Ancient Environments Revealed in Chicagoland's Architecture

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Abstract

The architecture of Chicago's greater metropolitan region–everything from its soaring, world-famous skyscrapers in the Loop to humbler and more utilitarian buildings in the suburban and rural collar counties – contains fascinating and often underexplored connections to long-vanished landscapes and seafloors of Illinois, with a historical record stretching back almost half a billion years. These connections are most abundantly displayed in local materials extracted from the region's commercial quarries, clay pits, streambeds, and farm fields and then used as structure-supporting and ornamental cladding materials for Chicagoland's buildings. But locally derived sediments and stonework are not the only links to ancient landscapes and environments. A diverse selection of public and private structures are also adorned with exotic stonework from distant quarries on this and other continents. Ironically, it is the built environment of northeastern Illinois and southeastern Wisconsin that gives us the broadest prospect onto the grand procession of geologic time and evolving natural environments.

Introduction

Chicagoland is many things to many people, but one unassailable source of regional pride is its fame as a locus of world-class architectural artistry and civil-engineering achievement. While the significance of buildings in this urban area has been extensively discussed in terms of the last two centuries of human history–what many Earth scientists now refer to as the Anthropocene Epoch (Zalasiewicz et al.)–the ornament and structural materials employed in these buildings in fact provide a much deeper historical narrative stretching back not just centuries, but thousands to billions of years, and not just through the latest geologic epoch, but far beyond into much earlier periods and even eons. In doing so, they provide fascinating clues into ancient environments of northeastern Illinois, the Midwest more generally, and even far-distant continents.

For this discussion, three recurring terms are here delimited.

- *Chicagoland* is here taken to be the city of Chicago, all of Cook County and its neighboring counties in the northeastern quadrant of Illinois, and Kenosha and Racine counties in Wisconsin. These areas share an especially interlinked architectural legacy.

- An *ancient environment* is one relatively short but significant and identifiable segment of our planet's immense rock cycle, in which the Earth's surface and energy-driven interior interact to form and transform the three main rock types - *igneous* (derived from crystallization of magma or lava), *sedimentary* (formed from deposited sediments or chemical precipitation), and *metamorphic* (a preexisting rock form altered by heat and pressure) (Tarbuck and Lutgens). As such, it is a snapshot of a particular region on the Earth's surface or beneath it, and is also a single perching-point in time, from which we can often deduce specific geologic and climatic conditions. For subaerial environments, significant biologic and ecological details, often in the form of fossils preserved in sedimentary rock, can also be inferred.

- The *built environment*, as discussed in architecture and civic-planning literature, most frequently refers to all aspects of the landscape fabricated by its human inhabitants–buildings, certainly, but also bridges, parks, power plants, harbor facilities, and other aspects of a community’s physical infrastructure. Here, however, the term is restricted to readily accessible office, commercial, municipal, residential, and cemetery buildings that have geologically significant materials in their structural elements or *cladding* (ornamental exterior surfacing).

Locally Derived Architectural Materials and Their Ancient Environments

1. From Unlithified Sediments

Brick is such a ubiquitous building element that it is easy to disregard the fact it has fascinating geologic origins. A favored and relatively inexpensive load-bearing and ornamental material in use for thousands of years, its predominant constituent is clay, a sediment of the smallest geologically classified particle size (diameter $\leq$ 0.003 mm). In Chicagoland a thriving brickworks industry flourished in the nineteenth and early twentieth centuries. (The only current Illinois brick manufacturer is in the Illinois River town of Marseilles; its clay supply comes from a pit in Cornell, situated on the ancient bed of Glacial Lake Pontiac.) (J. Vinci, Executive Vice President, Illinois Brick Company, E-mail message to the author, 5 September 2017) These facilities and their counterparts in the Milwaukee area produced a unusually broad spectrum of brick colors, from the off-white Cream City style, very common in buildings and lighthouses north of the Illinois border, to those of the buff, salmon, medium red, and dark purple tints seen throughout the region.

This impressive variety of color choices is partly the result of the source clay’s chemistry. The higher the calcite (lime) content, the whiter the tone, as exemplified by the Cream City style. But it is also dependent on how the bricks were fired. The early technique, using coal-burning beehive kilns, produced more variable coloring due to its more widely varying temperatures. In contrast, more modern tunnel kilns using natural gas can control internal temperatures much more precisely, resulting in very consistent results favoring one color in particular. (J. Vinci, E-mail messages to the author, 5 September 2017)

