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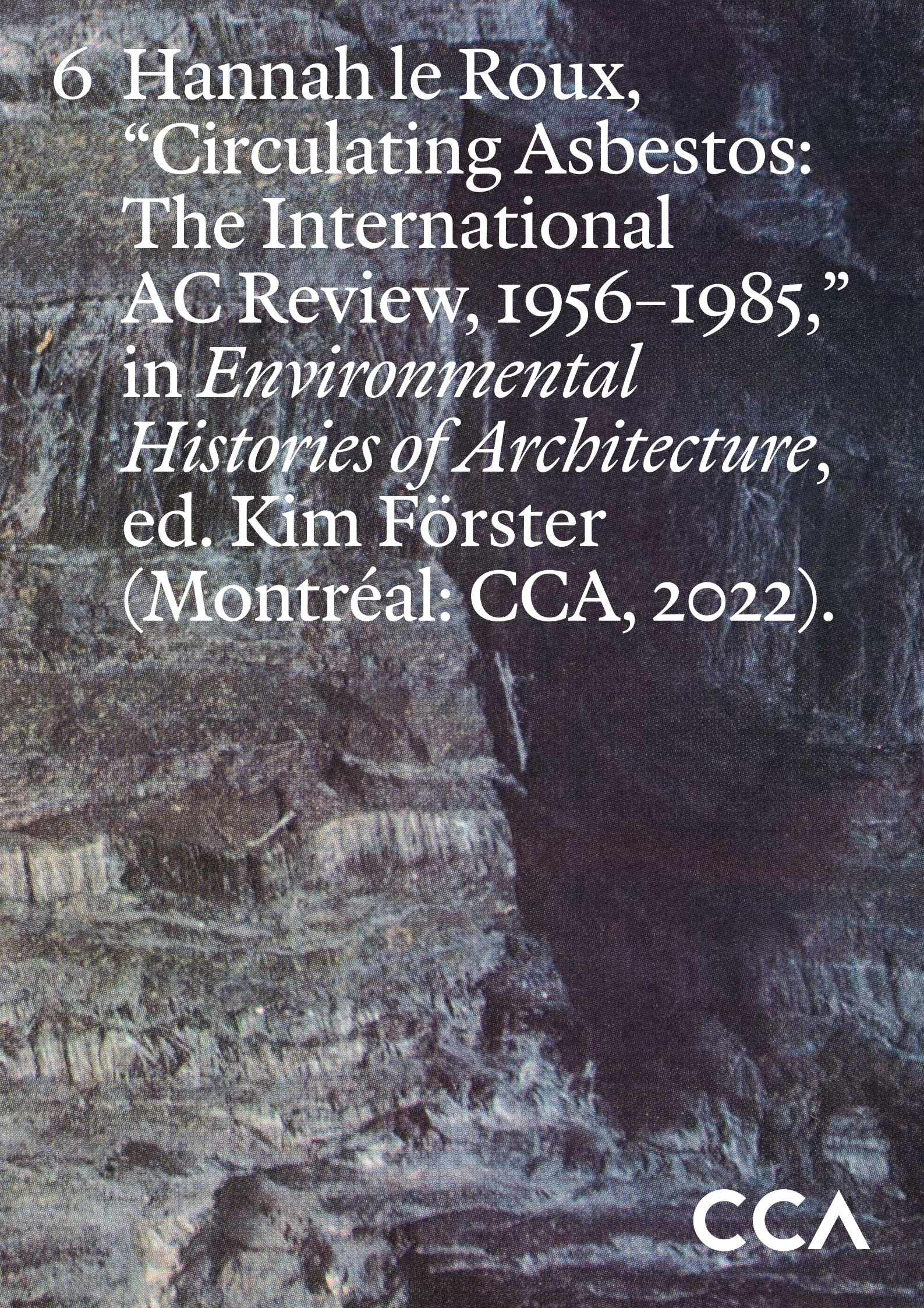

6 Hannah le Roux, "Circulating Asbestos: The International AC Review, 1956–1985," in *Environmental Histories of Architecture*, ed. Kim Förster (Montréal: CCA, 2022).

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Environmental Histories of Architecture is a series of essays that, together, rethink the discipline and profession of architecture by offering different understandings of how architecture and the environment have been co-produced. While cross-disciplinary research has focused on the new realities of the Anthropocene, architecture's complex historical relationship to nature—indeed to the very concept of the environment—has yet to be reconsidered in its political, economic, and cultural dimensions. The pragmatic, techno-utopian, or even environmentalist stances that have thus far monopolized this relationship do not equip architectural practices for the challenges ahead. The task now falls to anyone producing historical analyses and theoretical reflections to pursue a more critical, even operative, engagement with environmental relations beyond the themes of energy and climate change. Through unique methodological and conceptual framings, the eight chapters of *Environmental Histories of Architecture* examine the relationship between society and the environment, complicate understandings of architecture and history, and challenge assumptions of modernization and path dependency. In these ways, as highlighted in the concluding essay, the publication suggests sustainable trajectories for architectural thought and action that can overcome dominant narratives of inevitability and apocalypse.

Hannah le Roux
Circulating Asbestos: The International AC Review, 1956–1985

Hannah le Roux follows the material flows and corporate geographies of asbestos-cement, a construction material that proliferated globally in the twentieth century. As a challenge to architectural history and media, the essay reveals the industrial, academic, professional, and political links between modernity and toxicity: le Roux traces how the Swiss-based multinational Eternit marketed its asbestos product from the 1950s on through the company magazine *ac: International asbestos-cement review*; how architectural historian Sigfried Giedion placed himself at the service of industry by promoting asbestos-cement in writing for ac review and by using it to build his own home; and how, through the efforts of the United Nations, the material became widespread in the Global South through prefabricated housing. Even after bans in many countries, the lingering presence of asbestos-cement is a form of "slow violence" that suggests the need for a "slower science."

THE BINDER

A handsome grey binder lies on your worktop, in easy reach of your drawing board. [fig. 1] It holds eight issues of *ac: International asbestos-cement review*, which you call the *ac review*. You run down the index, find a project like the one on your board, and open the given page. Another architect, somewhere in the world, has shared his design with the editor who has featured it as an exemplary use of asbestos-cement. (1) It is crisply detailed in black-and-white photos. An isometric drawing, with the asbestos-cement products hatched in red, labelled as 1 in the key, makes it easy for you to adapt it to your own application. You cross-check asbestos-cement catalogues for the correct material names and sizes and begin to draft.

1 The gendered culture of asbestos-cement requires a comment here. Developed within patriarchal family empires, the staffing, sponsored architects, and marketing staff in the industry were exclusively male. On the other hand, a significant proportion of research in asbestos, and asbestos-cement cement legacies, is authored by female experts. See Sue Bannister, "Use of Asbestos Cement in Low Cost Housing," (Department of Housing, Republic of South Africa, 2001); Lundy Braun et al., "Scientific Controversy and Asbestos: Making Disease Invisible," *International Journal of Occupational and Environmental Health* 9, no. 3 (2003): 194–205; Jessica Van Horssen, *A Town Called Asbestos: Environmental Contamination, Health and Resiliance in a Resource Community* (Vancouver: University of British Columbia Press, 2016); Linda Waldman, "Strands of Struggle: Dealing with Health Citizenship in the Aftermath of Asbestos Mining," *Journal of Southern African Studies* 42, no. 5 (2016): 947–963.

As you place the issue back in the binder, you see the back cover has an advert for the local asbestos-cement distributors, the very company that publishes the review: Eternit in Brazil, Argentina, Venezuela, Lebanon, and Spain, but elsewhere called Isasbest, Senelac, Lusalite, Nicalit, Panalit, and Everite, amongst others. The Swiss Holderbank, run by the Schmidheiny family of industrialists, owned shares in many of them. From 1956 to 1985, they and other major asbestos-cement producers used the *ac review* to roll out representations of asbestos-cement in architecture from the Eternit headquarters and factory in Niederurnen, Switzerland. (2) [fig. 2] What you have at hand is the first truly global architectural journal, its distribution overlapping with the locations of asbestos-cement manufacturers in forty-two countries. Its dispersal is reflected in the multilingual summaries—French, German, Spanish, and Portuguese, depending on where it was distributed—that run alongside articles in English.

2 Florian Adler, "ac1," *ac 1: International asbestos-cement review* 1, no. 1 (January 1956): 5–6; Adler confidante (name withheld), personal correspondence, 2017; Werner Catrina, *Der Eternit Report: Stephan Schmidheinys Schweres Erbe* (Zurich: Orell Füssli, 1985), 71.

Guided by this media, which is tidy, accessible, and authoritative, you become part of a mediated mining-industrial strategy. When things are less busy—and this is a time of great economic growth in your country—you imagine inventing an innovative application that could be sent in for publication on the review's heavy, textured pages. Its striking front covers inspire creativity: they cycle between built projects and evocative images of the city, abstract graphics, and architects' drawings. For now, however, your relation to this information is more mechanical. Engaged by both pragmatic and visual supports, you become part of the *ac review*'s imagined community. Four times a year, around 20 000 to 72 000 copies of the journal—this high point a record circulation figure—arrive at offices like yours. (3) As you leaf through their grey, fibrous sheets, you join a generative complex that not only makes and refines building products but also produces the media that expands their market through architects like yourself.

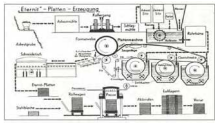
You circulate asbestos.

3 "The Founder of AC Review Goes into Retirement," *Eternit in-house magazine* (1986).

THE ASBESTOS-CEMENT MACHINE

Asbestos-cement is made in the same way as paper. Its culture stems from the turn of the twentieth century, when an Austrian inventor,

Ludwig Hatschek, fed a watery mix of 10 percent mineral silicate fibres and Portland cement into a cardboard machine. [fig. 3] The residue of this slurry, drained of water through the felt bed of a conveyor belt, was lifted by a centrifugal drum. Slit from the drum, the soft sheets of reinforced cement were draped over moulds. This mixing, rotating, coagulating, compressing, and curing of materials turned out to be an effective way to create cheap and strong sheet products with both tensile strength and mouldability. Hatschek patented the process under his name in 1901. (4) The Hatschek Process combined continual circulatory and linear movements with alchemical techniques of wetting, drying, and baking. It began with the arrival by rail of the raw materials from distant quarries and transformed them into artificial stone. But what the diagrams of the patent inevitably excluded were the messy realities at the ends of the production line: the tailings and miners in poorer parts of the world, the spillage from loading fibres, and the trimming, ageing, breaking, removing, and dumping of the products after their use in buildings. (5)



4 Ludwig Hatschek, Process of manufacturing imitation stone plates, slabs or tiles, US Patent 769.078A, filed 11 May 1900, and issued 30 August 1904.

5 The main sources for Eternit's asbestos fibres were initially quarries in Italy and Quebec, but from the 1940s the Schmidheiny family invested in South African mines.

The first Hatschek factory in Volkabruck, Austria, was likely a dusty place. The pounded cobs of fibres would release fibrils, microscopic particles of the very strong mineral silicates that are collectively called asbestos—chrysotile, crocidolite, and amosite being those used for asbestos-cement. The extreme thinness of these fibrils keeps them airborne in what Geoffrey Tweedale has termed "killer dust" given the risks it poses to bodies that inhale it. (6) While the first known cases of asbestos-related illness in the early 1900s were probably confined to doctors' diagnoses of individual deaths, their frequency would become an issue for public health discourse. (7) Ludwig Hatschek himself is alleged to have succumbed to an asbestos-related disease, and his heir, Hans Hatschek, gifted a hospital to the factory town in 1930. (8)

6 Geoffrey Tweedale, *Magic Mineral to Killer Dust: Turner & Newall and the Asbestos Hazard* (Oxford: Oxford University Press 2001). Oxford Academic online edition, https://academic.oup.com/book/5011.

7 Tweedale, *Magic Mineral to Killer Dust*, 13–15.

8 "Due Historie von Eternit," Eternit, https://www.eternit.at/unternehmen/ueber-uns/geschichte/. Eternit Austria's website alludes to Hatschek's death from "a long and difficult illness" in 1914. Everyone associated with the industry interviewed for this research has spoken of people they knew who have died of mesothelioma, suggesting an acceptance of this form of death in the culture of asbestos-cement's production.

Hatschek chose not to grow his own business internationally. Instead, he sold his patent to building materials companies to use exclusively within national markets. The diverse owners of these licenses would consolidate their interests, and by the late 1920s there were five major conglomerates with distinct geographical territories: Cape Asbestos and Turner & Newall in the United Kingdom, Johns-Manville in the United States and Canada, Etex in Belgium, and Eternit in Switzerland. (9) The Société Anonyme Internationale de l'Asbeste-Ciment (SAIAC) cartel of 1929 divided markets and agreed on quotas for the use of raw materials of which most by then were mined in Russia and Quebec—and, from the early 1900s, southern Africa. (10)

9 Tweedale, *Magic Mineral to Killer Dust*, 8.

10 Bob Ruers, "Eternit and the SAIAC Cartel," in *Eternit and the Great Asbestos Trial*, ed. David Allen and Laurie Kazan-Allen (London: IBAS, 2012), 15–20.

Members of the multinational cartel would have known that the British government had commissioned an investigation into factory deaths. The Merewether Report of 1930 firmly established that asbestos dust was a health risk and that its levels needed to be regulated. (11) There had also been a damning report on the mining

conditions in South Africa in the 1930s. (12) But the cartel members monitored the mining, making, and use of asbestos-cement in uneven ways. They only applied dust control within their factories, and then to inadequate levels, with miners and mining communities remaining exposed to unmeasurable loads of environmental dust well into the 1960s. (13) The products themselves, once installed, were not monitored for dust release. Eternit's chairman, Max Schmidheiny, although aware of American research on asbestos risks, stated in the 1960s that, because it was embedded in cement, the asbestos in asbestos-cement presented no risks. (14)

11 Edward Rowland Alworth Merewether and Charles W. Price, *Report on Effects of Asbestos Dust on the Lungs, and Dust Suppression in the Asbestos Industry*, ed. Home Office of Great Britain (London: His Majesty's Stationery Office, 1930).

12 George Frederick Slade, "The Incidence of Respiratory Disability in Workers Employed in Asbestos Mining with Special Reference to the Type of Disability Caused by the Inhalation of Asbestos Dust" (MD/PhD diss., University of the Witwatersrand, 1930).

13 Jessica van Horssen, "Locality and Contamination Along the Transnational Asbestos Commodity Chain," in *Histories of Technology, the Environment and Modern Britain*, ed. Jon Agar and Jacob Ward (London: UCL Press, 2018), 62–75.

14 Catrina, *Der Eternit Report*, 59–73.

In the first half of the twentieth century, the use of asbestos-cement in buildings grew in proportion to other environmental changes with latent risks. Asbestos and fossil-fuel consumption were co-dependents: asbestos could contain the spread of flames in oil-based material stores and garages. As its use spread, the rural world of untapped resources was shrinking. (15) Affordable, factory-made substitutes compensated for the loss of the timber reserves of the great North American and European forests and so allowed territorial expansion into former woodlands. Asbestos-cement could be moulded to resemble wood shingles and siding, opening North American markets, or to copy corrugated iron for applications in British colonies. (16)

15 J. Michael McCloskey and Heather Spalding, "A Reconnaissance-Level Inventory of the Amount of Wilderness Remaining in the World," *Ambio* 18, no. 4 (1989): 221–227.

