Chapter 12: The Architectural Geology of Downtown Chicago: A Sampler

The Near North Side and the Loop

Cook County

from:

Geology Underfoot in Illinois by Ramond Wiggers ©1997

— 12 —

The Architectural Geology of Downtown Chicago: A Sampler

The Near North Side and the Loop

Cook County

Not to find one's way in a city may well be uninteresting and banal. It requires ignorance—nothing more. But to lose oneself in a city—as one loses oneself in a forest—that calls for quite a different schooling.

—Walter Benjamin, "A Berlin Chronicle"

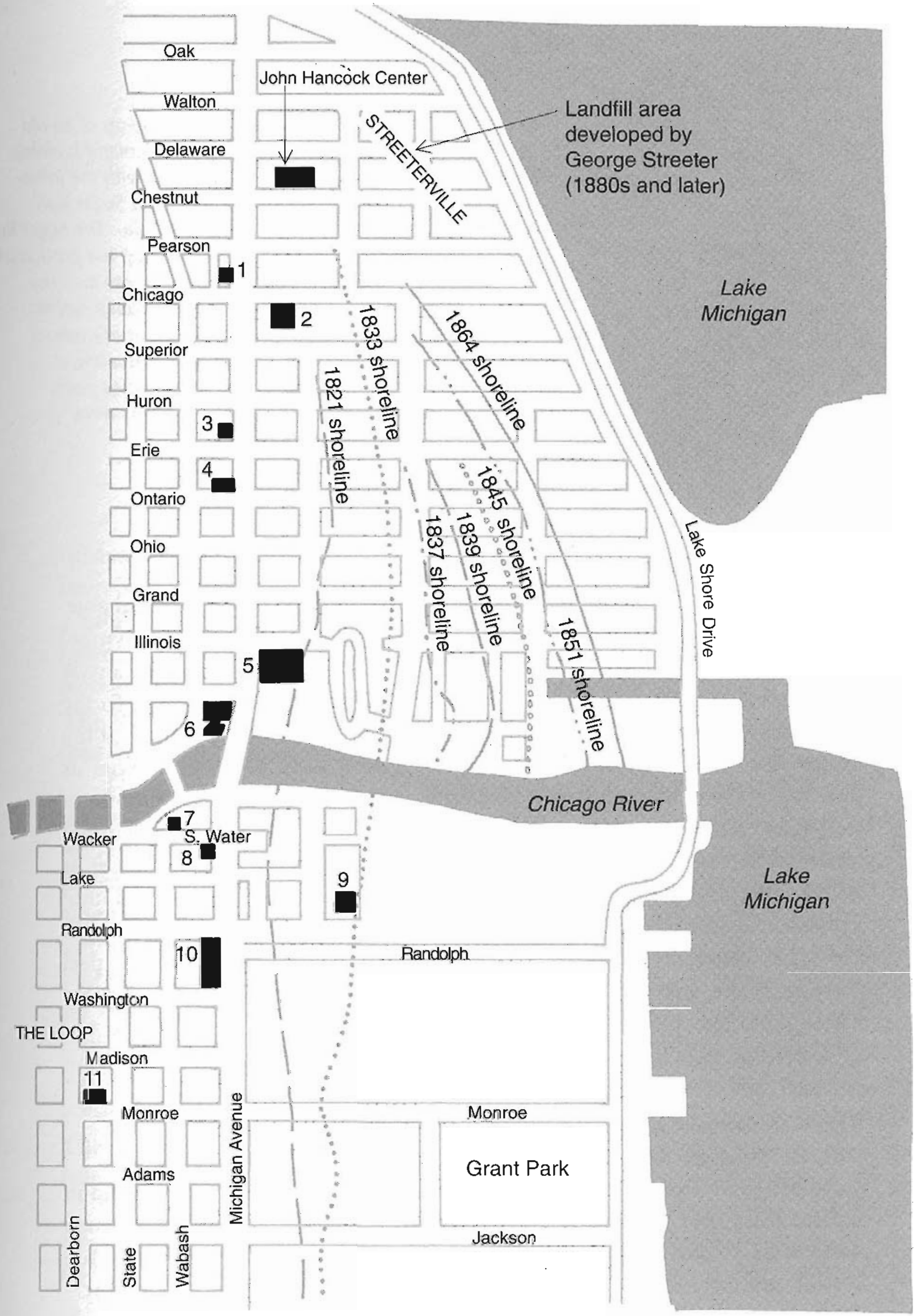
Earth science is an octopuslike subject, with its tentacles reaching into many unexpected places. To most people, geologic exploration implies a wild setting: the layer-cake chasms of Arizona's Grand Canyon, the volcanoes of Iceland, the glacier bays of Alaska. Few places, though, are as geologically rewarding as the heart of a great city, where the forces of economics, political power, and civic pride combine in the uniquely geological art form of architecture. For the person interested in the scientific underpinnings of architecture, losing oneself in downtown Chicago is much like losing oneself in paradise.