Among the multitude of ornamental and structural brick types in Chicagoland that are worthy of scrutiny, two older buildings are especially notable in their contrasts. In Geneva, a one-story building, built in the 1890s as the city power plant and renovated in 1999, stands just southwest of the State Street bridge over the Fox River. (M. Lambert, Preservation Planner, City of Geneva, E-mail messages to the author, 8-11 September 2017) Its exterior includes variably tinted bricks, probably produced in beehive kilns, that contain in addition to a limey clay matrix larger chunks of dolostone, chert, and other rock types (Figure 1). Apparently the source clay was derived not from well-sorted lakebed clays but from poorly sorted glacial till (see below), and was not screened before firing to remove its larger particles. In contrast, there is a solid consistency of color and fine-grained texture in the brickwork of the Loop's world-famous Monadnock Building, architect John Wellborn Root's remarkable early skyscraper design that features not the usual internal girder frame but a load-bearing masonry exterior. The somber, purplish-brown brick outer wall of the fortresslike ground story is a stolid 13 feet [Ed.: four meters] thick–no less than 39 common-brick widths. (J. Vinci, E-mail message to the author, 5 September 2017)

Figure 1. Detail of glacial-till-derived, nineteenth-century brick in Geneva's old city power plant. Note the pebbles of dolostone and chert embedded in the fired clay. While most Chicagoland brick is made from lakebed deposits of uniformly small particle size, this coarse, fruitcake texture and more variable color range provide more visual interest. Each brick has its own geologic story to tell and is not just an anonymous building block. (Photo by author)

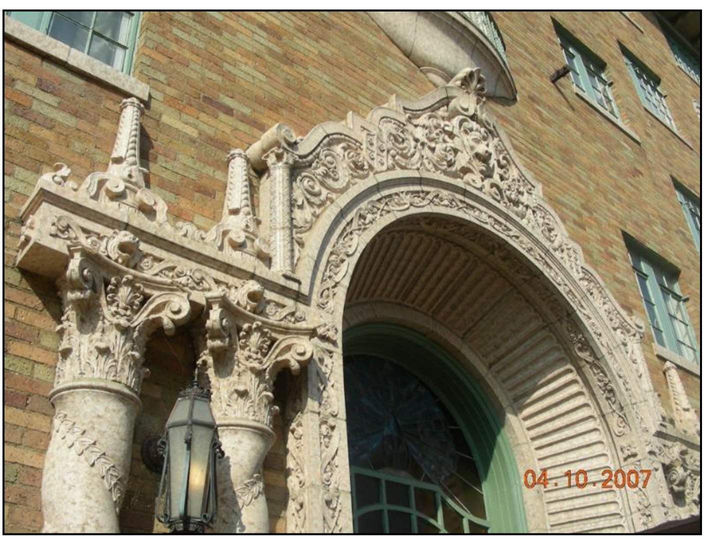

Figure 2. The Spanish Baroque comes to the Fox River Valley: detail of the flamboyant terra-cotta entrance of St. Charles's Hotel Baker. This demonstrates the great technical proficiency of the artisans of the American Terra Cotta Corporation, based in Terra Cotta, Illinois – now part Crystal Lake. (Photo by author)

Local clays have also been extensively employed in the manufacture of terra cotta (literally, “cooked earth” in Italian). In architecture, terra cotta (molded and fired clay units sealed with a gloss-producing glaze compound) has been most often used to provide an attractive and relatively inexpensive alternative to ornamental cladding stone–and one which can be manufactured in specific and highly detailed designs, as evidenced in the intricate botanical patterns created by the famous Chicago architect Louis Sullivan for the façade of the Gage Building on South Michigan Avenue (Twombly and Menocal). D. H. Burnham’s Fisher Building at 343 South Dearborn Street is clad in thousands of sections of superb terra cotta decoration, some suitably adorned with aquatic creatures (Sinkevitch). And in St. Charles, intricate Spanish Baroque motifs in the locally produced terra cotta bedeck the main entrance of the Hotel Baker (Anonymous).

Clever glazing techniques even allowed architects to mimic the look of much heavier and much more expensive dimension stone; for example, the Pulsichrome technique, pioneered by McHenry County’s American Terra Cotta Corporation, was a convincing stand-in for polished granite. Terra cotta also has the advantages of being fireproof, highly resistant to weathering, and easily cleaned (Berry).
(Figure 2).

In Chicagoland and the Milwaukee area the clay that served as the source for both unglazed brick and terra cotta has come from *pits*. (*Quarries*, on the other hand, are sites where bedrock rather than unlithified sediments are extracted from Earth’s crust.) These pits are dug into the region’s plentiful deposits of lakebed sediments of the Equality Formation–ideal for brickmaking because the clay, naturally sorted by suspension settling in relatively slack water, lacks larger particles. There have also been pits that draw from the more widely distributed *glacial till* of the Wadsworth, Lemont, and Tiskilwa formations. In the nineteenth century, till was at times a handier and cheaper local source, but the brick maker had to either laboriously screen out the gravel and pebbles it contained, or simply retain them in the mixture to be fired.