16 Turnall was the SAIAC cartel member that expanded widely into the British colonies. See Tweedale, *Magic Mineral to Killer Dust*, 8–10.

World War II further spread asbestos, which was used to fireproof military assets such as the Liberty ships built in New York and as a substitute for metallic building materials. (17) The cartel secured supplies outside of the war arena, with Eternit establishing factories in South America through the early 1940s and securing shares in South African fibre mines in the same period, eventually replacing their Italian resources. (18) The fibre trader Asbesco circulated raw material from its mills and mines in the Northern Cape to its subsidiaries and other global asbestos-cement manufacturers. (19) In making asbestos-cement, sharp "blue" asbestos fibres or crocidolite mined in southern Africa and Australia were mixed with softer Canadian and Russian chrysotile to add strength and consistency to cement slurries. (20) This blue asbestos content contributed to the magnitude of latent and distributed toxicity for a multitude of pipes, sheets, sidings, roof sheets, and other building products.

17 Rachel Maines, *Asbestos and Fire: Technological Trade-Offs and the Body at Risk* (New Brunswick: Rutgers University Press, 2013); South Africa War Supplies Directorate, *A Record of the Organisation of the Director-General of War Supplies (1939–1943) and Director-General of Supplies (1943–1945)*, ed. South Africa War Supplies Directorate (Pretoria: 1945).

18 Hans O. Staub, *From Schmidheiny to Schmidheiny: Swiss Pioneers of Economics and Technology* (Meilen, CH: Association for Historical Research in Economics, 1994).

19 Adrian Knoepfli, "The Schmidheiny Family Imperium," in *Eternit and the Great Asbestos Trial*, ed. David Allen and Laurie Kazan-Allen (London: IBAS, 2012), 21–24; Staub, *From Schmidheiny to Schmidheiny*.

20 Piet van Zyl, interview by author, Johannesburg, 2017.

Through this period, the highly engineered process of artificial stone production was domesticated by company media. The archival image of the first plant at Völkabruck depicts, somewhat unexpectedly, a traditional chalet-like house in the middle of the plant. (21) A possible explanation would be that the factory grew around the

inventor's own home, but it is also likely that it was built for display. The conjunction of factory and show house at the first Eternit plant allowed the new industry to display products as they would be used in the domestic market. It also established a theme that would become a feature of other promotional material that the industry would sponsor. In bringing the house into the factory as media, the asbestos-cement complex cojoined the growth of industrial materials with a popular nostalgia for the safety of the traditional home.

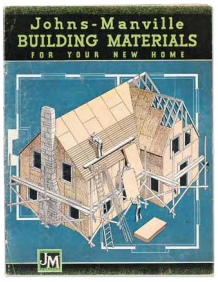
21 "Die Historie von Eternit," Eternit, https://www.eternit.at/unternehmen/profil/geschichte/; Philippe Carrard, Michael Hanak, and Bruno Maurer, eds., *Eternit Suisse: Architecture et culture d'enterprise depuis 1903* (Zurich: gta Verlag, 2003).

The enduring image of the home was reinforced, literally, by the material properties of asbestos-cement. The products produced new relationships between people and their homes by creating inorganic surfaces that looked natural but that needed less maintenance. Several manufacturing processes were patented. The first use was for stone and slates in 1900, then roof shingles and siding lumber in 1904, and multiple roofing materials from the 1940s onward. (22) A further patent, the Mazza process invented in 1907, shaped asbestos-cement around mandrels to create strong pressure pipes that could replace cast iron or brick drains. (23) These cheaper underground pipes for water, steam, and drainage systems allowed for the rapid and relatively cheap expansion of urban areas.

22 Ludwig Hatschek, Process of manufacturing imitation stone plates, slabs, or tiles.

23 J. Tidswell & Co, *Italit. Asbestos-Cement Pressure Pipes and Low Pressure Pipes* (London: Herbert Fitch & Co., 1951).

Prior to the 1950s, company catalogues were aimed at building material specifiers, including the owner-renovators of houses. The oldest ones from around 1875 put forward the narrative that asbestos-containing building products were introduced, materially and conceptually, into houses when the H. W. John's company marketed paints, roof coatings, and fireproofing out of New York. (24) In 1913, a booklet published by Johns-Manville explained *How to Roof Your Buildings Permanently*. (25) The title of the Bell's catalogue associated asbestos-cement with "permanence without maintenance." (26) The Johns-Manville catalogues of the 1930s carefully mediated the relationship between the advantages of modern products marketed as the last ones that owners would need for a roof or siding and the imagery of a traditional house. (27) They explained how the company's products could be applied right over the original ones. The substitutes also reduced the ongoing work of care in sanding, oiling, and resealing lumber by allowing choices of embedded colours and textures. In the catalogue images, fig. 4 the house was labelled and exploded as a set of surfaces, covering every side, whether as flooring, walling, roofing, or flue.



24 H. W. Johns Manufacturing Co., *H.W. Johns' Patent Asbestos Materials* (New York: The Company, 1875).

25 Johns-Manville, *How to Roof Your Buildings Permanently* (New York: Johns-Manville, ca. 1913).

26 Bell's Asbestos, *Permanence without Maintenance: A Photographic Record of the Use of Bell's Poilite and Everite Asbestos Cement in Modern Roofing* (London, Manchester: Bell's Poilite and Everite Co. Ltd, 1925).

27 Johns-Manville, *Johns-Manville Building Materials for Your New Home* (Asbestos, QC: Johns-Manville, 1935); *The Home Idea Book: Helpful Suggestions on How to Get the Most for Your Money in Building, Remodeling, Decoration, Maintenance* (New York: Johns-Manville, ca. 1939).

In comparison to increasingly scarce natural materials like lumber, clay bricks, and stone, asbestos-cement products were cheap, and so found a place in new urban tract housing. In Australia, the James Hardie company published the Fibrolite catalogue with house plans for "thrifty home builders" that used asbestos-cement for all surfaces, creating a local domestic vernacular that became known as "Fibro" houses. (28) These catalogues point to a conception of asbestos-cement as a surface that was compatible with the values of an emerging class of homeowners. Elsewhere, industry-sponsored model houses drew attention to the modern qualities of the material—its affordability,

smoothness, strength, and thinness. The famous Levittown houses, built in the late 1940s with reference to traditional building forms, were clad in asbestos-cement siding developed by Johns-Manville. (29) The appearance of the house had become an expression of consumer taste, whether through colour, texture, or material mimicry, made economical through the Fordist production of space. What these houses sponsored by the asbestos-cement cartel members lacked, however, was the distinction of high design—and the endorsement of architects. The *ac review* would address that absence.

28 James Hardie & Co., *Catalogue for Hardie's Fibrolite Asbestos Cement Sheets, Asbestos Cement Slates, Corrugated Roofing Sheets* (Rivervale, West Australia: The Company, 1930), https://archive.org/details/JamesHardieCoy.Ltd.1930/mode/2up.

29 James Dugan, "We Live in the World's Most Famous House," *Maclean's Magazine* (1 May 1952), https://archive.macleans.ca/article/1952/5/1/we-live-in-the-worlds-most-famous-house.

AC 1

In 1946, Eternit hired a young architect, the German-born and British-trained Florian Adler, as their publicity manager. He would be based at the head office in Niederurnen, in north-eastern Switzerland. Adler's father had lectured in architectural history at the Bauhaus and his stepfather worked for Eternit in Germany. (30) At first, Adler worked on projects to create materials, colour ranges, experimental designs, and innovative building methods, reporting to the company director, the engineer Hans Frey. (31) In 1955 Eternit initiated a partnership with the publisher Hans Girsberger in Zurich that began with the launch of the *ac review* in 1956, providing the company with "discreet advertising for product and image." (32) Adler would edit the review from the corporate headquarters in Niederurnen. Later, Girsberger and then Karl Krämer would publish a series of compilations of case studies from the journal. Edited by Adler's collaborator Olinde Reigle, they were grouped by application or building types under the *ac* logo. (33) fig. 5 These books and the journal would complement catalogues as the source of information for architects and associate the names of well-known designers with asbestos-cement products.

30 Florian Adler, Curriculum Vitae. Adler confidante (name withheld), email to author, 15 November 2017.

31 Adler, Curriculum Vitae.

32 Anonymous, "The Founder of AC Review Goes into Retirement," 1.

33 Olinde Riege, ed., *ac Ing: Eine Zusammenstellung von Asbestzement-Anwendungen für den Ingenieur* (Zürich: Girsberger, 1964); *ac Panel: Asbestzement-Verbundplatten und -Elemente für Aussenwände* (Zürich: Girsberger, 1967); *ac Façade: Asbestzement-Platten und -Tafeln als Aussenwandverkleidung* (Zürich: Girsberger, 1968); Riege and Eternit AG, *ac Domus: Einfamilienhäuser mit Asbestzement* (Zürich: Karl Krämer, 1973), amongst others.

Through the *ac review*, Eternit's approach to marketing departed from earlier media and the other cartel members who strove to convert homebuilders to their products. The company modernized marketing itself, aiming it instead at architects who, as specifiers, would in turn link asbestos-cement with mass housing. (34) The post-World War II period brought relative stability in Europe and Japan and development discourse to the Global South, and urban growth through reconstruction and new towns provided substantial work for architects. The cement used to make Eternit asbestos-cement was often supplied by manufacturers financed by Holderbank, so adding asbestos compounded the cement industry's profits. (35) As Eternit grew, the origins of the industry in the hacking of a cardboard machine remained as a referent. Continuous and growing production and the design of substitutes for organic materials were all consistent faces of what was becoming an expansive complex—an asbestos-cement machine, in effect—rolling out building products, media materials, and risk at scale.

34 For a history of the architect as specifier, see Katie Lloyd Thomas, *Building Materials: Material Theory and the Architectural Specification* (London: Bloomsbury, 2021).

35 These associations are spelled out in the analytical diagram in Sarah Nichols, "Pollux's Spears," in "The Costs of Architecture," special issue, *Grey Room* 71 (Spring 2018): 141–155; Pollux [George Baehler], *Zement und Baumaterialien Turst [The Cement Trust in Switzerland]* (1946), cover, cited in *Grey Room* 71, 138.

The distribution of the *ac review* transcended the market boundaries that the SAIAC cartel members had established: it reached architects internationally. This strategy would support its cosmopolitan image, encouraging architects across the world to contribute to its content. Architects were invited to submit photos and working drawings of projects using asbestos-cement to the editor, who noted that "copyright" and other costs would be covered. (36) *ac 1*, the initial edition, suggested it had access to the international Eternit group of companies: "Though 'ac' will not serve the commercial interests of any one manufacturer, it will make full use of the information disseminated by the many asbestos-cement works throughout the world," thus relieving its architect, engineer, and builder readers "of the need to study many separated leaflets, brochures, etc., dealing with the same subject." (37) If the front cover blurred the structure of the cartel in favour of a global asbestos-cement aesthetic, the back page made its outlets quite clear. Copies bought in colonial Rhodesia (now Zimbabwe) would advertise Turnall, the trade name of the British-owned Turner & Newall, while those distributed over the border in South Africa carried publicity for Everite, an Eternit subsidiary.

36 Adler, "ac1," (1956): 7.

37 Adler, "ac1," (1956): 5.

Adler's editorial vision for the *ac review* would expand the association of asbestos-cement to something more than a pragmatic and strong material bought by builders. He echoed concerns developed within the lineage of modern architecture. The themes and case studies of the first forty issues regularly picked up the threads of the 1930s: the iconic architect's home, mass housing, the provision of modernizing social facilities—especially schools and factories—and prefabrication. Each issue published ten or more projects grouped thematically according to these typologies, amongst others. Construction details were elaborated in cut isometric views, an approach that a subsequent Girsberger publication, *Detail*, would perfect. For its first decade, the *ac review* regularly aimed its content at the European arena, reflecting asbestos-cement's use in extensive post-war projects of reconstruction that relied on fast and standardized construction methods. The growth in asbestos production, mostly used in asbestos-cement, was phenomenal, increasing over five-fold between 1950 and 1975 to around five thousand metric tons per year. (38)

38 Barry Castleman, "The Export of Hazardous Industries," in *Encyclopedia of Environmental Health*, 2nd ed., vol. 1, A–C, ed. Jerome O. Nriagu (Amsterdam: Elsevier, 2019), 764–769.

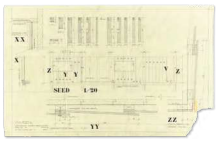
Such raw figures did not feature in the new review's texts. The journal scored a coup, rather, in having the preface of the first issue penned by Sigfried Giedion, the Bohemian-born Swiss architecture historian who had served as the secretary for the *Congrès internationaux d'architecture moderne* (CIAM). This network had been the contact zone for modernist architects across Europe and beyond since the late 1920s, orchestrating congresses and publications. (39) Giedion's piece, entitled "Industry and Architect," invoked Walter Gropius as the pioneer "speaking for cooperation between industry and architect" who would coordinate the increasing standardization of the building industry and create "a new individual whole." (40) Gropius, the exiled founder of the Bauhaus, was by then a professor at Harvard, Royal Institute of British Architects Gold Medal award winner, and partner in the transnational Architects Co-Partnership. In mentioning Gropius, Giedion was recalling the global scale of CIAM's ambition to coordinate architectural and planning approaches, and Gropius and his colleagues' engagement with industrial building materials.

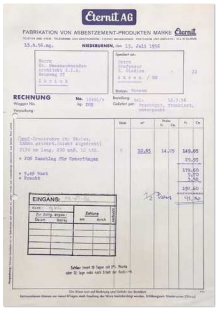
39 Eric Paul Mumford, *The CIAM Discourse on Urbanism, 1928–1960* (Cambridge, MA: The MIT Press, 2000).

40 Sigfried Giedion, "Industry and Architect," *ac 1: International asbestos-cement review* 1, no. 1 (January 1956): 5-7.

Behind the scenes, however, the relations between theory and material generated by the *ac review* were more prosaic. Giedion was in effect a paid propagandist for the asbestos-cement industry. The proximity of players had a role in his inclusions. By 1956, when his preface was published in the *ac review*, Giedion had commissioned the design and construction of a mountain retreat for himself on a small parcel of land facing the Alps. fig. 6 It was placed off the road that winds up from the town of Niederurnen at the head of the Walensee, where Eternit's headquarters and first factory were located. This route passes through Amden, where Adler lived, midway between the cerebral producer of avant-garde architecture theory and the production line of the factory.