When we think of the primary materials that shape our modern civilization, we think mainly of steel, plastic, and the microchip. But no other culture has relied on stone products as comprehensively and as voraciously as ours. If we used our terms more precisely, we would call this the Stone Age. According to the State Geological Survey, in one average year in the recent past, Prairie State quarries produced the equivalent of more than five tons of stone for each Illinois resident. These quarries supply massive amounts of sedimentary rock—Ordovician sandstone, Silurian dolomite, and Mississippian limestone—for a wide array of applications, from massive blocks destined for Lake Michigan piers to fine quartz grains used in glassmaking. In Chicago's monumental heart, though, the ornamental stone comes most often from sources outside the region, and even outside the nation. Here in the urban core, one can get an excellent glimpse of the geology of the greater world.

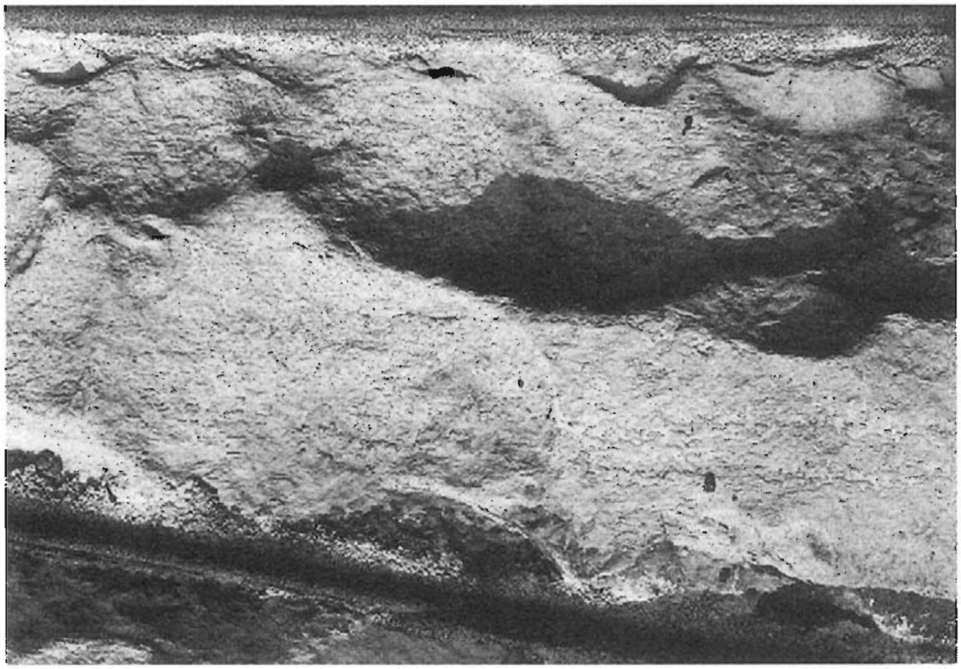
In contrast to the ridged morainal country to the north and west, Chicago sits on the almost perfectly flat floor of ancestral Lakes Chicago and Nipissing—predecessors of Lake Michigan from approximately 14,000 to about 4,000 years ago. When these waters covered the metropolitan area, they deposited a deep layer of fine sediments. As the owners of Chicago's earliest tall buildings soon learned, these silts and clays hardly make an ideal substrate. Anchoring a skyscraper in Chicago is much more difficult than in New York City, where surface exposures of the tough, Paleozoic schist have facilitated the construction of Manhattan's two high-rise districts, Midtown and the Wall Street area. The main danger posed by the Windy City's unconsolidated lakebed deposits is that they tend to settle unevenly when subjected to great weight. No one sitting in a sixty-fifth-floor office wants that sort of uncertainty.