Both the region's lakebed clays and glacial till are of decidedly recent origin, in the Quaternary period, which began ca. 2.6 Mya (million years ago). The Quaternary comprises the Pleistocene-epoch ice age as well as the Holocene, our current epoch, which began 10 Kya (thousand years ago).

Regional tills make up Chicagoland's vast system of long, arcuate ridges called *end moraines*, as well as the flat surfaces–the *ground moraines*–between them. Containing all sediment sizes from clay to cobbles and boulders, these tills are artifacts of the Wisconsin ice sheet that advanced into the region over 24 Kya, and subsequently reached the vicinity of modern Peoria and Bloomington and then melted back, departing from Illinois's northeastern corner by 13 Kya (Wiggers).

Ground moraines consist of till that was largely spread under the glacier when it was advancing; the end moraines were built up along a long front at the glacier's edge. The ridges formed in fairly exacting climatic conditions, when the previously frigid local environment had warmed just enough that the margin of the ice sheet was melting at roughly the same rate new ice was being pushed up from behind. This allowed the new sediments embedded in the still-moving ice to be brought up from the rear and be dumped in greater depth along a single front (Tarbuck and Lutgens).

In contrast, regional lakebed clays were formed in the melting days of the Pleistocene, when the rapidly waning Wisconsin ice sheet produced glacial meltwater that ponded into a network of proglacial lakes (e.g., Lake Pontiac, cited above) and also raised the water level in the Lake Michigan basin to approximately 640 feet above modern mean sea level, or about 60 feet higher than Lake Michigan's modern level. (This higher, ancestral version of the lake from 14 Kya to a little less than 12 Kya is referred to as Lake Chicago (Wiggers). Finer sediments settled to the bed of these still bodies of water to produce well-sorted layers of clay.

One other type of Pleistocene-derived building materials–*glacial erratics*–deserve brief mention. These boulders extracted from farm fields, stream beds, and excavation sites have been widely used as stand-alone ornaments in gardens and at driveway entrances, and even in the construction of fieldstone houses. These hefty specimens, which include a broad range of rock types and ages not encountered in Illinois's own bedrock, were transported far southward from their own outcrops by the advancing Wisconsin ice sheet, and can be traced to such locales as southern Ontario, northern Wisconsin, and Michigan's Upper Peninsula. Many of these rocks are ancient igneous and metamorphic types well over 2 Gya (billion years old) (Figure 3).

Fieldstone dwellings are a fairly common sight, especially in the outlying communities to the west of Chicago. One notable example is the Young House on Main Street in the historic Fox River town of Oswego. Its lower story features a facade of small boulders of at least several geologic origins and ages. These boulders, or “hardheads” in the local parlance, were apparently obtained from the bed of the Fox and possibly from farmers' fields as well–though most of their journey from more northern bedrock outcrops was accomplished via Pleistocene ice sheet. (R. Matile, Director, Little White School Museum, E-mail messages to the author, 9-10 September 2017) One notable example of a larger building using fieldstone in its façade is the imposing Richardsonian Romanesque Calvary Memorial Church in downtown Oak Park. Whether the various rocks incorporated on its façade were derived from local erratics rather than a specialty stone supplier is unclear, however.

2. From Quarried Bedrock

Most of Chicagoland (with the exception of its far western fringe and a few smaller areas in northern and southern Cook County) is underlain by bedrock of just one geologic period and one prevailing rock type – a bone-white to pale-gray dolostone of the Silurian Period (445-419 Mya).

It is also widely known in the literature as dolomite–a term which for clarity’s sake is best restricted to the rock’s predominant mineral constituent–this sedimentary stone is most often quarried from those sections of the region’s Silurian strata formally known as the Racine and Joliet formations. These layers of sedimentary rock formed by chemical precipitation on a shallow-water carbonate platform on the Kankakee Arch, situated between the deepening Michigan and Illinois basins. (Mikulic and Kluessendorf). This was a time when, due to the high worldwide sea levels of the Tippecanoe Sequence, this portion of the continent, situated in the subtropics of the Southern Hemisphere, was covered in a shallow epeiric sea. Paleogeographers have posited that the Chicago region then lay 25 or 30 degrees south of the Equator. (Scotese). While they may well have formed as limestone, these strata were subsequently chemically altered into dolostone, perhaps in the hotter and more highly saline conditions prevalent in region at the end of the Silurian and in the succeeding Devonian period. The modern Persian Gulf may serve to give us a good idea of the climatic and marine conditions then prevailing in Chicagoland.