The house design included the input of several modernist architects from the CIAM and Swiss circles for whom Giedion was champion and theorist, including his son-in-law, Paffard Keatinge-Clay, and Konrad Wachsmann, whose students at the Illinois Institute of Technology did a project to rationalize its structure and siding. (41) Le Corbusier sketched a cladding scheme that used Glasol, a range of coloured asbestos-cement panels, in the living room. fig. 7 Adler helped with the house's asbestos-cement details. (42) Despite this designer pedigree, Giedion had to account to concerned neighbours and the council that governed the aesthetics of buildings in the rural setting of Amden, and the final design reflected a conservative notion of hillside chalets, the starkness of asbestos-cement finishes played down through quiet detailing. Drawn up in several versions by Eduard Neuenschwander, its roof, siding, and columns were all asbestos-cement, along with the small plaque at the entrance with the house's name: Haus am Hinterstein. fig. 8 Notwithstanding its restraint, an image of the house, with Giedion posing between a bay of asbestos-cement pipes used as columns, was the cover art for *ac 8* in 1957. fig. 9 Inside the issue, an article by Giedion, entitled "A Historian's Experience of Building a House," detailed the various collaborations in its creation. (43) What was not disclosed but remains as an archive trace in the form of invoices fig. 10 is that the asbestos-cement materials had been partly or fully donated by Eternit, and offset by a fee for his preface to *ac 1*. (44) The full value of their sponsorship was just over 2 700 Swiss Francs.





41 Sigfried Giedion, "Die Erfahrungen Eines Historikers Beim Hausbau" [A Historian's Experience of Building a House], *ac 8: International asbestos-cement review* 2, no. 4 (October, 1957): 3–12.

42 Oliver Keatinge Clay, email to author, June 2018.

43 Giedion, "Die Erfahrungen eines Historikers beim Hausbau"

44 "Enclosed you will find copies of the invoices for the Eternit materials for your house in Amden. Our agreement at the time was that we would supply you with the asbestos-cement at half price, with the exception of the trial façade, for which we would bear the full cost of the materials. For reasons of internal accounting, our invoices are for the full amounts. [breakdown of invoice] Mr. Adler informed us that you still had to be paid a fee for your work on the *International asbestos-cement review* and that you would prefer this to be used to settle your invoice. We have therefore agreed with Mr. Adler that the wages of CHF 535.50 paid by us for the façade will be repaid by 'ac.' The magazine 'ac' will therefore take over these additional CHF 535.50. In view of your valued cooperation with this magazine, 'ac' will still be charged internally by us with the credit for the roof and the columns." (Translation from German by author) Eternit AG, letter to Professor S. Giedion for asbestos-cement pipes, 12 January 1957. 1/FA/hg/jj, File 202-014, gta Archives / ETH Zurich, Eduard Neuenschwander.

This mutually beneficial relationship, supported by the close geographical links between Giedion, Adler, and the Eternit offices and factory, represents a capitulation of CIAM's claims to authority. While Giedion might not have known of asbestos-cement's risks—he personally exposed himself to it by installing Le Corbusier's panels—he was willing to elaborate on the material's symbolic value and enfold it into his own house in exchange for a modest sum. Enfolded in his "discreet" act of trading text for building materials is acceptance of a new hierarchy: capital will set the agenda for architectural culture, right down to the scale of the home.

Giedion's text for the inaugural issue of *ac review* ended opposite a photograph of a Greek temple at Paestum, suggesting material endurance, classicism, and perhaps the historian's philosophical perspective on asbestos-cement. (45) This connection recalls another encounter between the classical and the contemporary. In his discussion of *Phaedrus* in "Plato's Pharmacy," Jacques Derrida proposed writing as a *pharmakon*—a remedy or toxin, depending on the perspective. (46) Risk is created by the portability of the pharmakon. Its mobility establishes a safe distance between the leader, whose word is captured in writing, and the reader. In the discreet exchange of asbestos-cement panels from Eternit for his writing, Giedion and the movement that he had stood for entered a morally indeterminate relation. The prestige that the Haus am Hinterstein leant to Eternit products was bought at the price of their latent poison, a quality that, like the name of the company behind it, was concealed in the public record. As pharmakon, *ac 1* erased the uncomfortable content of asbestos-cement. It was not represented as a latently toxic material, but rather as a subject for discursive work. Asbestos-containing materials were linked to higher values, such as the themes of collaboration, endurance, and modernization that exploited the moral value established by Giedion and CIAM. Glossing over the toxic fibrous content of asbestos-cement meant a successive generation of housing experts could take such claims at surface value.

45 Giedion, "Industry and Architect," 7.

46 Jacques Derrida, "Plato's Pharmacy," in *Dissemination*, trans. Barbara Johnson (London: The Athlone Press, 1981), 61–156.

In her meditation on how to act in the face of the coming catastrophe of global climate change and pollution, philosopher of science Isabelle Stengers draws on and extends Derrida's reading of the pharmakon. For her, it is the art of simultaneously confronting and staying with the ambiguity of expert practices. Accepting the ambivalent nature of such practices as either remedy or poison, she suggests, means opposing those who would fully exclude any collaboration that "could be dangerous." She compels us to pay attention to the *milieu* in which the mainstream of expertise operates. The art that she envisages involves experts joining the struggle against the environmental risks created by irresponsible growth by becoming "allies, with questions like 'how can we contribute to avoiding this danger?'," performing struggle and creation at the same time rather than postponing any engagement until a utopian "after." (47)

47 Isabelle Stengers, *In Catastrophic Times: Resisting the Coming Barbarism* (London: Open Humanities Press, 2015), 104.

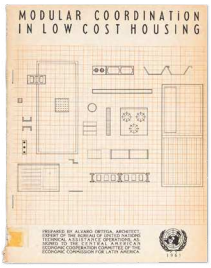
In the sense that architectural history constitutes a form of re-creation of architectural thought and action, it needs to take to heart Stengers' encouragement to pay attention to milieu. Indeed, the *ac review* is a pharmakon, in its ambiguous representation of architecture as a common good, while peddling toxicity. It does this by amplifying the middle path it takes between the modes of artistic and rational production. Its milieu—that is, its sponsors and their discursive advisors—never allowed it to represent architecture without asbestos content, nor to scrutinize the safety of what that meant. It rewarded those who agreed to these limits by the publication of their designs, while projecting a pseudo-scientific sense of order through technical means such as well-indexed precedents and exploded details.

Mindful of the concern that Stengers and others have expressed with the conceptual limits that industry creates for scientific thought, the *ac review* consciously delimited the capacity of architecture professionals and their advisors to think about the environmental risks they were creating. (48) In the transitional period of the review's global growth from *ac 1* up to an eventual admission of its culpability in creating a milieu, it persuasively shaped architects' views on asbestos-cement. The medium that Eternit and Adler shaped was one where "industrialization took command," to misquote Giedion,

of its potential specifiers by supporting them to think about architecture, and most dangerously, the home, as a space for asbestos use. Moreover, the audience for this medium would consciously be shifted to include professionals responsible for housing the poor in the Southern hemisphere.

48 I also draw this term from Isabelle Stengers. See "Experimenting with Refrains: Subjectivity and the Challenge of Escaping Modern Dualism," *Subjectivity* 22, no. 1 (2008): 38–59.

AC 58



In 1968, Adler invited a Colombian architect to speak at a conference that he was arranging in St. Gallen, Switzerland. (49) Alvaro Ortega (1920–1991) was an "Inter-Regional advisor to the United Nations in New York City, 1965–1970. Missions in Africa, Asia, and in the Americas, dealing with Housing, Design, and Building Technology and Material, and Modular coordination practice." (50) Ortega, a Wheelwright scholar, had completed a Master in Architecture at Harvard University in 1945 under Gropius' chair, at a time when the program was experimenting with modular construction, an interest that he revisited in a UN report in 1961. (51) [fig. 11] Ortega also worked at the Centro Interamericano de Vivienda y Planeamiento (CINVA), the Pan-American housing education and research centre in Bogotá where many Latin American social housing specialists were trained. In *ac 22*, the review had introduced his design of *canaletas*, an experimental asbestos-cement roofing profile that Eternit would market through its associated companies from the 1960s onward.

49 Undated list of travel and consultancy activities. Unpublished document in loose folder titled LIBRO-AO, Alvaro Ortega fonds, John Bland Canadian Architecture Collection, McGill University [hereafter, Ortega fonds, CAC, McGill]. Ortega would return to McGill as a researcher in the 1970s with the Minimum Cost Housing Group. The CCA archive holds that group's material, which includes the Ecol house constructed from a low-technology version of canaletas made from halved asbestos-cement pipes.

50 Alvaro Ortega, "Personal History" (unpublished document, ca. 1983), 2. Ortega fonds, CAC, McGill.

51 Alicia Imperiale, "An American Wartime Dream: The Packaged House System of Konrad Wachsman and Walter Gropius," in *ACSA Fall Conference* (ACSA, 2012), 39–43.

Adler's invitation to Ortega marked the expansion of the *ac review*'s role. It signalled a shift from marketing to European architects to circulating asbestos-cement products for low-cost housing beyond Europe. In his letter, Alder wrote, "It will be of the greatest interest to manufacturers from development countries and others to get to know your views on the possibilities of industrialised building and the sort of cooperation between architects, agencies such as yours and the building materials industry.... Our publishers would be pleased to pay you (or is it the United Nations) a fee for your participation at this meeting." (52)

52 Florian Adler, letter to Alvaro Ortega, 23 April 1968. Loose object in "asbestos-cement" files, Ortega fonds, CAC, McGill.

The presentation that Alder was requesting from Ortega would showcase canaletas in use in various Latin American housing projects and would also appear in print in *ac 58*. The other speakers proposed included Jean Prouvé, Robert Günthard on an experimental housing scheme at Niederurnen, and G. E. Bonnell on marketing the T-N (Turner & Newall) house. Adler noted in his invitation that the list of participants for the St. Gallen meeting included representatives from Eternit companies based in what it called "development" countries around the globe: Dimatit in Morocco; Duralita in Guatamala; Eternit in Brazil, Colombia, Ecuador, Lebanon, Venezuela, San Salvador, and Costa Rica; and Everite in South Africa. (53) But it also included countries involved in foreign aid, specifically asbestos companies in England and Scandinavia. In line with the exclusively male composition of senior Eternit staff, Adler also mentioned that there was a program worked out for "accompanying ladies." (54)

53 Adler, letter, 1968.

54 Adler, letter, 1968.

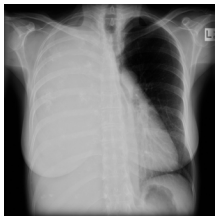
The number and spread of companies affiliated to Eternit had been growing since the 1940s. Adler travelled twice to and extensively in South America including to Brazil, Chile, and Argentina, where Eternit had subsidiaries, advising on the application of its products. (55) In 1985, the Swiss journalist Werner Catrina listed Eternit subsidiaries in around thirty countries, while a Belgian report listed fifty in the "ensemble" constituted by the Emsens, Cuvelier, and Schmidheiny family interests in Eternit. (56) The spread of Swiss asbestos-cement technology over time can also be found in a marketing brochure of Bell Engineering Works, a subsidiary of the engineering works Escher Wyss that was directed by Schmidheiny family members between 1936 and 1966. (57) It lists the sales of slurry, sheet, and stamp machines to manufacturers on every continent.

55 Adler, letter, 1968.

56 Catrina, *Der Eternit Report*; GRESEA, *Etude du secteur de l'asbeste-ciment*, (Brussels: Groupe de recherche pour une strategie economique alternative, 1979).

57 Bell Engineering Works Ltd., *Asbestos Cement Machines*, (Kriens-Lucerne: Escher Wyss Gruppe, 1978). Jacob (aka Jakob) Schmidheiny II (1875–1955), brother of Eternit's founder Ernst Schmidheiny I, was President of the Board of Directors of Escher Wyss and Co. See Staub, *From Schmidheiny to Schmidheiny*.

The invitation to Ortega came at a critical moment for the asbestos-cement industry. Its Western European and North American markets would soon begin to contract in the face of imminent liabilities. Increasingly, the medically reviewed evidence that asbestos fibres inhaled during both occupational and environmental exposure caused cancer was becoming public knowledge. In his exhaustive study of the medical and legal aspects of asbestos, Barry Castleman notes that "the pivotal year was 1964, when some but not all of the manufacturers of asbestos insulation products began to affix the first generation of caution labels." (58) The first medical paper linking environmental exposure to asbestos fibres to a previously rare, fatal cancer, mesothelioma, fig. 12 had emerged from studies on people who had lived near Northern Cape asbestos mines and mills, but never worked in them. (59) In 1965, a conference on asbestos disease was held at the New York Academy of Sciences, a central location for the media, and close to the UN headquarters. The opening speaker, Dr. Irving Selikoff, spoke of asbestos-related illnesses amongst shipbuilders, drawing attention to research that would support the extensive damages suits filed in the United States by the end of the decade. (60)



58 Barry I. Castleman and Stephen L. Berger, *Asbestos: Medical and Legal Aspects*, 4th ed. (Englewood Cliffs, NJ: Aspen Law & Business, 1996), 318.

59 J. C. Wagner, C. A. Sleggs, and Paul Marchand, "Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province," *British Journal of Industrial Medicine* 17, no. 4 (October 1960): 260–271.

60 Irving J. Selikoff, "Opening Remarks," *Annals of the New York Academy of Sciences* 132, no. 1 (1965): 7–8; I. J. Selikoff, J. Churg, and E. C. Hammond, "Relation between Exposure to Asbestos and Mesothelioma," *New England Journal of Medicine* 272, no. 11 (March 1965): 560–565.

As with Giedion, it is unclear whether Ortega was aware of the risks embedded in asbestos-cement. He may have been unconsciously weighing the tensions between its asbestos content and its use in his image of housing as a chronic disease when he wrote in *ac 58*: "The lack of adequate shelter for the majority of the world's population is a problem with the characteristics of a chronic disease—something similar to cancer." (61)

61 Alvaro Ortega, "World Housing Problems," *ac 58: International asbestos-cement review* 15, no. 2 (April 1970): 4.

The timing of the St. Gallen meeting also coincided with a shift in architectural taste away from modular building. Richer countries that had embraced prefabrication or kit buildings to build quickly and grow their markets in the post-World War II era were moving to more bespoke designs. In the South, technocratic approaches to housing supply were proving unaffordable for countries with limited foreign exchange reserves. Asbestos-cement's declining role as the avant-garde

material in European mega-projects in favour of exposed concrete was reflected in a short exchange between Adler and one of his editorial board members, the radical French architect Claude Parent. (62) In forming new spaces for post-war society, Parent's argument went, the modular forms of asbestos-cement products could not create the fluid and continuous surfaces that new mass publics desired. (63)

62 Florian Adler and Claude Parent, "Discussion," *ac 29: International asbestos-cement review* 8, no. 1 (January 1963): 3.

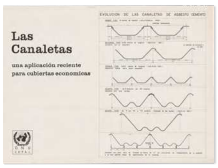
63 The Schmidheiny family also had extensive interests in cement through the Holderbank, later Holcim holdings. The asbestos-cement and cement businesses were split between two of Max Schmidheiny's sons, Stephan and Thomas, in 1976. For background on these intertwined holdings, see Nichols, "Pollux's Spears."

In drawing attention to Ortega's canal-shaped profiles, *ac 58* reassigned innovation to the South—and to hybrid industrial and artisanal approaches to mass housing. The canaleta design was proposed during Ortega's first mission for the UN in Guatemala City in 1959–1960, fig. 13 at a time when he was researching the potential for the transnational standardization of building material modules. (64) The prototypes, shaped from slit, uncured Mazza pipes on moulds with a peaked cross section, were fabricated for a pilot project in Mexico where Ortega was posted as a consultant to the United Nations Economical Commission. (65) These asbestos-cement ribbed sheets could span the full width of a small hall or dwelling without intermediate support, allowing the elimination of timber or steel rafters. This freed up capital to be spent on the roofing material.