The eleven buildings described in this essay are located within what most readers would regard as a healthy ninety-minute walk. The starting point, the Chicago Water Tower, is Chicago's most celebrated landmark and stands at the focal point of the busy Near North Side. This land just above the final stretch of the Chicago River is a perfect example of the impact human activity has had on the Lake Michigan coastline. Originally, the eastern portion of the Near North Side was either submerged ground or an unappealing patch of coastal sand dunes, depending on the exact locale. In the 1820s, Michigan Avenue stood only a city block or two from the waters of the lake. This locale did not attract the general attention of builders and investors until the 1880s, when one of the most picturesque of the city's many scoundrels, George "Cap" Streeter, grounded his ship on a shoal, roughly where the mighty John Hancock Center now stands. When he realized that he was stranded for good, Streeter convinced local contractors to dump their construction waste around his vessel. Soon the whole area was filled in; and the real estate value of the parcel, known as Streeterville, soon became apparent. Because the land had been snatched from the lake, it was not in Illinois's jurisdiction, or so Streeter contended. He proclaimed his domain an autonomous district and set himself up as its federal governor—an impressive promotion for one who formerly had been an itinerant showman and circus producer. Amazingly—given Chicago's penchant for strong-arm politics—it took three decades for the city's judges and nabobs to dislodge him from his waterfront roost. When he was booted out, he was convicted not of impersonating a U.S. government official or of deluding investors but of selling hard liquor on the Sabbath.

This introductory architectural-geology tour begins not far from where Cap Streeter's weary vessel came to rest.



Downtown Chicago, with the eleven buildings visited on this tour shown in solid black and numbered. 1: The Chicago Water Tower; 2: The Olympia Center; 3: The Terra Museum of American Art; 4: The Woman's Athletic Club; 5: Chicago Tribune Tower; 6: The Wrigley Building; 7: The Seventeenth Church of Christ Scientist; 8: The Carbide and Carbon Building; 9: The Amoco Building; 10: The Chicago Cultural Center; 11: Inland Steel Building. —Modified from Bretz, 1955



A close-up of an old Chicagoland building faced with the Joliet-Lemont Sugar Run dolomite. The Sugar Run cladding is a particularly handsome material that often weathers to a buttery yellow. Unfortunately, it sometimes peels away in layers.

The Chicago Water Tower
(North Michigan Avenue at Chicago Avenue)

This modest but world-famous structure is Chicago's sacred totem pole. Because it survived the devastating 1871 fire, it became the city's symbol of determination and survivability. Designed by W.W. Boyington in a style that might be termed Amateur Gothic, it was completed in 1869. To the geologist familiar with this region's rock types, the handsome stone of the Water Tower and its associated pumping station is an old friend. Note its glowing yellowish tone: this is the trademark of the Silurian dolomite of the Sugar Run formation (often called, not quite accurately, limestone) quarried in the Lemont-Joliet area. Also offered commercially as Joliet or Athens marble—another misnomer—this stone was commonly used until Indiana's Bedford limestone supplanted it in the 1890s. The Bedford lacks the warm, golden tint of the local rock, but it does not exfoliate, or peel away in layers, the way the dolomite does. No one wants a building that sheds like a sheepdog. The Sugar Run dolomite was deposited some 420 million years ago, when Illinois was positioned below the equator and was covered with a warm, shallow sea.

The Olympia Center
(161 E. Chicago Avenue, half a block east of Michigan Avenue)

This 1984 example of postmodernism shows the latest major trend in architecture: after years of buildings fronted with steel and glass, ornamental stone is back with a vengeance. This structure is sheathed from head to toe in pink granite quarried in Sweden. The transatlantic seaborne-transportation costs for a stone shipment this massive must have been staggering: which perhaps is the We've-Got-It-and-We-Flaunt-It message inherent in this

Simple but effective contrast: the Olympia Center's pink Swedish granite near ground level. The upper panel has been polished to a high gloss; the lower panel remains unpolished and rough.

otherwise understated design. Some of this beautiful crystalline rock has been polished; and for simple but effective contrast, some of it has not. Take a hand lens or magnifying glass to this stone and examine the individual minerals. These small individual components slowly crystallized from a body of molten rock while it was still seated far underground.