Silurian dolostone in the Des Plaines Valley was identified as a valuable stone resource early in the history of the metropolis, when it was exposed during the digging of the Illinois and Michigan Canal in the 1830s and 1840s. And since at least the 1850s, it has been quarried there under such commercially appealing if geologically inaccurate trade names as the Athens Marble and the Athens Limestone. In this case, Athens refers to Lemont's original town name and not to its famous namesake in Greece. To be limestone rather than dolostone, the rock would have to have had mostly calcite rather than dolomite composition; to be true marble, it would have had to endured the heat and pressure necessary to recrystallize its minerals to produce marble's characteristic sugary texture (Wiggers; Village of Lemont).

Many of the region's historically significant stone quarries are now inactive, but they have taken on a new life as city parks (e.g., Chicago's Palmisano Park, Lyons's Cermak Quarry Park, and Racine's Quarry Park) or as flood-overflow reservoirs (the Elmhurst Quarry). Nevertheless a few large operations such as the Vulcan Materials quarries in Racine and McCook, and the Hanson Material Services's Thornton Quarry are still

Figure 3. Silurian dolostone in its native habitat. Here its horizontal strata are dramatically exposed in a cliff face at the northern tip of Lake Michigan, in the Garden Peninsula of Upper Michigan. (Photo by author)

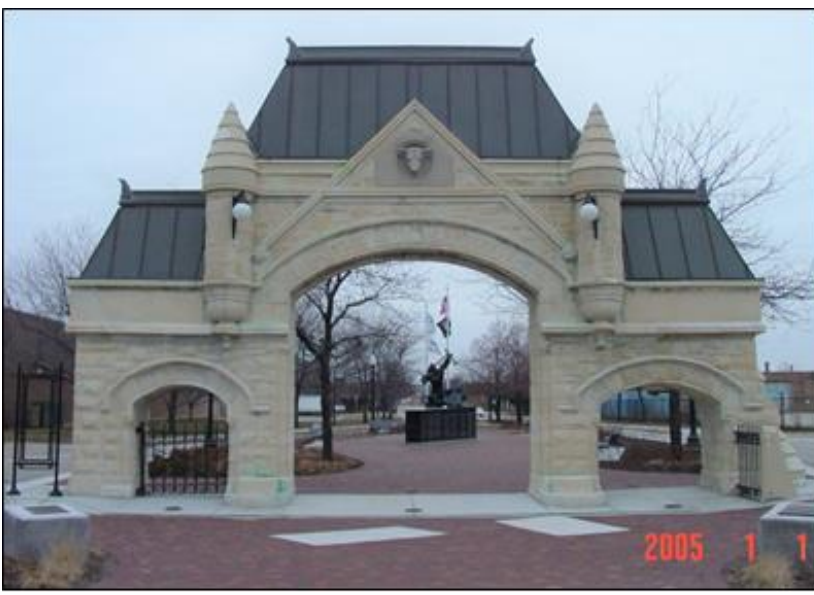

Figure 4. Chicago's Union Stockyard Gate, an excellent example of the ornamental use of Chicagoland's local Silurian dolostone. This 420 Myo sedimentary rock, still a very common sight throughout the region's built environment, was mostly quarried in Lemont and Joliet. It hit its peak of popularity with architects before the mid-1890s. (Photo by author)

major producers of aggregate stone for road building and other construction uses. Sections of the last two are also now dedicated as reservoirs for Chicago's massive Deep Tunnel flood- and sewage-control project (Metropolitan Water Reclamation District of Greater Chicago). At Thornton and at Racine's Quarry Lake, ancient reef structures stand well exposed in the facewalls and have long been the focus of much research into the marine paleoecology of the Silurian Period. At that juncture of geologic time, our metropolitan region was part of a larger barrier-reef complex that ringed the Michigan Basin. As such, it was the direct ancestor of today's similarly sized Great Barrier Reef off eastern Australia (Figure 4).

The heyday of producing local dolostone specifically for cladding and dimension stone was undoubtedly the late 1800s, and voluminous amounts of stone from quarries in Lemont and elsewhere now adorn countless older buildings, rail stations, and homes across the region. The dolostone is easily recognized by the attractive buttery yellow tint it often develops after exposure to the elements. Unfortunately, this propensity for pronounced chemical weathering also leads to its spalling or *exfoliation* (peeling away in thin, sheetlike fragments) (Wiggers). This can lead to thorny maintenance issues and the loss of highly desired carved ornamental details, as is obvious in the pronounced degradation of surfaces of the Union Stockyard gateway. Fortunately many Chicagoland buildings, including the iconic Chicago Water Tower and Pumping Station, have not suffered gravely from over a century of exposure to our harsh climatic extremes.