64 Alvaro Ortega, "Modular Coordination in Low Cost Housing," (San Salvador: UN Economic Commission for Latin America, 1961).

65 Alvaro Ortega, "Modular Coordination in Low Cost Housing" and "Economic Roofing for Central American Dwellings," *ac 22: International asbestos-cement review* 6, no. 2 (April 1961): 23–26 and 47–49.

Ortega's canaleta designs were patented in a manner that blurred the line between humanitarian and business agendas. In his publications for the UN, they were promised an open-source, global norm, while in practice, they were copyrighted to Eternit. In 1970, in a letter to Alfredo Arias, an engineer from Panama, regarding the complexity of the caneltas' copyright status, Ortega explained that the Mexican prototype was named as a UN section but not patented so that no one could profit from its humanitarian value. (66) However, drawings from the Mexican factory show that they had drawn up two slightly different but detailed profiles for the canaletas, including the "canaleta doble, tipo ONU." (67) The other profile, with a ridged base, appears to have been reproduced commercially by many Eternit-linked companies in South America: Nicalit in Nicaragua, Eternit Bresil, Ricalit in Costa Rica, Eternit Pacifico, Colombit in Colombia, and Fibropan in Panama, amongst others whose catalogues Ortega collected. fig. 14 In clarifying the situation to Arias, Ortega noted that the commercial profiles were also used by Eternit-affiliated companies in Africa, Asia, and other American countries and that Eternit had applied for a patent for these profiles, but that he was not aware of the result. (68)



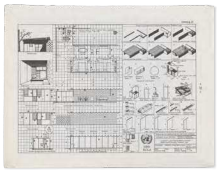
66 Alvaro Ortega, letter to Alfredo Arias, 27 October 1970. Loose object in "asbestos-cement" files, Ortega fonds, CAC, McGill.

67 Asbestos de Mexico, S. A. Tlalnepantla, "Canaleta Doble Tipo ONU" (1:1 scale section and perspective of a ribbed asbestos cement sheet) and "Canal No. 2" (1:1 scale drawing of sections of a set of sheets and terminals for asbestos cement roofing). Drawings no. 7566A, CAC35/001001/33 and no. 7865-A, CAC35/001001/46. Ortega fonds, CAC, McGill.

68 Ortega, letter to Alfredo Arias, 27 October 1970. Loose object in "asbestos-cement" files, Ortega fonds, CAC, McGill.

Ortega's UN advisory role gave opportunities to specify the use of the canaletas in training programs, such as at CINVA, and for low-cost houses, including his pilot project in Guatemala City. (69) He also worked to multiply the potential of asbestos-cement elements in social housing for the new Southern markets by designing comprehensive housing systems. At the time of the canaleta prototypes, Ortega created extensive documentation for cluster housing using interlocking modular elements. The first aspect of this work was an extensive survey of building modules around the world. Based on his conclusions, Ortega designed the ISTMO experimental house, which occupied a

6 x 6 metre grid made up of 600-millimetre modules, each corresponding to the width of a canaleta bay and wall panel. (70) [fig. 15] Four houses would be clustered in a pinwheel formation. Their design specified asbestos-cement products for the roof, partitions, and fittings, including a water pod suspended over the wet core.



69 Undated list of travel and consultancy activities. Unpublished document in loose folder titled LIBRO-AO, Ortega fonds, CAC, McGill.

70 The ISTMO house was documented both in the 1961 report and in article with the same title, "Modular Coordination in Low Cost Housing," *Ekistics* 13, no. 80 (1962).

The cluster of ISTMO houses was not realized, but the UN logo is on a comprehensive report on the proposal, authored by Ortega. (71) At the same time, canaleta products were proliferating in catalogues of companies related to Eternit. (72) In 1967, in one of his later missions as a UN technical advisor, Ortega revived his proposal for the use of canaletas in a modular housing approach for Ceylon and suggested the foundation of a factory, but there is no evidence of the proposals being adopted. (73) In the face of these challenges, the canaleta as a roof surface was to receive a fresh circulatory boost from its publicity in the *ac review*. Ortega's participation at the meeting at St. Gallen, seen against this shifting context, suggests that he had come to the end of his role in circulating asbestos through his UN work. His conceptual work had been reduced to a product, circulated for reinterpretation by the readers of the review.

71 "Modular Coordination in Low Cost Housing."

72 Binder labelled CANALETA, Ortega fonds, CAC, McGill. The trademarks include Canalete, Canalon, Cabalettes, Panaletas, and Canal.

73 Alvaro Ortega, *Draft Report: Concrete Prefabrication and Building Components in Ceylon*, (Colombo: unpublished manuscript, 1967). Ortega fonds, CAC, McGill.

In the 1960s, the era of decolonization in Africa and leftist gains in Latin American countries, experts would extend their interest in technocratic solutions in prefabrication and refugee housing—as well as reconstruction in the West—to the consideration of more human-centred and localized developmental strategies in "the huts and villages of half the globe." (74) In 1964, the United Nations convened the UN Conference on Trade and Development, with rotating leadership from "developing countries."(75) In 1965, the United Nations Development Programme absorbed the activities of the Technical Assistance Board with a mandate that further broadened the field of reference for developmental projects. UN-supported reports such as *The African Building Materials Industries and Fibro-Cement Composites. Report of the Expert Working Group Meeting, Vienna, 1969* had a representative from the *ac review* and included a visit to an Eternit factory. (76) The broad agenda of such fora was to develop alternative approaches to materials and construction systems for the tropics. Poorer countries without access to asbestos or iron reserves, or reliable industrial expertise, had to use scarce foreign exchange to import products for the critical components of roofing, structural, and sanitation systems, leading to calls for the use of local building materials. Studies drew contrasts between the developmental value of local, organic materials including adobe or bamboo, as well as plant-based cladding and roofing that could create local work, and that of prefabricated, industrialized materials, specifically asbestos-cement. (77)

74 "To those people in the huts and villages of half the globe struggling to break the bonds of mass misery, we pledge our best efforts to help them help themselves." President John F. Kennedy, "Inaugural Address," 20 January 1961, Washington, D.C., quoted in Ortega, *Draft Report*.

75 "UN Documentation: Development," United Nations, https://research.un.org/en/docs/dev, accessed 17 May 2022.

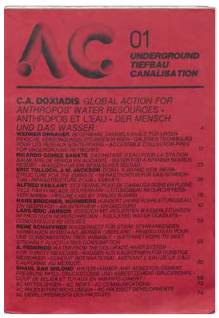
76 UN Industrial Development Organization, *Fibro-Cement Composites. Report of the Expert Working Group Meeting, Vienna, 1969* (New York: United Nations, 1970), 5; *UN Economic Commission for Africa, The African Building Materials Industries* (Addis Ababa: UN Economic Commission for Africa, 1969).

77 See for instance Koenigsberger's list of alternative fibres including abaca, copra, or ramie in Charles Abrams, *Man's Struggle for Shelter in an Urbanizing World* (Cambridge: The MIT Press, 1964), 210.

International materials companies remained interested in these markets, but the power of the developing bloc pushed back at one-way technological transfers. As a compromise between camps, the orthodoxy for generic low-cost houses was conceptually split into local and foreign elements. In 1964, Ernest Weissmann, head of the UN Technical Assistance Board and, like Giedion, a former CIAM member, wrote a preface to a study co-authored by Otto Koenigsberger on roofs for the tropics, noting that "the... Committee on Housing, Building and Planning has decided that among the areas of research we should concentrate on three basic elements of shelter: the roof, the frame of the house, and the floor." (78)

78 Otto Koenigsberger and Robert Lynn, *Roofs in the Warm Humid Tropics*, Architectural Association Papers, no. 1 (London: Lund Humphries, 1965), 6. Koenigsberger was a well-respected architect and lecturer for the Architectural Association's course in Tropical Architecture. The report compared the thermal impacts of different roof types and found that the aluminum roof sheeting slightly outperformed asbestos-cement.

As the first "development decade" of the 1960s came to an end, work by such experts moved away from industrial material specifications. Rather, technology was represented as just one element in a far wider matrix of choices that needed to include human, environmental, urban, and historical dimensions, as Constantin Doxiadis's *Ekistiks* would exemplify. (79) In 1974, though, Doxiadis too became part of the *ac review*'s network of content suppliers when Adler invited him to write an article for a new journal aimed at development experts in settlement and sanitation design, *AC Underground Tiefbau Canalisation.* (80) fig. 16 The introduction explained that this trilingual journal would "serve as a link between all those that calculate, design, and construct conduits and the producers of asbestos-cement pipes" by "setting this limited subject in a wider context." (81) Articles in the inaugural issue covered the infrastructure for the new settlement in Dubai and linked the Colorado River to "thirsty Mexicans." Doxiadis's article, entitled "Global Action for Anthropos' Water Resources," proposed categorizing the networks of water supply according to their density of use. The scientific contribution of the journal, he hoped, would "by a worldwide exchange of information... increase the knowledge and proper respect for that most precious of all elements." (82) He accepted a fee of 100 Swiss Francs per page, his "usual rate" for writing, paid on his request to the Ekistics Centre in Athens. (83)



79 Constantinos A. Doxiadis, "Ekistiks, the Science of Human Settlements," *Science* 170, no. 3956 (1970): 393–404.

80 Florian Adler, letter to Professor C. A. Doxiadis, 14 February 1974. Files/23159, Constantinos A. Doxiadis Archives. Constantinos A. Doxiadis, "Global Action for Anthropos Water Resources," *AC Underground* no. 1 (1974): 4–6.

81 Florian Adler, untitled editorial, *AC Underground* no. 1 (1974): 3.

82 Doxiadis, "Global Action for Anthropos Water Resources," 4.

83 J. Zachariou, letter to Florian Adler, 26 April 1974. Files/23159, Constantinos A. Doxiadis Archives.

Poverty as cancer, water as the most precious element: No doubt, Ortega and Doxiadis, along with other architects whose work in Africa and Latin America appeared in the *ac review*, were sincere in their commitment to a distribution of technical expertise in the Global South as a developmental project addressing basic needs. (84) But their science was limited by a narrow temporal perspective. The lifespan of asbestos-cement sheet products before they release fibres is between thirty and fifty years. Even if deeply embedded asbestos fibres pose no risk before then in carefully maintained and stable conditions, in the wake of thunderstorms, their cement matrix crumbles, leaving residues of dust in the soil, air, and water. (85) Pressure pipes degrade under the acidity of wastewater, age, or underground stress, carrying fibres downstream. (86) The consequence of the intentional circulation of asbestos-cement away from regulatory environments was to spread such residues across the constructed world, with

particularly severe consequences for the poor who received the most exposure in the form of low-cost housing.

84 "Economic Housing in South Africa," *ac 32: International asbestos-cement review* 8, no. 4 (October 1963): 36–40; "Progress in South American Housing," *ac 58: International asbestos-cement review* 15, no. 2 (April 1970): 6–10; "Resettlement Project of the Niger Dam Authority, Kainji; Architect: J. R. Atkinson," *ac 58: International asbestos-cement review* 15, no. 2 (April 1970): 29–40; "A School for Girls at Kimwenza, Zaire; Architect: Olivier Bovy," *ac 73: International asbestos-cement review* 19, no. 1 (January 1974): 56–57; "Vaulted Roofs for Breezy Cool Rooms in Two Hospitals at Ourossogui and N'dioum, Senegal; Architect: P. C. Humblet, with M. Penafiel," *ac 85: International asbestos-cement review* 22, no. 1 (January 1977).

85 Stephen K. Brown, "Asbestos Exposure During Renovation and Demolition of Asbestos-Cement Clad Buildings," *American Industrial Hygiene Association Journal* 48, no. 5 (1987): 478–486; James Phillips and David Rees, "The Legacy of in Situ Asbestos Cement Roofs in South Africa," *Occupational and Environmental Medicine* 74 (2017): A76–77; A. Mathee, Y. E. R. von Schirnding, T. de Wet, and K. Mokoetle, "Potential Risk Factors for Asbestos Exposure Amongst Six-Month-Old Infants Living in the Township of Soweto, South Africa," *International Journal of Environmental Health Research* 10, no. 2 (2000): 135–139.

86 James H. Tucker, "Corporate Compliance and Compensation Problems in Environmental Protection: Implications of 'United States V. Reserve Mining Company'," *Natural Resources Lawyer* 10, no. 3 (1977), 555–590; National Building Research Institute, "Final Report on an Investigation of Longitudinal Cracking of Aged Asbestos Cement Pipes," in C/BOU (Pretoria: Centre for Scientific and Industrial Research, 1983).

South African scholar Rob Nixon has defined the term "slow violence" to describe how the environmental damage wrought by extraction not only impacts heaviest on poor and less visible communities built around resources but is often multiplied exponentially by the use of those resources over long periods of time. (87) The gift of time promised by the asbestos-cement's lack of maintenance simply deferred risks, especially in places where they are not monitored. As a company with interests spanning fibre mining and distribution, cement, technology, and manufacture, as well as a participant in global fora, Eternit's collaboration in developmental discourse would circulate these risks globally to sites with the least governance. The *ac review* further multiplied them by promoting asbestos-cement to architects, through other architects, extending its circulation to the most vulnerable users.

87 Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge: Harvard University Press, 2011).

AC 67–89

The July 1972 cover of *ac 67* featured a life-size lump of blue asbestos ore. (88) [fig. 17] An image of banded stone set against a cream-coloured backdrop, its delicate fibres breaking free from the darker bedrock, was confrontational. It was one of just two representations of raw material on the covers of the *ac review*'s thirty-year run, and the only one of the very toxic blue asbestos—crocidolite. It appeared just as the first national asbestos bans were being enacted in Denmark. In the United States, the first lawsuit had been launched against a North American asbestos-vinyl manufacturer for failing to provide health warnings for workers, enabling subsequent actions that would force the Johns-Manville Corporation to declare bankruptcy. (89) The orientalist representation of asbestos, with the light-washed, toxic lump carefully poised on its shiny base, alluded to the issue's theme of asbestos-cement in Japanese architecture—projects that have since been demolished to remove dangerous building materials. (90) The iconography in *ac 67* of a lump floating free of the mess generated by the milling, transportation, and processing of often invisible fibres was not incidental. The cover image styled asbestos as a curious natural form, dissociating it from conditions in the remote mines in South Africa, including those—Kuruman Cape Blue and Danielskuil Cape Blue—in which the Holderbank held investments until 1981. (91)

88 The identification is by Carl Anhaeusser. The sample is likely crocidolite or "blue" asbestos mined in South Africa by Eternit at the time of the *ac review*.

89 Castleman and Berger, *Asbestos: Medical and Legal Aspects*; Paul Brodeur, *Outrageous Misconduct: The Asbestos Industry on Trial* (New York: Pantheon, 1985).

90 Kenichi Miyamoto, Kenji Morinaga, and Hiroyuki Mori, *Asbestos Disaster: Lessons from Japan's Experience* (Tokyo: Springer, 2011).