The Terra Museum of American Art
(666 North Michigan Avenue)

The facade of this relatively small, new building is the best place in the city to see the glory of polished marble in the full sunlight. Marble is a metamorphic carbonate rock that has been a favorite of architects and sculptors for thousands of years. To be metamorphosed into high-quality, white or pale gray marble, the parent limestone must be almost pure calcite, and it must be subjected to high enough pressure and temperature to at least partially recrystallize the calcite. In many rocks, the constituent minerals are changed into something else during metamorphism; but calcite remains calcite. Note how the blue veins running through the white matrix add to its beauty. Veins in marble are usually composed of another carbonate mineral that is present in small quantities.

The Woman's Athletic Club
(626 North Michigan Avenue)

This 1920s-era building features a facing stone of particular beauty and elegance at the corner of North Michigan and Ontario. This veined, greenish black rock recalls the look of deep salt water on a cloudy day. It is a type of cladding (ornamental covering material) that architects call verde antique marble; to geologists, it's not a marble, but serpentine. If one exciting new theory is correct, you are looking at the rarest rock type of all: a highly

Work in progress on the Wrigley Building. The same natural forces that weather and weaken stone surfaces have attacked this structure's gleaming white cladding. Molded plastic replicas now replace the original terra-cotta tiles.

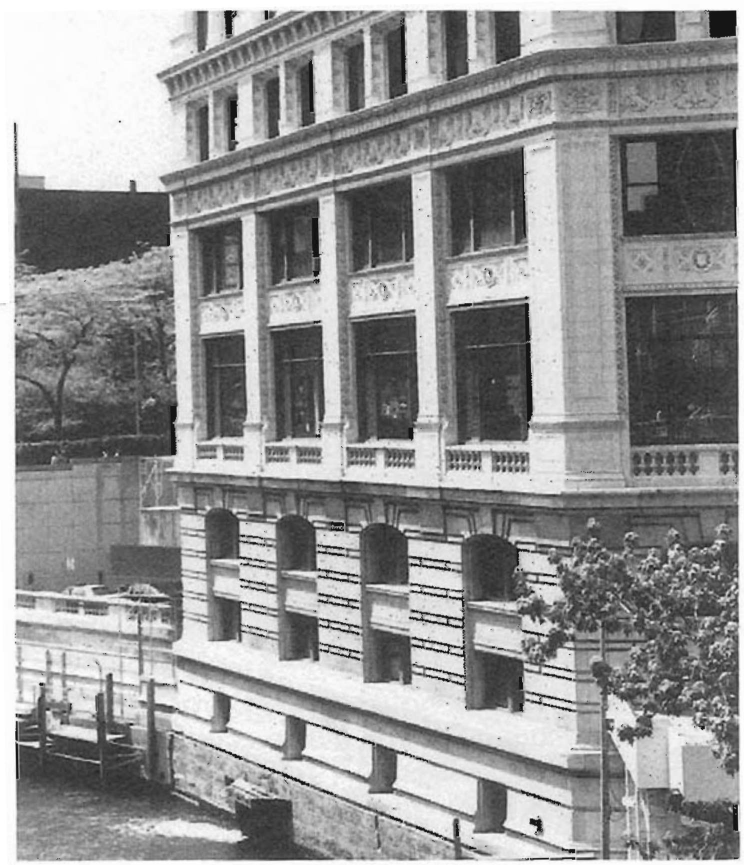
metamorphosed piece of the earth's mantle, the deep-seated zone that underlies our planet's relatively thin crust. The theory proposes that serpentine is formed in the chaotic setting of an oceanic spreading center, when a portion of the upper mantle comes in contact with seawater. Many millions of years later, a large assemblage of rocks, known as an ophiolite sequence, may be scraped up onto the leading edge of a continent when it collides with a volcanic-island arc. Serpentine is one small part of that ophiolite sequence. On both sides of North America—for example, in Vermont's Green Mountains and in California's Sierra Nevada—serpentine deposits are part of jumbled complexes that apparently began in the middle of ocean basins and ended up high in the continental highlands. No mean feat. The somber beauty of this serpentine reveals something more than our passion for using ornamental stone. It also demonstrates what remarkable changes the earth produces in the span of geologic time.