Exotic Architectural Materials and Their Ancient Environments

While brick made from Illinois clays is still a major architectural material in modern Chicagoland, locally quarried dolostone for cladding and other ornamental applications waned in popularity by the 1890s, with the arrival of other stylistic trends, including those with strong references to the classical and Romanesque traditions of Europe. As the region's economic standing has grown, institutions, corporations, and wealthy homeowners have vied for the architectural limelight by commissioning the designs of the greatest architects of the Chicago and Prairie Schools–among them, John Wellborn Root, Daniel Burnham, Louis Sullivan, and Frank Lloyd Wright–as well as such prominent out-of-town firms as the Manhattan-based McKim, Meade, and White.

These architects and the many who have followed in succeeding generations have usually preferred either the glazed terra cotta cited above or ornamental stone from more distant sources. The result is that Chicagoland today is an open-air natural-history museum and vast lexicon of planetary geology that showcases ancient environments spanning more than two and a half billion years of Earth history. This treatment can by no means cover all the rock types used in our built landscape, and must highlight only a few of the most commonly used and geologically significant types.

1. Indiana Limestone

While it is by no means the most eye-catching substitute for the temporarily out-of-fashion Silurian dolostone, Indiana Limestone more than any other type rivals it in its widespread use throughout the region. Also known as the Bedford Limestone–a reference to the town in southern Indiana where it has been abundantly quarried-it is, technically speaking, a *grainstone*, as defined by the standard Dunham Classification Scale used to delimiting varieties of carbonate sedimentary rock. As such, it is a granular limestone with virtually no mud content (Powell). Its official stratigraphic name is the Salem Formation (Hill).

The Indiana Limestone dates from a period traditionally referred to in United States usage as the Mississippian Period (359-323 Mya; alternatively cited as the lower portion of the Carboniferous Period). The span is notable for yet another sea-level highstand, the Kaskaskia Sequence. The Midwest straddled the Equator and was largely covered by a shallow tropical sea. Its bed was an extensive carbonate platform similar to that on which Florida and the Bahamas now stand (Keith; Hine). The sea bottom was blanketed by thick deposits of the mineral calcite (calcium carbonate, lime), which was in turn produced by microbial activity and by larger, reef-dwelling organisms (Anbu et al.).

While it formed in what many would agree is a paradisiacal environment by modern Midwestern standards, the Indiana Limestone's appearance when used as dimension stone is anything but exotic. Unwaveringly a bland light gray and amazingly uniform in its fine-grained texture, it has all the visual appeal of an unadorned concrete retaining wall. (Indeed, most participants in the author's architectural walking tours assume it is poured concrete until told otherwise.) That said, it was wildly popular with architects and engineers for a good half-century. One source claims that by the end of the nineteenth century it accounted for one-third of America's cut-limestone production, and two decades later up to 80 percent (Park). This no doubt was primarily because of its superb physical properties, which resoundingly outstrip those of the Silurian dolostone. Chief among these is its ability to become stronger when bearing a load (Wiggers). and case-hardened on exposure to the elements (Powell). The latter allows its cut surfaces to resist significant weathering. As a result, Indiana Limestone cladding that has been exposed to the harsh climatic extremes of Chicago’s heat island for over a century often looks as though it is freshly cut and newly installed.

However, even a dimension stone as resilient as the Indiana Limestone is not impervious in all circumstances. If salt-compound deicers are used nearby on walkways and the salty meltwater soaks into the cladding, a white crusty material, called *efflorescence*, will crystallize on its surface. This can often be observed at the base of Chicago’s Tribune Tower, on North Michigan Avenue. If the chemical reaction producing the efflorescence is allowed to proceed, and if care is not taken when spreading deicer near the base of the building, more serious damage in the form of exfoliation may occur (McDonald).

While probably the most famous use of the Indiana Limestone is the exterior of New York City’s Empire State Building, it can also be found on a large number of the Chicago region’s libraries, post offices, and other prominent public buildings. Besides Tribune Tower, already noted, it can be seen in vast quantities in a short stroll along Chicago’s Michigan Avenue–for example, on the exteriors of the Art Institute and the Chicago Cultural Center. But perhaps the best site to appreciate another of its signal virtues–its ability to be intricately carved–is Louis Sullivan’s diminutive but architecturally matchless Getty Tomb in the

Figure 5. Intricate sculptural detail in in the Indiana Limestone of Louis Sullivan's Getty Tomb in Graceland Cemetery, in Chicago's Lincoln Park district. Note the staining of the central stone panels from the weathering of the bronze window grille above it. This is a deposit of copper (II) carbonate hydroxide caused by the bronze reacting to atmospheric water and carbon dioxide. The classic malachite greenish-blue is usually considered an ornamental asset of weathering bronze, but in this case, it has adversely affected the stone beneath it. (Photo by author)

Figure 6. Cladding of the 3.5 Byo Morton Gneiss ("Rainbow Granite") on the exterior of an otherwise undistinguished bank building on Ridge Road in the historic southern suburb of Homewood. Some effort was made here to mount the panels so that the wavy foliation of this ancient metamorphic rock was oriented more or less vertically. (Photo by author)

North Side’s Graceland Cemetery. As with the Silurian dolostone, close examination of Indiana Limestone cladding will sometimes reveal the presence of small fossils of ancient marine invertebrates (Figure 5).