91 These mines have left an unresolved legacy of asbestos-related diseases not only amongst miners but also in remote neighbouring communities. For a selection of the considerable literature on South African asbestos mining conditions, see Lundy Braun and Sophia Kisting, "Asbestos-Related Disease in South Africa: The Social Production of an Invisible Epidemic," *American Journal of Public Health* 96, no. 8 (2006): 1386–1396; Robert R. Jones, *Secondary Asbestos Remeditation Plan* (Grahamstown: Department of Environmental Affairs, 2009).

But the *ac review*'s tidy representation of asbestos began to unravel shortly thereafter. Within three years, it included an article on "Marketing and Ethics" written by Stephan Schmidheiny, who took over Eternit's asbestos-cement holdings, severing it from the Holderbank cement company, which would be managed by his brother Thomas as of 1978. (92) An editorial titled "Asbestos – a health hazard?" came out in 1977, and a further editorial, "Questions which we seek the answer," came out in 1978. (93) Between them, however, the content of the *ac review* was consistent: special issues on schools and utilitarian "buildings that don't count" and ongoing coverage of projects, including works by Rogers and Piano, Norman Foster, Günter Behnisch, and Ralph Erskine. (94)

92 Stephan Schmidheiny, "Marketing and Ethics," *ac 77: International asbestos-cement review* 20, no. 1 (January 1975): 5–8; Dominique Barjot, "Holcim: From the Family Business to the Global Leadership (1993-2007)," *l'Harmattan: Revue française d'histoire économique* 1, no. 1 (2014): 56–85. The reasons for the corporate split are not spelled out but it was likely to allow the cement business to distance itself from liabilities arising in the asbestos-cement business.

93 "Asbestos – a health hazard?," editorial in *ac 85: International asbestos-cement review* 22, no. 1 (January 1977): 55–57; and "Questions which we seek to answer," editorial in *ac 89: International asbestos-cement review* 23, no. 1 (January 1978): 4–5.

94 "Buildings that don't count? Workshops, small factories, storage sheds, etc., a neglected category of utility buildings," special issue, *ac 87: the international asbestos cement review* 22, no. 3 (July 1977): 4–34.

The journal's name changed in January 1980 to *AC: the international fibrecement review*, reflecting the growing stigma of and bans on asbestos in the Global North and Eternit's turn to substituting cellulose fibres—its so-called Nutec or New Technology—in those markets. (95) As European countries effected bans on asbestos, the *ac review* went from quarterly to biannual publication frequency. It doubled in price, halved circulation, changed publishers, and finally, for the last issue, found a new editor. (96) The cover art had by then become less memorable. The last issue was number 112, published in October 1985. Yet before disappearing outright, it was dispersed to the Global South. After the *ac review* ceased publication, the publisher and remaining editorial team produced a Spanish-language publication entitled *fcla: El Fibrocemento en América Latina* that repeated its format. *fcla* first came out in June 1986 and ended after three issues.

95 "The rightful place for fibre-cement," editorial in *ac 97: the international fibrecement review* 25, no. 1 (January 1980).

96 Interview with Anthony Tischhauser, 2018; "The Founder of AC Review Goes into Retirement."

It is no longer easy to find copies of the *ac review*, despite its peak circulation of 70 000. Perhaps libraries removed them. After all, they represent an evidentiary trace. While the asbestos-cement companies within the reach of potential civic claims have largely liquidated—Johns-Manville in 1982, Eternit subsidiaries in the United Kingdom in 2017, Eternit Brazil in 2018, and Turner & Newall in 2001—Eternit Switzerland was sold to its sibling company, the future Holcim, in 1986. Court action was instigated in Italy in 2009 against Eternit directors on behalf of workers in the mining town of Casale Monferrato who suffered abnormal levels of mesothelioma. As a consequence of this action, the records of Eternit in Switzerland have become inaccessible, allegedly destroyed or sealed on company orders. (97) This means that histories of this dangerous material must be written without full access to the official archives of its producers. The remaining copies of the *ac review* therefore function as an alternative archive of the history of Eternit's growth, crisis, dispersal, and retreat in the asbestos-cement industry.

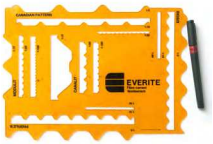
97 Brian Gibson (former "issue manager" of Everite, as well as an administrator of Eternit's [Swiss] legacy companies), emails to author, 2019. In contrast to the total inaccessibility of historical corporate archives on Eternit, there are some traces of records of the two other major asbestos-cement companies, Turner & Newall and Johns-Manville, partly through a legal disclosure that has led to the online repository toxicdocs.org.

The issues of the *ac review* that this work draws on are found in collections on three continents: Africa, Europe, and South America. Between them there are variants of languages and back-cover advertisements, but the content is universal. The first set is in a public library in South Africa, the site of some of the most extensive impacts of asbestos-cement distribution by architects. In this country, over one million state-funded houses, including some self-help units intended for the poorest and most marginalized Black residents, remain roofed with aging sheets. (98) But this circulated risk is not confined to Africa; there are parallel projects in South America and Southeast Asia. What they share is their relationship with Niederurnen, the place where asbestos-cement sheets and the *ac review* were pressed. Much as asbestos was mixed in cement, its history is embedded in the material used to sell it to architects.

98 Llewellyn B. Lewis, "Power and Influence Relations between a Firm and Its Environment and the Development of a Political Strategy for a Firm in the Black Market" (master's thesis, Business Law, University of South Africa, 1977). Following the Latin American practices pioneered by Ortega, Everite promoted canalit roofing in rural Black areas where dwellings had to be partially constructed by their tenants. See also B. Gibson, J. M. teWaterNaude, and D. Rees, "Public Health, Asbestos Cement Roofs and the Free State Audit," *Occupational Health Southern Africa* 27, no. 1 (2021): 3–5.

Rather than exorcizing the *ac review* as a misconstrued, even freakish project within architecture, I have tried to revive it as a useful product, while staying alert to the tragedy of its impact. Re-read as evidence, the *ac review* is a substitute for the absent official archive that would spell out Eternit's influence on architecture. In its style, content, distribution and relations, the *ac review* aligned with the production of the material that it circulated. As a pioneering model for its time, and the most global and sophisticated face of the multinational building material companies, it influenced the ubiquitous framing of architectural culture through sponsored media. With this forensic end, it can be re-read along with the exhibitions, catalogues, and personal archives of the architects patronized by Adler. This evidence, taken together, explains and reflects the complicity of architects in circulating asbestos and signals the danger of assuming that such entanglements ended with its banning. In coming clean about architecture's sponsorship by manufacturers of the products it contains, asbestos is a toxin that we need to confront.

AC 113



A plastic stencil lies on my worktop. fig. 18 I received it in the early 1980s from Everite, Eternit's South African asbestos-cement subsidiary, on a factory visit to their Kliprivier plant. The lecturer in construction technology arranged these visits each year for architecture students. The stencil would guide our hands as we drafted the undulating profiles of their roof sheeting in working drawings. A few years later, I went again to the factory, for the launch of the cellulose-fibre-cement board products that would allow architects to set aside their concerns about specifying asbestos-containing products, at least for flat cladding. (99)

99 The launch of NuTec did not mean the end of asbestos-cement production in South Africa, where it continued to be sold and used in low-cost housing until 2008.

We did not realize that in that same factory roofing sheets produced for low-cost houses in the townships still contained asbestos. Years later, I came across their debris. In the township of KwaThema—built in 1952 as a model for urban Black housing across southern Africa that would endure for the next quarter century—people were assigned small rental houses, half of which had asbestos-cement roofs

and no ceilings. Their post-apartheid owners have begun to alter them, replacing sheets with tiles or tin. Without oversight of these removals, the brittle, seventy-year-old sheets end up as fragments on open land. [fig. 19] [fig. 20] The rift between the asbestos-cement contained in the *ac review* and this strewn toxic mess compelled me to reconsider architecture's—and hence my own—circulatory role.

In the process of milling asbestos from its rocks, the term given to fibres that fall below the machine is *unders*. Dealing with this messy material and placing it back in the manufacturing process is an engineering problem. The meetings, reflections, and editorials, and even the details that rationalized its use by architects in effect served to cover up asbestos's risky loose state, but it could not be avoided forever. In considering the circulatory machine that was *ac review*, the path of this research has gone to its unders and afters. It has set aside texts to speak to people at the tailings of Kuruman and Thetford Mines and the factory at Kliprivier, many of whom live with the fear of mesothelioma. It has uncovered correspondence from Eternit tucked in files in the archives of Ortega, Doxiadis, Giedion, and others in South Africa. There are fragments of asbestos fibres at every step of this trip that bear testimony to the leaky realities of engineered processes. There is no circulation without some mess. In this sense, the narrative of the *ac review*'s circulation has no end, rather standing as a marker of the sort of state shift to what Michelle Murphy calls "chemical regimes of living" in the world under industrialised capitalism. (100)

100 Michelle Murphy, "Chemical Regimes of Living," *Environmental History* 13, no. 4 (2008): 696.

Stengers writes of the milieu in which scientists think; something constructed like a groove, along which they are guided to progress without distractions. (101) Or perhaps the milieu operates something like a stencil does for architects, delimiting what we draw and even preventing us from viewing what we are really doing as we focus on the work of reproducing an abstraction of a material. Even though I do not remember reading the *ac review* in the 1980s, it was, like the stencil, an ambivalent pharmakon, delivering toxicity in the guise of utility and creating and maintaining a reassuring milieu. The packaging of fibres in cement, then of asbestos-cement in houses, and finally, of these houses in the pages of a seductive review dissociated their toxic latency and made the architect-reader complicit. Asbestos was considered safe because it was embedded in architecture.

101 Isabelle Stengers, *Another Science Is Possible: A Manifesto for Slow Science* (Cambridge, UK: Polity Press, 2017).

Stengers's remedy to the pharmakon is to reduce its distance from reality. Asbestos needs to be represented differently by embracing "slower science," by paying attention to its relations across space and above all, by telling the environmental consequences at the start and end of its circulation. As Nixon asks, "How can we convert into image and narrative the disasters that are slow moving and long in the making, disasters that are anonymous and star nobody, disasters that are attritional and of indifferent interest to the sensation-driven technologies of our image-world?" (102) Such acts of storytelling would present an unmediated counter to the pharmakon that the asbestos-cement industry created by replacing rock with asbestos; maintenance with performance; materials with products; design with strategy; and knowledge with media. Reversing the machine, and restoring our relation to geological and organic cycles, this alternative form of architectural media should refuse to allow any substitutes.

102 Nixon, *Slow Violence and the Environmentalism of the Poor*, 3.

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Nations Archives, New York Public Library, gta archives, RIBA library, the John Blandt Canadian Architectural Collection at McGill University, the Johannesburg Art Library, the Jorge Luis Arrigone Housing Collection, the Constantinos A. Doxiadis Archives, and the Canadian Centre for Architecture library and archives.

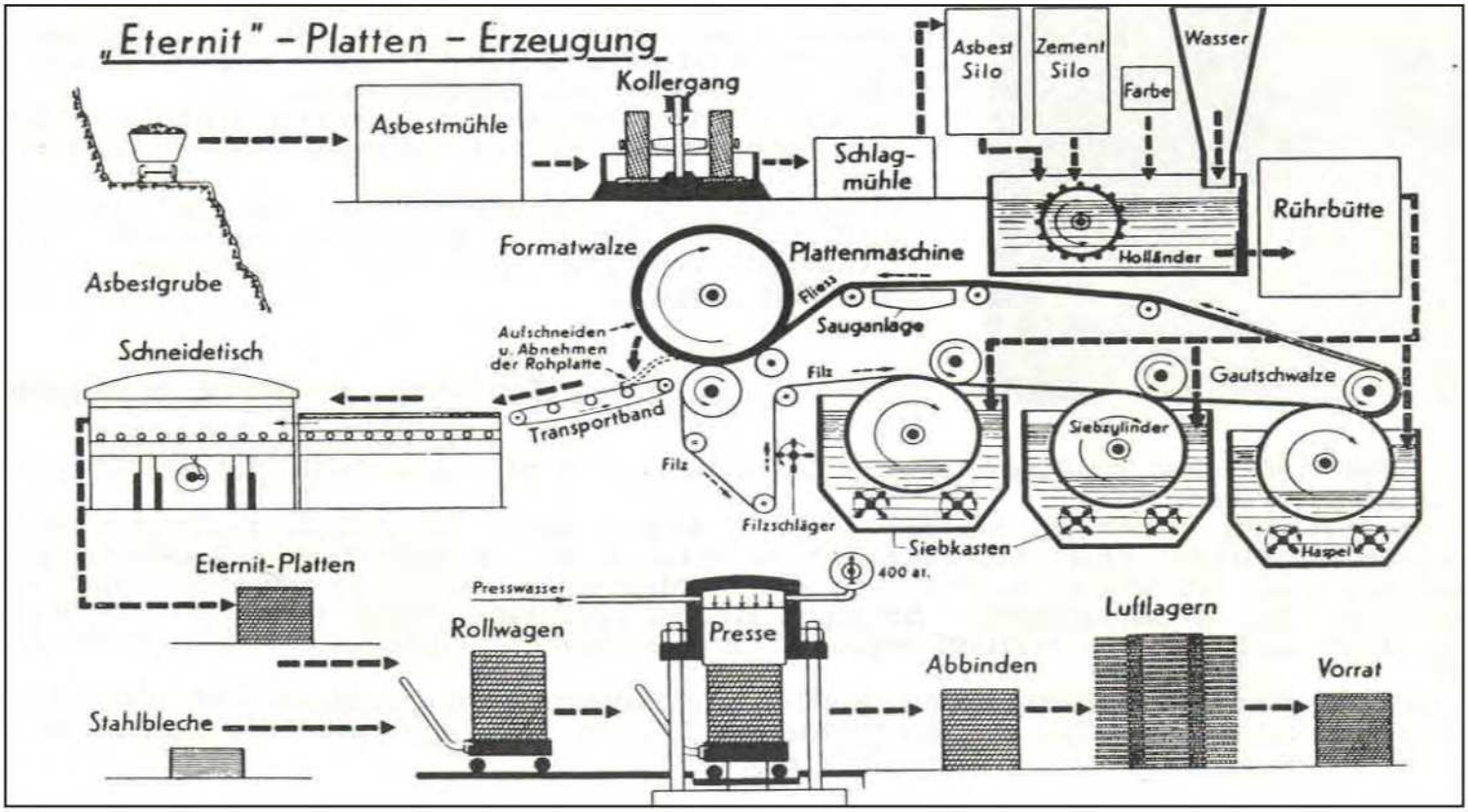
6 – 1

ac: International asbestos-cement review binder, issues 1–8, ca. 1957. Collection of gta Archives, ETH Zürich.

fig. 1

6 – 1 Weathering test panels opposite the Eternit factory, Niederurnen, Switzerland. Photograph by Hannah le Roux, 2018. © Hannah le Roux

fig. 2



6-2 Hatschek patent diagram from Ludwig Hatschek, *Festnummer der Zeitschift der Eternit-Werke* (Vöcklabruck, 1956), 13. Published in R. F. Ruers, "Macht en tegenmacht in de Nederlandse asbestregulering" [Power and Countervailing Power in Dutch Asbestos Regulations] (PhD diss., Erasmus Universiteit Rotterdam, 2012), 49, https://repub.eur.nl/pub/31855/. ® Eternit Austria

fig. 3

6 - 4

Johns-Manville, *Building Materials for Your New Home* (Asbestos, Québec: Johns-Manville Co. Ltd., 1935), cover. ID:87-B8794, CCA.