Chicago Tribune Tower
(435 North Michigan Avenue, at the Chicago River)

As every tourist wandering in this locale soon notices, the ground-level exterior of this Chicago landmark contains inset pieces of stone and building material taken from some of the world's most famous historical sites. Among the more geologically interesting specimens are a white granite or granitelike glacial erratic plucked from Boston's Bunker Hill, limestone from the Great Pyramid of Giza, and a chunk of coquina from Fort Maria, in St. Augustine, Florida. Coquina is a particularly eye-catching form of limestone, predominantly made of shell fragments and other hard remains of marine creatures, all cemented together into a crumbly rock with a texture that bears more than a passing resemblance to a granola bar. Of the three specimens cited here, only the Bunker Hill erratic is igneous in origin, rather than sedimentary. Look closely at its interlocking crystals, which long ago precipitated out of a molten slurry of magma far beneath the earth's surface.

The Wrigley Building
(410 North Michigan Avenue, at the Chicago River)

As the Water Tower is symbolic of the city's pertinacity, this gleaming mass of light and grace symbolizes Chicago's willingness to expend limitless energy to achieve its goals. At night, the structure is illuminated by banks of metal-halide lights that seem to outdo the sun. Originally, the building's cladding was glazed terra-cotta—baked clay covered with a glossy coating (in this case, a shimmering white). Still, the building's geological significance lies not in the terra-cotta itself but in how natural forces have worked upon it. For decades, the building's management had to deal with the fact that the tiles were developing hairline cracks in response to the great variations



The Wrigley Building's base, along the Chicago River. The lowest level (with the arched windows) is faced with Mississippian Bedford limestone; above it is the ornate glazed tiling.

in temperature. Rainwater seeping through the cracks and the mortar caused the supporting iron shelves to rust. The rust expanded, causing bigger cracks. In winter, water turned to ice and triggered another expansion process, frost wedging, the same process geologists often see dislodging rock in outcrops. By 1984, this assault of the elements prompted the Wrigley Company to begin replacing the terra-cotta piece by piece with plastic replicas.

The Seventeenth Church of Christ Scientist
(55 East Wacker Drive)

A close inspection of the exterior of this distinctive house of worship reveals that the facing stone is travertine, a striking rock type that contains banded patterns of spongy pockmarks. (The best place to see the banding is on the church's south side.) Travertine forms at the mouths of hot springs and in other zones of seepage, when calcium carbonate precipitates out of mineral-rich water. The most famous source of travertine is in the volcanic terrain around Tivoli, Italy; but it also occurs in small quantities in Illinois—for instance, in the bluff of the Mississippi River valley near Wolf Lake, where lime-saturated water has seeped through thick Pleistocene loess deposits.

Travertine, an unusual carbonate rock, has been a favorite of architects for centuries. Here on the Seventeenth Church of Christ Scientist, the pockmarks characteristic of this stone form a linear texture that runs perpendicular to the ground.

The Carbide and Carbon Building
(230 North Michigan Avenue)

What a darkly beautiful structure this gilt-trimmed Art Deco skyscraper is. At this stop, you can easily find an unusual limestone that is most often called black marble—an understandable gaff considering that marble is the metamorphic derivative of limestone. When you examine the main entrance, you'll notice that the black marble is offset by the mellowest of ornamental metals, bronze. One of the major sources of black marble is the Ordovician Chazy group—specifically, the Crown Point limestone, mined by the Vermont Marble Company in Isle la Motte, one of the islands in Lake Champlain. This stone, also nicknamed "Champlain Black" for obvious reasons, often contains the fossil snail *Maclurites magnus*. The existence of undeformed fossils is one indication that this handsome stone was not significantly altered by the powerful mountain-building forces that affected the Northeast in the Paleozoic era.