2. Lake Superior Brownstone

If the impersonal gray uniformity of the Indiana Limestone has most often been used to enforce the coolly reserved elegance of Neoclassical facades, the Lake Superior Brownstone, at the other end of the aesthetic spectrum, was a favorite of the architectural movement referred to as the Richardsonian Romanesque. Named for late-nineteenth-century Boston architect Henry Hobson Richardson, this style eschewed classical symmetry in favor of a massive, brooding, medieval look featuring steep gables, turrets, massive arches, and facades with projecting rusticated surfaces (Eckert). The ochre to purplish-maroon color of this clastic sedimentary rock dramatically reinforces this somber look.

Wisconsin stratigraphers refer to the brownstone as the Bayfield Group, while the corresponding Michigan term is the Jacobsville Sandstone (LaBerge). Much of not all of Chicago-region brownstone was quarried on or near Basswood Island, in what is now Wisconsin’s Apostle Islands National Lakeshore (Eckert).

In terms of its appearance, properties, and architectural use, the Lake Superior Brownstone was the more easily obtainable and hence less expensive Midwestern equivalent of the trend-setting Connecticut Valley Brownstone quarried in New England and used extensively in eastern cities–most notably, in fashionable residential buildings of

Manhattan's Upper West Side. But whereas the Connecticut Valley stone dates from the boundary of the Triassic and Jurassic periods (200 Mya), the Lake Superior equivalent originated in the Proterozoic Eon, probably at some point between 600 and 950 Mya, and is therefore at least three times as ancient. It is interesting to note that despite the great disparity in age, these two look-alikes formed in major failed continental rifts in the North American continent. In the case of the Bayfield/Jacobsville, however, recent detrital-zircon dating analysis suggests that it was deposited long after all rifting in what is now the Lake Superior region had ceased (Malone et al.). It should be noted, though, that most sources still place it in the Mesoproterozoic Era, with an age of 1,100 Mya (LaBerge).

Whichever phase of the Proterozoic Eon this iron-rich, highly oxidized, and rough-textured sandstone actually dates from, it contains intriguing clues to its formational environment. It contains abundant examples of sedimentary structures called ripple marks and crossbedding, which, when combined with other evidence, point to massive amounts of stream-borne sand being deposited in a lacustrine environment floored by more ancient volcanic rock (Hamblin). These features are often visible in buildings clad in Lake Superior Brownstone–including Lake Forest College's Hotchkiss Hall and the Chicago Club, at the corner of South Michigan Avenue and Van Buren Street downtown. Other good spots to examine the brownstone are at the intricately carved entrance to the Fine Arts Building, just a few paces south of the Chicago Club, and at DeKalb County's Sycamore Public Library.

3. Morton Gneiss

No other dimension stone used in the metropolitan region can match either the ancient pedigree or the flamboyant aspect of the Morton Gneiss. This pink-to brown-tinted, high-grade metamorphic rock is usually been marketed evocatively but somewhat misleadingly as the Rainbow Granite–another example of how architects and builders tend to lump all ornamental stone into simplified and often quite inaccurate categories (most usually, just marble and granite) (Figure 6). In all fairness, though, gneiss is a high-grade (highly altered) metamorphic rock whose parent rock can indeed be granite, as it probably is in this case.

What now sets the Morton Gneiss apart from real granite is that its mineral crystals, instead of being equidimensional with no one prevailing arrangement, are oriented in parallel to form bands that are in places quite planar but in others wildly undulating or radically folded. This banded texture is referred to as *foliation*, and it is also found in slate, another metamorphic rock type much used in architecture. However, slate's foliation is much more dependably sheetlike, which gives it its tremendous usefulness as flat-surfaced flagstone, table tops, and roofing tiles (Tarbuck and Lutgens).