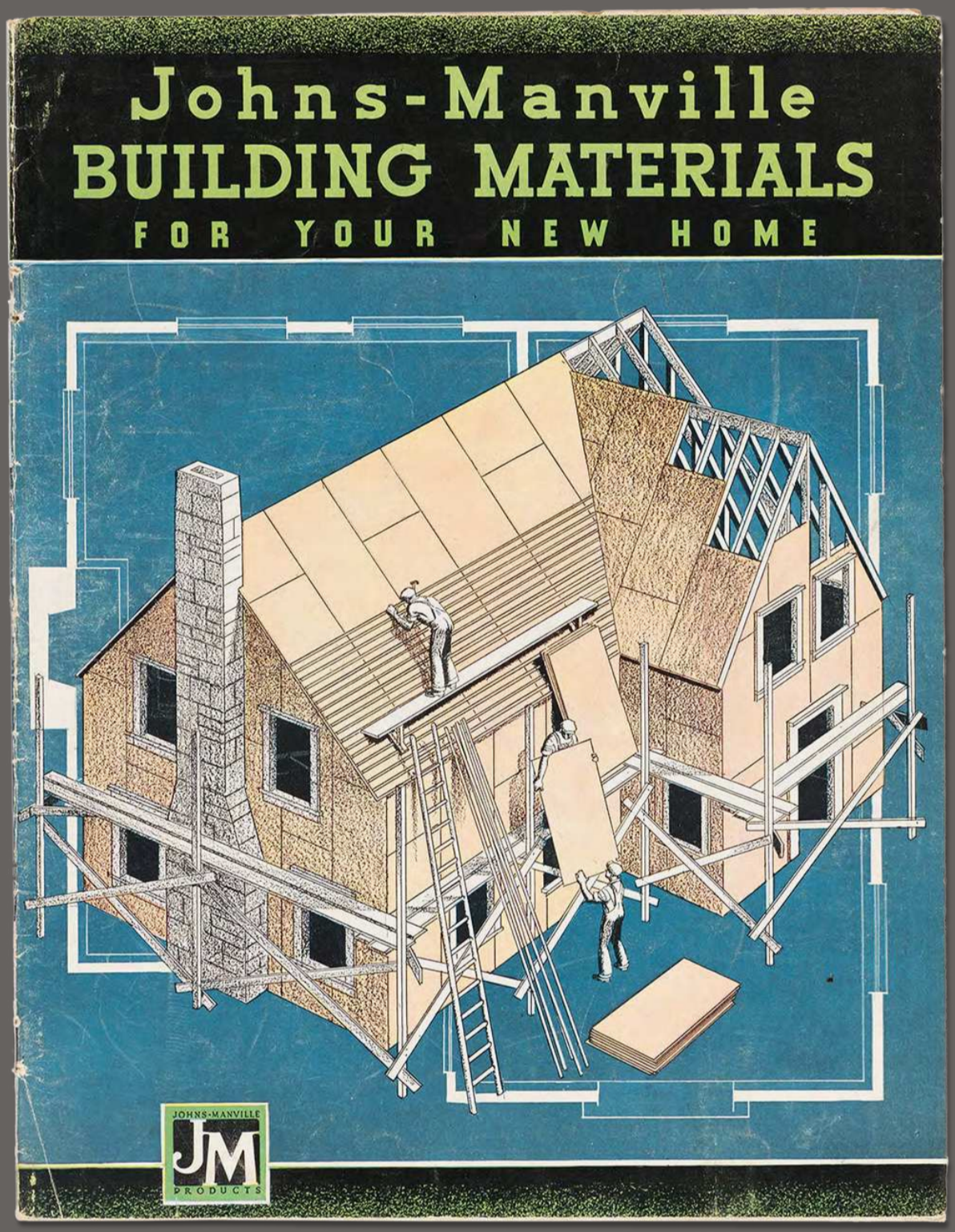


fig. 4

6 – 5 *ac* book series. Collection of gta Archives, ETH Zürich. © Publishers Girsberger, Zürich. Photograph by Hannah le Roux, 2019. © Hannah le Roux

fig. 5

6–7 The south façade of Haus am Hinterstein, designed by Eduard Neuenschwander for Sigfried Giedion, 1955–1956. Photograph by Hannah le Roux, 2018. © Hannah le Roux

fig. 6

Le Corbusier, Sketch for the interior of Haus am Hinterstein, designed by Eduard Neuenschwander for Siegfried Giedion, Amden, 1955–1956. Box 202-104, gta Archives / ETH Zurich, Eduard Neuenschwander. © FLC/ Socan

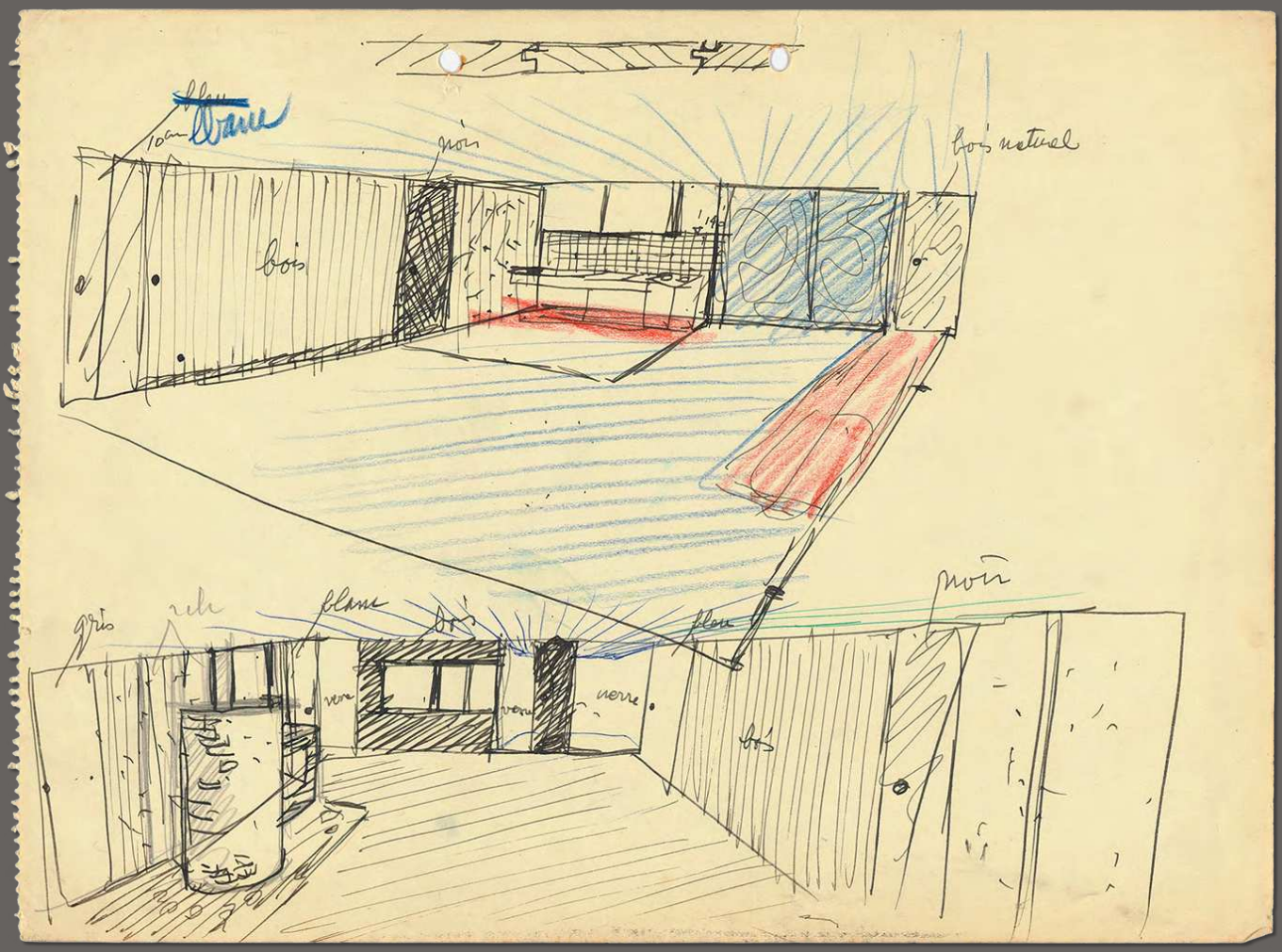
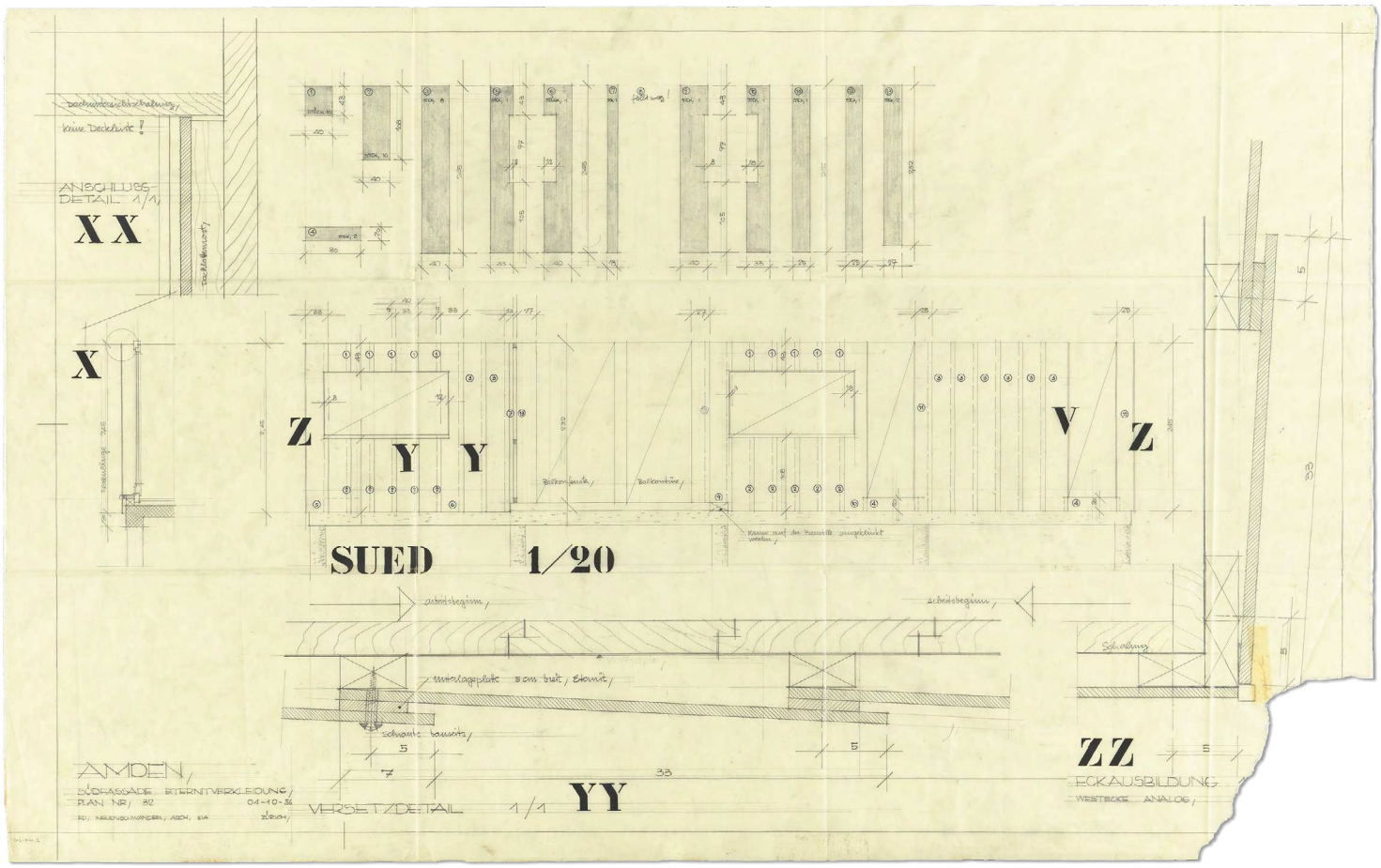


fig. 7



6–7 Eduard Neuenschwander, drawing no. 32 showing Eternit cladding used for the south façade of Haus am Hinterstein, Amden, 1956. Box 202-104, gta Archives / ETH Zurich, Eduard Neuenschwander. © Atelier Neuenschwander

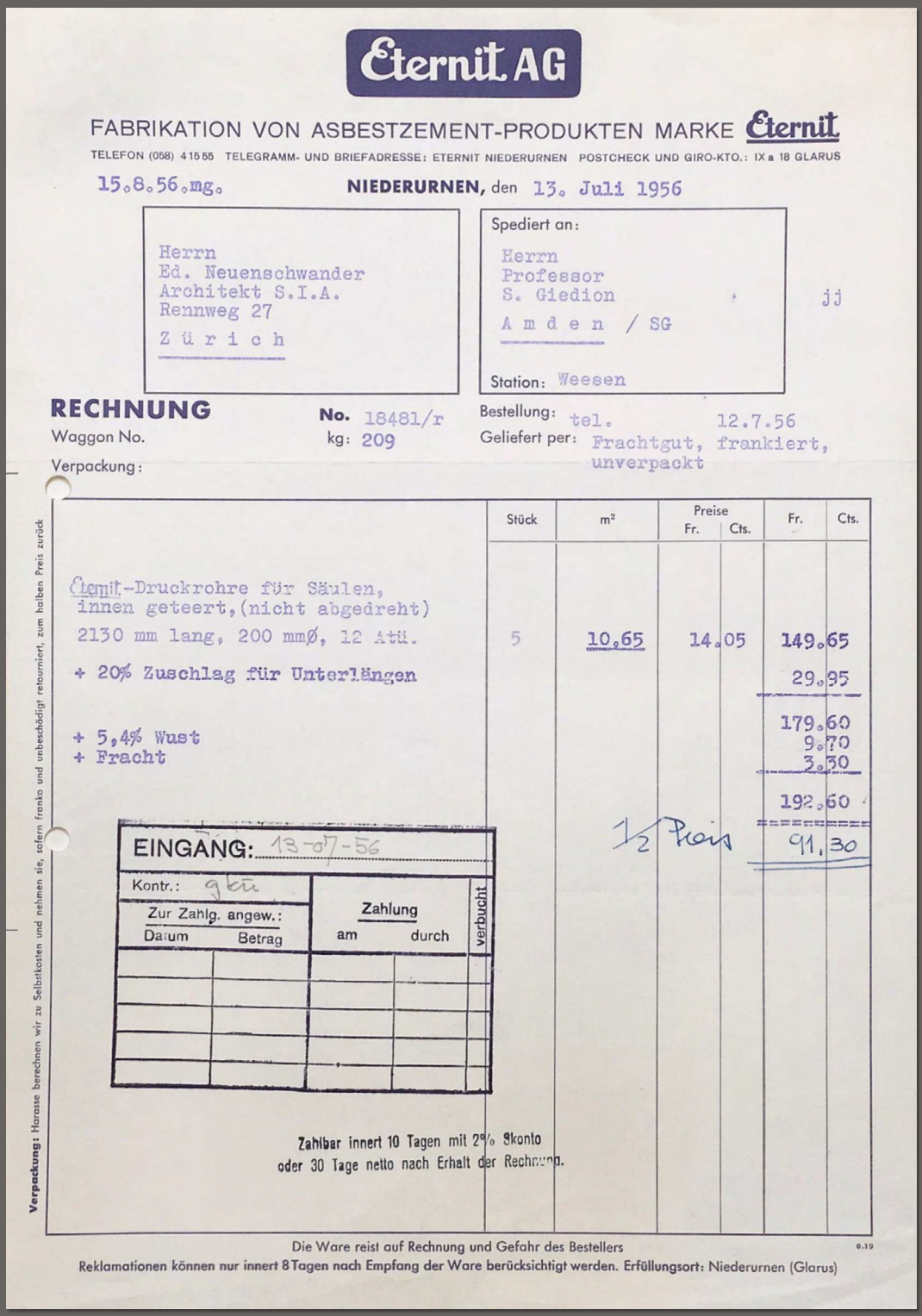
fig. 8

6 - 7

ac 8: International asbestos-cement review (October 1957), cover featuring Haus am Hinterstein. W.I586, CCA.
© Publishers Girsberger, Zürich

fig. 9

6 - 7 Eternit AG, invoice to Professor S. Giedion for asbestos cement pipes, 13 July 1956. Box 202-104, gta Archives / ETH Zurich, Eduard Neuenschwander.