The Amoco Building
(200 East Randolph Street)

At eighty-two stories, this great white monolith is the second tallest building in Chicago. All too often architecture commentators have described it in scalding terms that could have melted the entire Wisconsinan ice sheet. One criticism is that it is too inhuman, too imperious, too impersonal. But to someone who in the early 1970s watched it rise on its exposed, provocative site—and who has since seen it float in the lake mist, seemingly detached from the earth—it appears that its lack of compromise is precisely its strongest point. If the architects have spurned it, I suggest that geologists, who have a greater tolerance of the inhuman, adopt it. Given the building's troubled history, it could use a sympathetic support group.

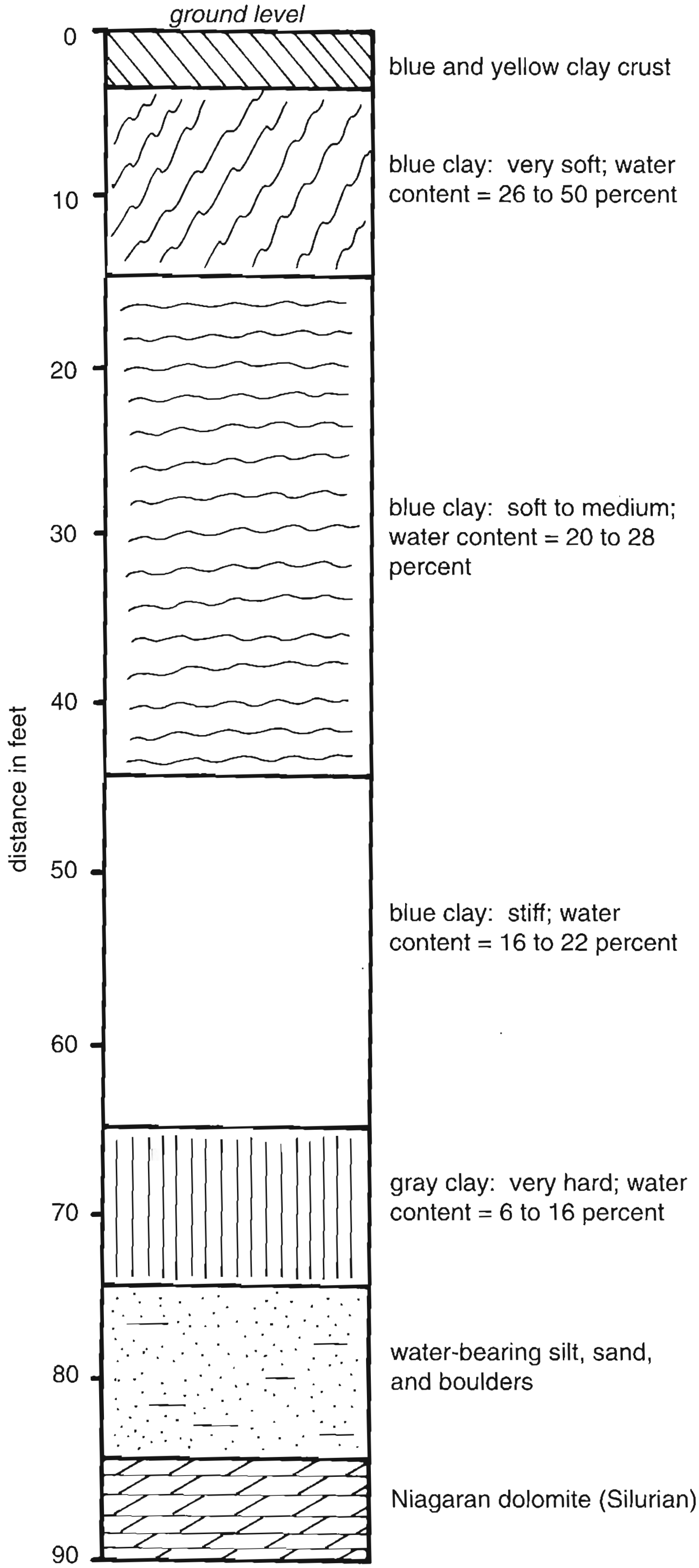
When first erected, the Amoco Building was sheathed in the renowned Carrara marble (real marble this time, and the very best). So much cladding was needed for a surface this huge that the project badly depleted the centuries-old, northern Italian quarries that once supplied Michelangelo with the raw material for his sculptures. But when the thin-cut marble slabs were shipped to the New World and installed on the Amoco Building's sides, things went horribly wrong. The marble, exposed to the worst of Chicago's climatic extremes, warped like waterlogged plywood. Imagine the collective look on the faces of the Amoco brass when they learned that the entire building would have to be resurfaced with thicker, more resistant white granite from North Carolina. It would not have been a good day to ask for a raise. The colossal resurfacing project took place in the early 1990s. I happened to walk by one breezy spring day when the newly arrived granite

