour the "contagion environment" of the hygienists, for Simonnet the "constructive imaginary" of builders, make the inventions a possibility. A second parallel occurs in the function of the laboratory. Latour attributed to the "laboratory" a crucial role in Pasteur's ascendancy. "Their [the Pasteurians] 'contribution,' if we insist on this term, is to be found in a certain style of movement that was to allow them to connect 'diseases' with the 'laboratory'" — a place of which nothing had previously been expected. [17] Latour continues, "In the laboratory, the work of a normal man is scaled up. ... [P]henomena are finally made smaller than the group of men who can dominate them." [18] The laboratory is a place of displacement and of transfer. Laboratories do not so much create new knowledge; rather, by translating already existing knowledge into a different setting, they give it authority.

17 Ibid., 62.

18 Ibid., 73–74.

All this has a parallel with Simonnet's account of the early development of cement. Traditionally, lime was burned by the builder who was going to build with it, because this was the only certain way to guarantee its quality: lime production was a local affair, dispersed among many, many producers who were also builders. But when, in the early nineteenth century, chemists became interested in the production of stronger mortars, they went to the chalk quarries that were known to produce the best limes, and they analyzed their composition. With this knowledge, the chemists were able to manufacture high-grade limes synthetically, which they were then able to market nationally. Lime production, and later cement production, moved from being dominated by many local producers — builders making lime for themselves — to industrial concerns, where the know-how and the guarantee of quality came from the laboratories of the chemists. This shift is, for Simonnet, a decisive precondition for the subsequent development of concrete — and it is a narrative very different from Collins's stress on artisanal experiments with pisé and molding techniques. "The pre-history of construction in cement, in concrete," Simonnet writes, "is not only a matter of the building site/laboratory of the engineer, but also of future commercial exploitation of chalk quarries" — made possible by the work of the chemists' laboratories. [19] Whereas Collins accorded no particular role to the laboratory, for Simonnet it is a decisive agency. In the seemingly banal commodification of lime and then of cement, Simonnet says, lay the germ of a revolution in building: "insidiously, the mastery of solidity was transferred from

19 Simonnet, *Béton* (see note 5), 28.

a bodily activity (in the work of building) to the management of supplies." [20]

But does Simonnet's exceptionally intelligent and nuanced account of the origin of concrete constitute a "myth"? It certainly dispels the two previous myths—the individual inventors and the anonymous artisanal process of working with a molded material—and replaces them with what is, at least for the present, a much more credible story of origins. For the time being, it is the best we have, but there is no guarantee it will be good for all time—it will last only so long as no other version of the origin of concrete comes to supersede it, when it, too, will come to be seen as a myth. Simonnet's account is not free of uncertainties and aporias. In particular, it relies on the gestation of a "technical imaginary" in the minds of unidentified, and unidentifiable, builders. Here we are obliged to accept something to which we have no access: the thought processes of unknown men, in whose minds a notion of "compactness," of "density," allegedly took hold, making it possible for "matter" to become "material." [21] In the current post-Foucault, post-Latour climate of the history of sciences, we are receptive to the "technical imaginary"—but for how long? Nothing lasts. Even the very authors of those doctrines seemed to turn against their own progeny. Foucault, shortly before his death, surprised everyone by announcing his lifelong debt to Martin Heidegger, an origins man if ever there was one: "My entire philosophical development was determined by my reading of Heidegger." [22] And in the 1990s Latour issued a kind of product recall to retract Actor-Network-Theory, of which *The Pasteurization of France* had been a prototype. [23] Myths of origin are only as good as the times they are made for.

20 Ibid., 22.

21 Ibid., 33.

22 Michel Foucault, "Final Interview," *Raritan Review 5*, no. 1 (1985): 1–13, here 8.

23 Bruno Latour, "On Recalling ANT," *Sociological Review 47*, no. S1 (1999): 15–25.