Eternit AG

FABRIKATION VON ASBESTZEMENT-PRODUKTEN MARKE Eternit

TELEFON (058) 41555 TELEGRAMM- UND BRIEFADRESSE: ETERNIT NIEDERURNEN POSTCHECK UND GIRO-KTO.: IX a 18 GLARUS

15.8.56.mg. NIEDERURNEN, den 13. Juli 1956

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Ed. Neuenschwander
Architekt S.I.A.
Rennweg 27
Z ü r i c h

Spediert an:
Herrn
Professor
S. Giedion
A m d e n / SG
Station: Weesen

jj

RECHNUNG No. 18481/r
Waggon No. kg: 209
Verpackung:

Bestellung: tel. 12.7.56
Geliefert per: Frachtgut, frankiert, unverpackt

	Stück	m²	Preise Fr.	Cts.	Fr.	Cts.
Eternit-Druckrohre für Säulen, innen geteert, (nicht abgedreht)						
2130 mm lang, 200 mmØ, 12 Atü.	5	10,65	14	05	149	65
+ 20% Zuschlag für Unterlängen					29	95
					179	60
+ 5,4% Wust					9	70
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fig. 10

6 - 9

Alvaro Ortega, *Modular Coordination in Low-Cost Housing* (New York: United Nations Economic and Social Council, 1961). BIB 203424, CCA. © Copyright holders unidentified

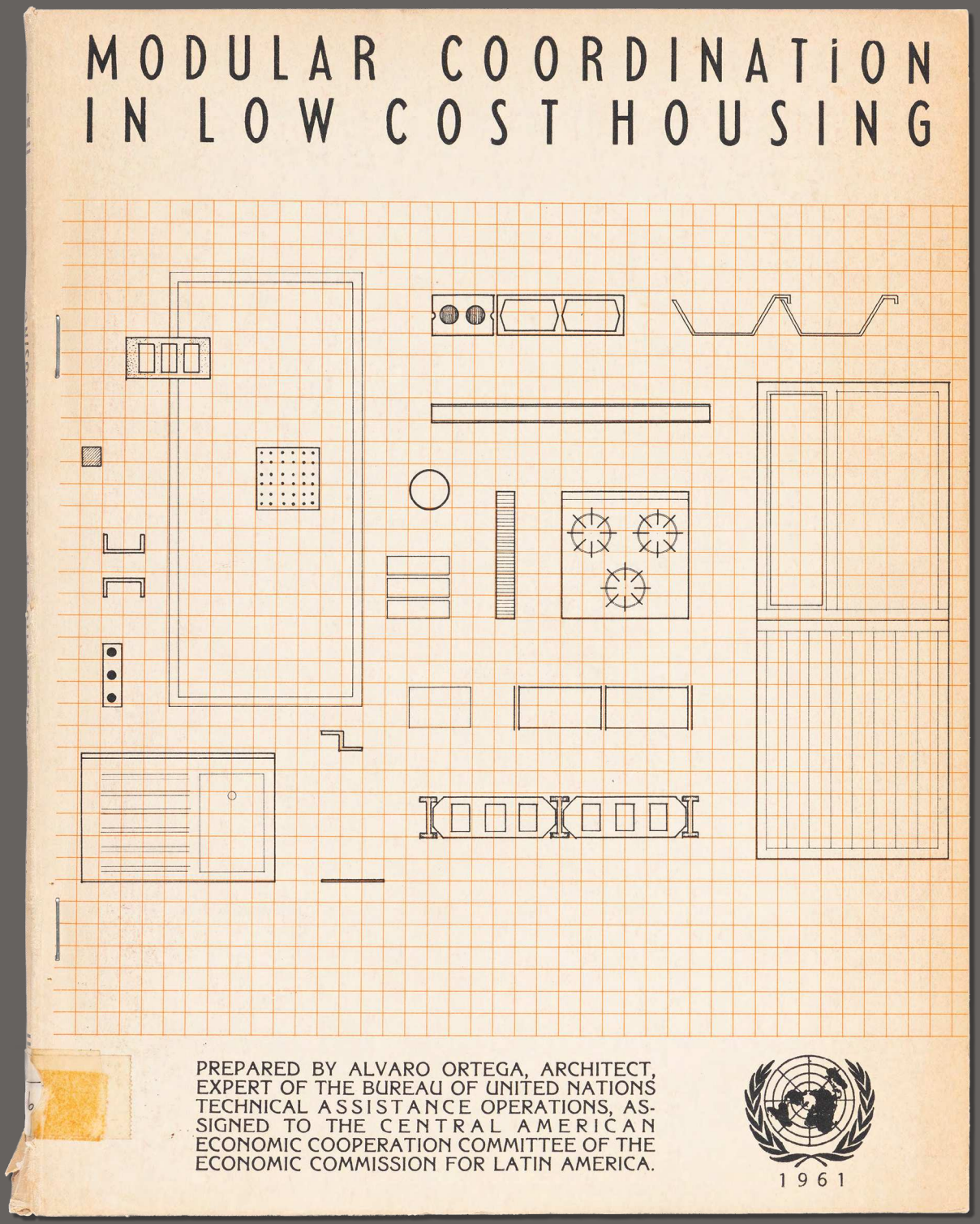


fig. 11

6 - 10

Frank Gaillard, case study of mesothelomia – sarcomatoid showing right “white lung” displacing the heart to the left and the diaphragm inferiorly, and amorphous calcifications scattered throughout right hemithorax, 23 February 2010. rID: 8705, https://radiopaedia.org/cases/8705. CC BY-NC-SA 3.0.

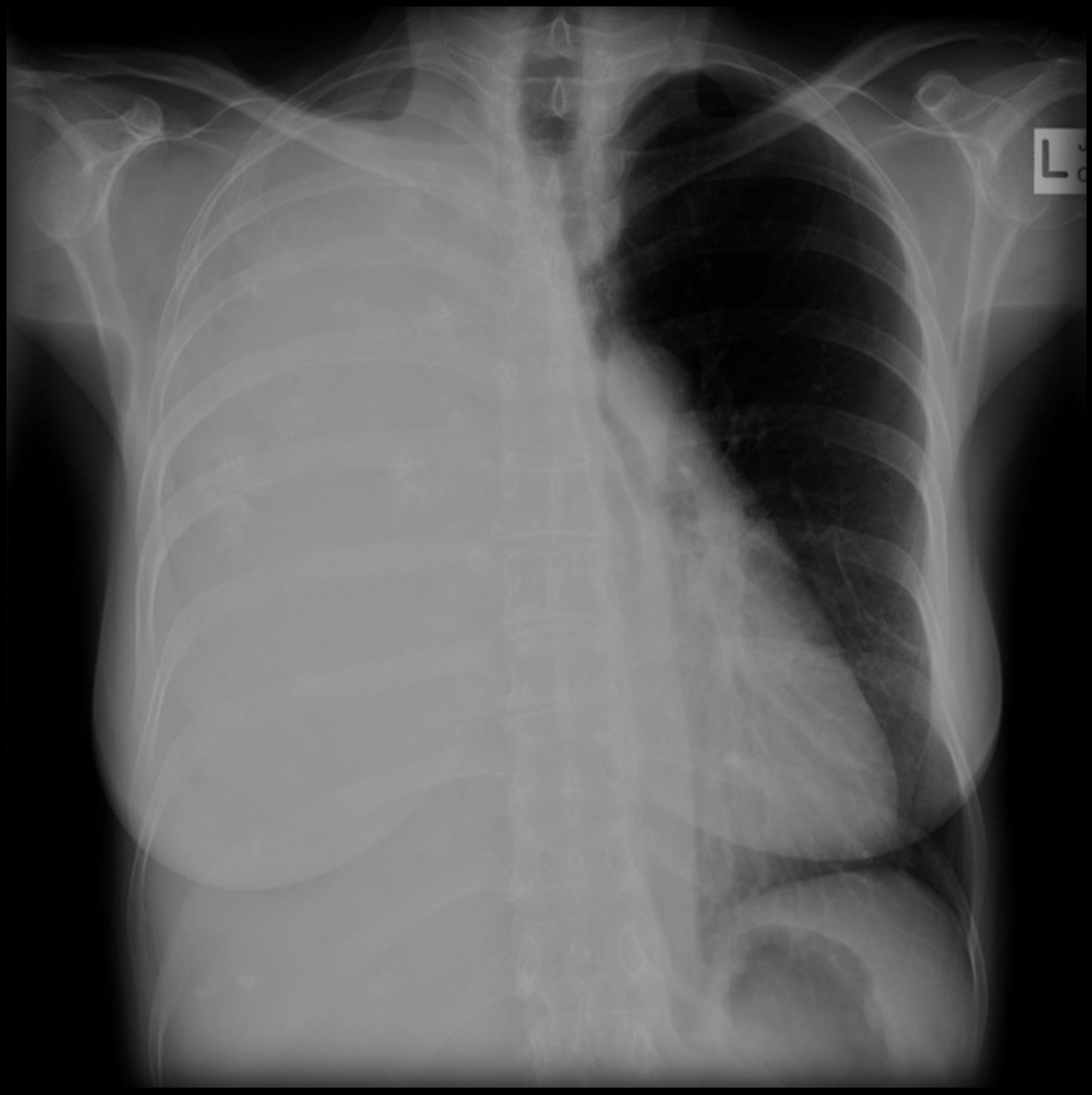


fig. 12

6 – 11

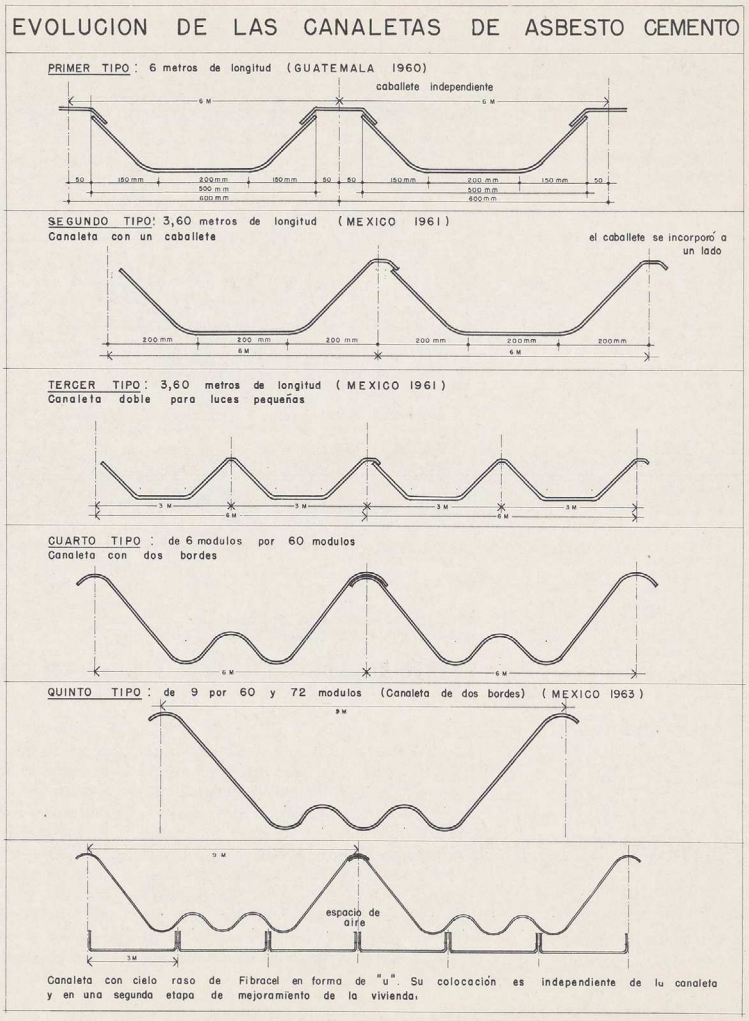
Photographer unknown, canaleta used in Guatemala housing, ca. 1961. Alvaro Ortega fonds, John Bland Canadian Architecture Collection, McGill University. © Copyright holders unidentified

fig. 13

Las Canaletas

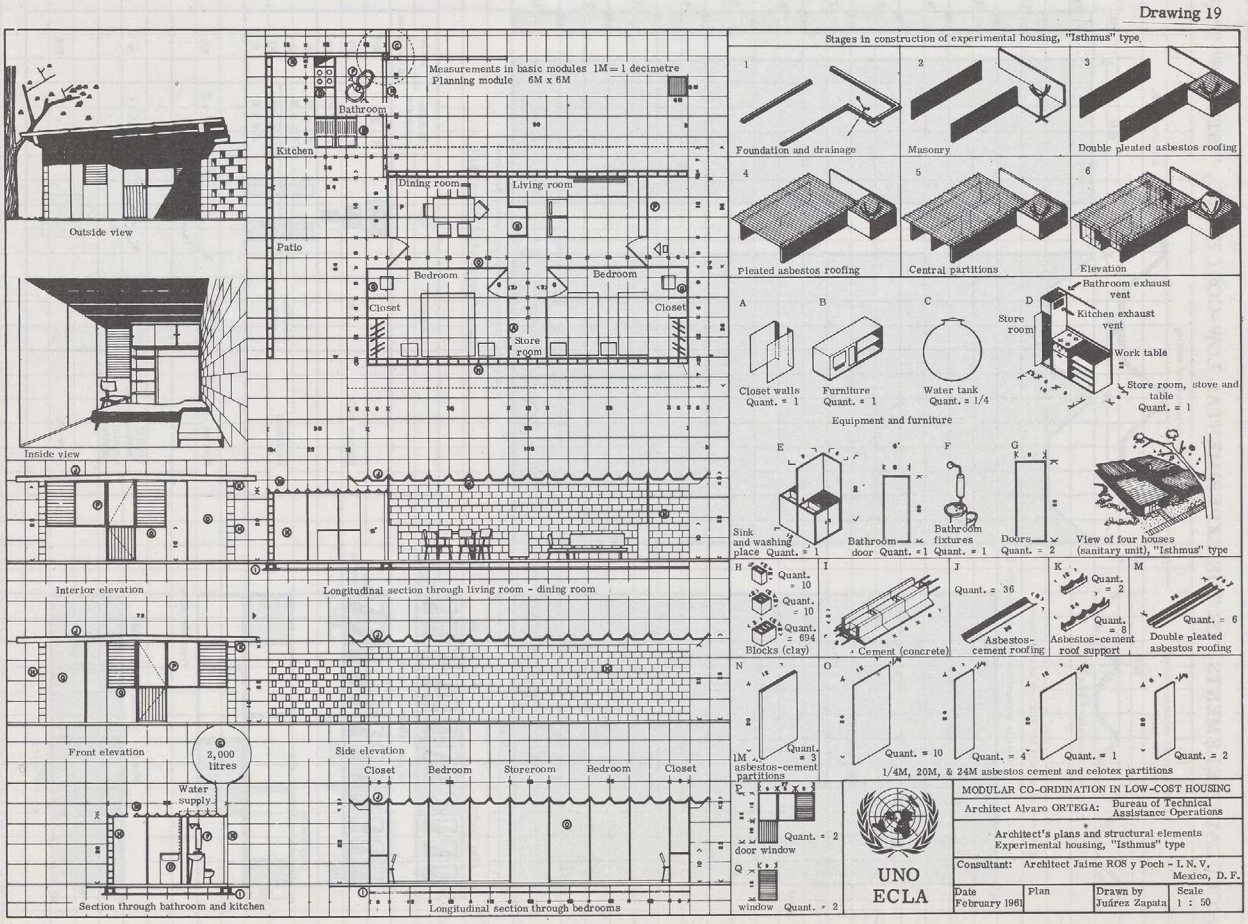
una aplicación reciente para cubiertas economicas