The Morton Gneiss takes its geologic name from the small Minnesota town where it has long been quarried. It is there, approximately 90 miles [Ed.: 150 kilometers, if you prefer metric] southwest of the Twin Cities, where it outcrops in the valley of the Minnesota River. Its formation bears the impressive distinction of being the oldest portion of the Earth's crust ever identified in the United States. Using Uranium-Lead isotopes extracted from zircon crystals found in the rock, geochemists have determined the origin of the Morton Gneiss goes back to a staggering 3.5 Gya (billion years ago) (Bickford et al.). This places it near the beginning of the Paleoarchean Era of the immense span of early time dubbed the Archean Eon (4.0 to 2.5 Bya). While not quite as old as other crystalline rocks subsequently discovered in northwestern Canada and western Australia, the fact remains that it is unimaginably ancient. When one runs one's hand over a polished panel of Morton Gneiss cladding, one is touching an artifact of an Earth vastly different than our own cooler and more biologically diverse world. This stone is more than three-quarters the age of our planet and solar system.

This rock we now identify as gneiss was originally emplaced at depth as unmetamorphosed granite, where it formed part of the Superior Province or Superior Craton, the core of the Canadian Shield (Card and Ciesielski). While this rock unit in its subterranean origin provides no direct evidence of the contemporary subaerial surface far above, other geologic clues point to landscape that must have been a common sight across Earth's smaller, Archean continents: it was most likely a rolling landscape of bare rock hills and valleys, with the forces of erosion unimpeded by a mantle of well-developed soils or vegetation. Approximately a billion years later, vast compressional forces produced by the collision of the Superior Province with the Minnesota River Terrane, a separate, migrating slice of continental crust, turned the original granite into the gneiss we see today (Mangou).

One common feature of this stone is a clear indicator of its own internal environment of intense heat and pressure endured during metamorphism. Some Morton Gneiss cladding panels, when cut and polished, reveal large, sharp-edged inclusions of amphibolite, a very dark-toned rock that may be derived from still older lava rocks such as basalt or the very exotic komatiite (Goldich et al.). The best place to see this feature is on the first-story façade of Chicago's 333 North Michigan Avenue Building, a classic example of Art Deco architecture from the Roaring Twenties. Here on a panel facing the sidewalk, where it is passed by thousands of tourists and office workers each day, one can easily discover a big black amphibolite inclusion with a long attenuated tip projecting into the halo of lighter-colored minerals surrounding it. It looks as though it were a strand of saltwater taffy being pulled apart under tremendous heat and pressure.

As a favored architectural cladding stone, the Morton Gneiss had its heyday in the period between the two World Wars. This fact is underscored in Chicago by its extensive use as the exterior for another Art Deco landmark, the Adler Planetarium, where the swirling details and overall impact of the polished Morton Gneiss just might outshine the building's design itself. It is entirely fitting that an edifice devoted to the study of our 13.7 Gya universe should be so thoroughly dressed in rock that is among the most ancient this relatively young planet can now offer up to view.

Since the middle of the twentieth century, the Morton Gneiss has often been relegated to humbler settings–for example, it has been a favorite for grave headstones and mausolea (Minnesota Historical Society). Still, it remains a fairly common sight in less funereal settings our region's built environment–in a Homewood bank facade, in the cladding of a Roman Catholic church in Kenosha, and even in a less than impressive strip-mall installation in Geneva.

4. Mount Airy Granite

If the Morton Gneiss is the showiest crystalline rock used in Chicagoland's built environment, the Mount Airy Granite may well be the most understated and utilitarian in appearance. But it certainly lives up to its sterling reputation for reliability and durability in harsh conditions.

Architecturally employed granites are many, and they actually vary quite considerably in color and texture, from Vermont's fine-grained, salt-and-pepper Barre Granite to Wisconsin's ruddy, coarse Wausau Red and the unusually dark-hued Quincy Granite from Massachusetts (see below). The Mount Airy, rather coarse-grained, falls at the light-gray part of that spectrum, and from a distance it appears off-white. Quarried in the town of the same name in North Carolina's Piedmont province, this widely marketed dimension stone formed in the middle part of the Devonian Period, approximately 390 Mya. At that benchmark in geologic history a zone of crustal subduction, situated between the eastern coast of Laurentia (ancestral North America) and an approaching microcontinent, produced a series of *plutons*–large bodies of granitic magma rising through preexisting rock. These ultimately cooled and solidified while still at considerable depth. Another pluton in this series is now also exposed at the surface by millions of years of subsequent erosion is Georgia's Stone Mountain (Atkins and Joyce) (Figure 7).

In downtown Chicago, undoubtedly the best place to examine the Mount Airy Granite close at hand is the Aon Center (formerly the Standard Oil, then the Amoco Building). The stone here was installed between 1990 and 1992, two decades after the immense 83-story tower itself was completed (Sinkevitch). Originally clad in the famous Carrara Marble, also used by Michelangelo for his sculptures four centuries before, the newly completed building had a luminous, almost opalescent aspect. Unfortunately, the building soon became a showcase example not of architectural magnificence but of marble's vulnerability to rapid deterioration in exposed, polluted settings and in moist climates with dramatic temperature extremes (Wiggers). A bad choice of stone type for this blustery setting was exacerbated by the fact that the marble facing panels were, thanks to newly developed technology, cut extra-thin, at no more than 1.5 inches [Ed.: 38 mm] thick. The result was that the panels began to lose their structural integrity and warp badly. Ultimately, the only solution was to replace the entire skin of the giant, once-gleaming skyscraper with the duller but more resilient Mount Airy Granite, 2 inches [Ed.: 50 cm] thick. The cost of replacing all the cladding was, when adjusted for inflation, roughly half the original construction cost of for the entire structure (Levy and Salvadori).