The base of the soaring Amoco Building. North Carolina granite has replaced the shimmering Carrara marble that proved inadequate in this blustery, exposed site.

lay stacked on the street. The construction crew looked on in bafflement as I eagerly examined the stone with my hand lens. You can easily do the same at any point within reach on the building's exterior. Keep in mind that this rock, which imparts a much duller luster than the gleaming Carrara marble did, was emplaced in the heart of the ancient Appalachians late in the Paleozoic. In that era, eastern North America was the continent's leading edge, and over the course of many millions of years it collided with several other landmasses, including northwestern Africa.

The Chicago Cultural Center
(78 East Washington Street)

For many years this noble edifice was the main branch of the Chicago Public Library. Its exterior combines pale granite with the Midwest's most famous and most widely used sedimentary cladding, the Bedford limestone. Unlike the Silurian Sugar Run dolomite used at an earlier phase in Chicago's development, this carbonate rock often has a cold, cement-gray tint. What makes it wildly popular is that it is easy to cut and carve, and very durable. Reputedly, it even gains strength as it ages; and it does not stain when subjected to weathering. An ironic result of this stone's evident superiority is that venerable buildings sheathed in it often look like two-year-old imitations of venerable buildings. The Bedford is quarried in southern Indiana;



Generalized stratigraphic section of the unstable lake sediments that underlie the Inland Steel Building. To anchor the building, steel pilings were driven through nearly 85 feet of silt and clay to the more solid Silurian Niagaran dolomite. –Illinois State Geological Survey it is part of the same Mississippian Salem formation that outcrops in southwestern Illinois. Geologists call this type of limestone biocalcarenite. It is made up of tiny fossil fragments cemented in a matrix of calcite.

If you walk into the Cultural Center's Washington Street entrance, you'll also find a superb example of the Carrara marble now so vividly absent from the Amoco Building. The splendid main staircase in front of you is made of this premium ornamental stone. When newly cut, it has a sugary texture; if you run your fingertips over its highly polished surface here, you may be able to detect it. You may also spot some of the interlocking calcite crystals that reveal that this stone was once unmetamorphosed limestone. A distinctly different marble, quarried in Ireland, borders the mosaics of the staircase's railing. It's just the color stone from the Emerald Isle should be: a deep, lustrous green.

Inland Steel Building
(30 West Monroe Street)

No baby boomer can look on this stainless-steel gem of an office building without feeling a pang for the brave new world of 1950s modernism. This green-and-silver masterpiece, adored by practically everyone with an interest in architecture, may seem distinctly ungeological. But here, obviously, the geology lesson lies not in the building's exterior but in how its engineers coped with the treacherous lake sediments described at the head of the essay. The Inland Steel Building was the first structure to use what has since proven to be the most effective anchoring technique: steel pilings driven all the way through the thick blanket of silt and clay to the much firmer Silurian dolomite bedrock. Here, the pilings had to extend 85 feet straight down before they met the solid pre-Pleistocene surface. In earlier decades, builders tried some less successful stabilization schemes. One was simply to spread out the weight of the building as broadly as possible, on a raftlike base. Caissons—first used in the last decade of the nineteenth century, for the late, lamented Chicago Stock Exchange—were another partial solution. They consisted of deep holes lined with timber and filled with concrete. They attached the buildings' foundations not to distant bedrock but to a stiffer layer of clay known as hardpan. Despite all the care, settling remained such a common problem that many building entrances were placed higher than normal, to compensate in advance for the sinking that was likely to follow.