ONU
CEPAL



6 – 11 Alvaro Ortega, "Las Canaletas," cover of offprint from *ac 32: International asbestos-cement review* (October 1963): 27-29. Alvaro Ortega fonds, John Bland Canadian Architecture Collection, McGill University. © Copyright holders unidentified

fig. 14



- 35 -

6 - 12 Alvaro Ortega, United Nations experimental house type ISTMO, 1961. Alvaro Ortega fonds, John Bland Canadian Architecture Collection, McGill University. © Copyright holders unidentified

fig. 15

6 - 13

AC 01: Underground Tiefbau Canalisation (01/1974), cover. P 27606, ETH Bibliothek. gta Archives. © Publishers Girsberger, Zürich

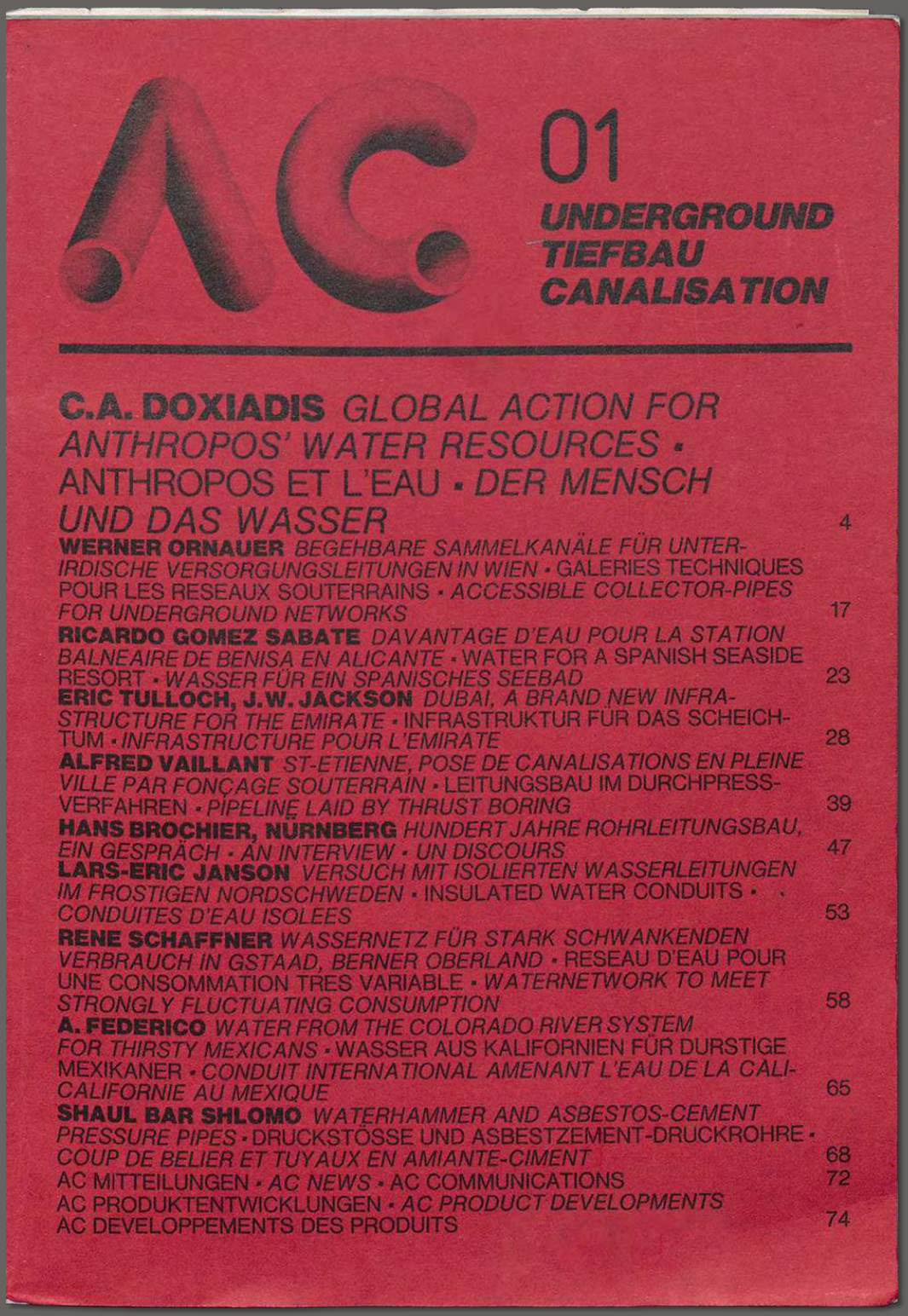


fig. 16

6 – 14

ac 67: International asbestos-cement review (July 1972), cover featuring a lump of crocidolite, "blue asbestos." W.I586, CCA. © Publishers Girsberger, Zürich

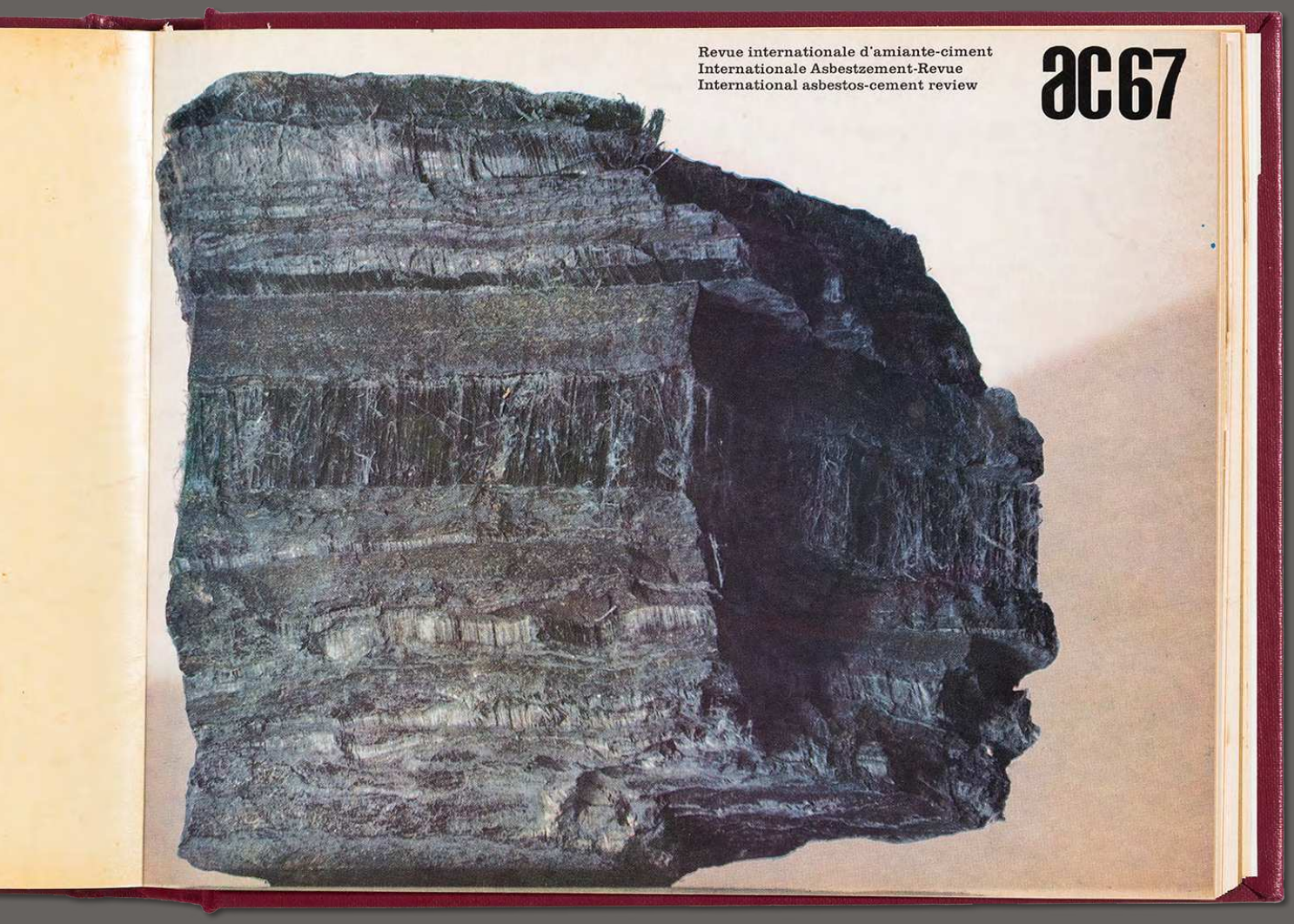


fig. 17

6 - 16 Everite stencil, a drafting guide with asbestos-cement roofing profiles distributed to South African architects, ca. 1985. Photograph by Hannah le Roux. © Hannah le Roux

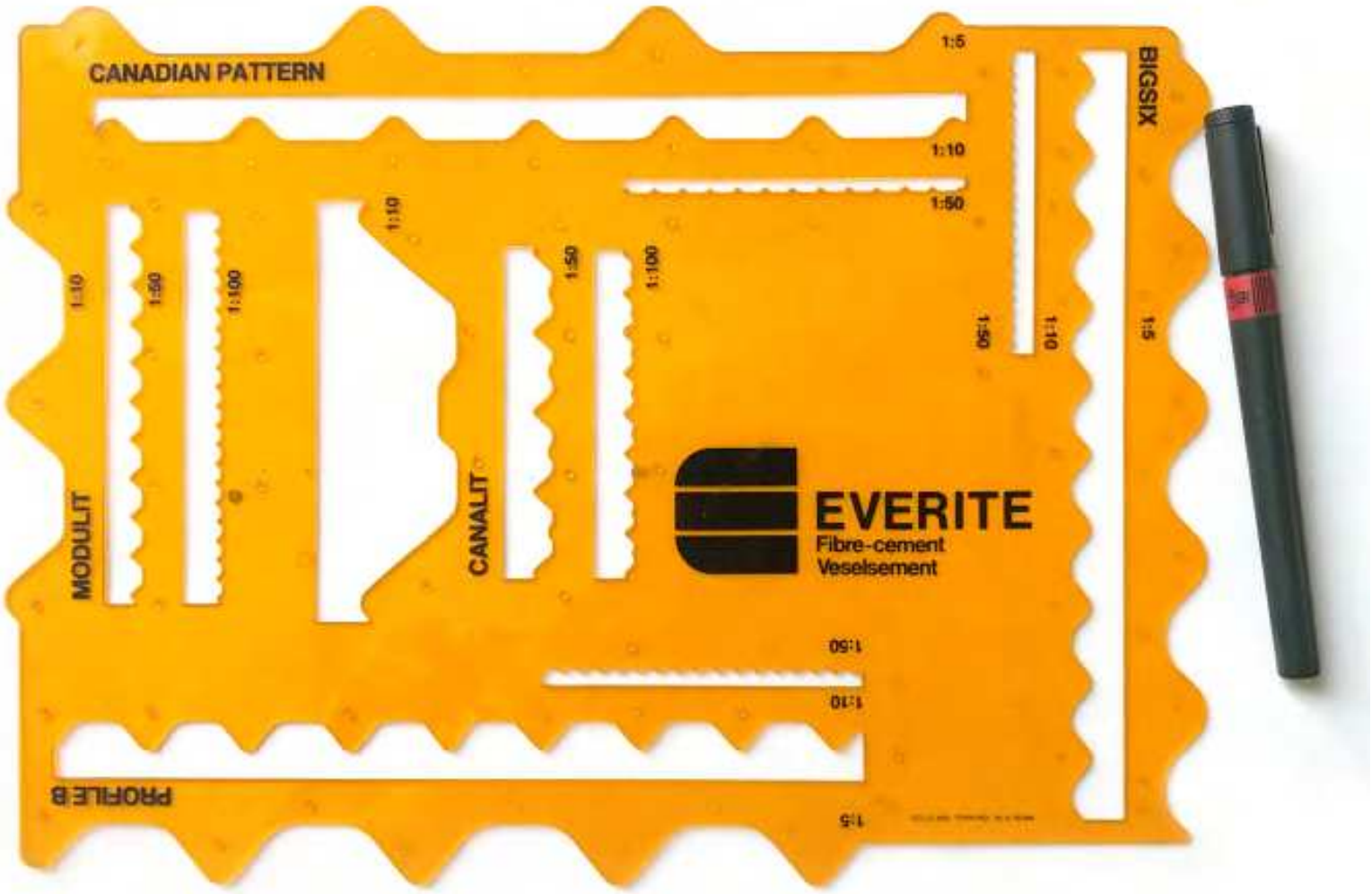


fig. 18

6 – 17 House demolition rubble in KwaThema, South Africa, 2020. Photograph by Hannah le Roux. © Hannah le Roux

fig. 19

6 – 17 Building waste dump near KwaThema, South Africa, 2020. Photograph by Hannah le Roux. © Hannah le Roux

fig. 20

Environmental Histories of Architecture is a series of essays produced as part of Architecture and/for the Environment, the third research project (2017–2019) of the Multidisciplinary Research Program, organized by the CCA with generous support from the Andrew W. Mellon Foundation. The project—developed by Kim Förster (CCA Associate Director, Research, 2016–2018) with advisors Daniel Abramson, David Gissen, and Imre Szeman—examined unresolved, and perhaps irresolvable, contradictions and ambiguities in architecture's environmental history. With *Environmental Histories of Architecture*, the CCA launches an open-access publishing model to circulate the ideas generated through its research programs.

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