5. A Bevy of Other Stone Types

The preceding descriptions highlight only a small sampling of the exotic stone types on view–and ancient environments revealed–in Chicagoland's built environment. Among the many others that are both architecturally sought-after and geologically significant for the ancient igneous, sedimentary, and metamorphic environments they illustrate are:

-The pink, striped or mottled **Etowah Marble** and the resplendent **Cherokee White Marble**, both products of the Murphy Marble Belt of

Figure 7. Louis Sullivan's Egyptianate Ryerson Tomb in Chicago's Graceland Cemetery. Its exterior is clad in the uncommonly dark-toned but beautifully polished Quincy Granite of coastal Massachusetts. (Photo by author)

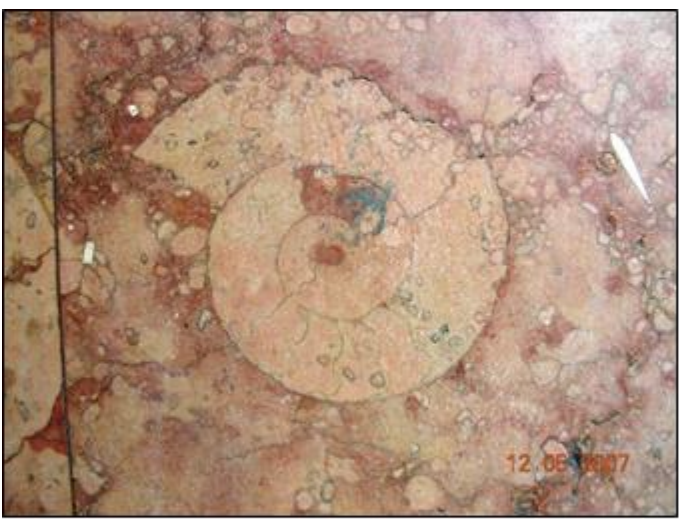

Figure 8. A beautifully preserved Jurassic-Period ammonoid fossil in a doorway of Chicago's Pittsfield Building. This sea creature, now in a nook facing the traffic-clogged commotion of East Washington Street, once swam in the warm waters of great Tethys Seaway. (Photo by author)

Georgia, USA, and both nicely on view in St. Charles. Originally marine limestone of the Cambrian Period (540-485 Mya), this rock was later metamorphosed during subsequent mountain-building episodes (Pivco). The Etowah can be found on the exterior of the old St. Charles National Bank Building, on West Main Street; the Cherokee White, on the town's landmark example of the Art Moderne style, the Municipal Center, which stands a short walk away, gracing the east bank of the Fox River (St. Charles Public Library).

- A very unusual red limestone, the strikingly patterned **Rosso Verona**, is quarried in San Ambrogio di Valpolicella, near Verona, Italy (Bradley). Of great appeal to urban-paleontology buffs, this stone has light pink nodules set in a scarlet matrix that, in places, also contains coiled shells of 160-Myo Jurassic-Period ammonoid cephalopods. The overall effect is somewhat surrealistic: ancient sea creatures seem to swim amid gnocchi pasta set in a sea of tomato soup. This strange tableau can be scrutinized in the Loop, on panels that decorate the entranceways of the Pittsfield Building at 55 East Washington Street, just west of the Chicago Cultural Center. Before their demise the ammonoids–relatives of modern octopi and the chambered nautilus–occupied the warm waters above a submarine plateau in the great Tethys Seaway that separated northern and southern portions of the supercontinent of Pangae (St. John) (Figure 8).

- The world-renowned **Carrara Marble**, already mentioned in the description of the Mount Airy Granite, may be gone from the Aon Center, but it is still on in the grand staircase just inside the building's southern entrance. See it also in the interior of the Chicago Cultural

Center. Like the Indiana Limestone that serves as the building's exterior, the Carrara was formed on a carbonate platform environment. But, like the Rosso Verona on view just across the street, it dates from the younger Jurassic Period (Pivko).

- The other famous Old World stone to be found at the Cultural Center is mounted in round insets in the side panels of the Carrara Marble staircase railing (Wiggers). This is the **Connemara Marble**, quarried in County Galway, Ireland. It is, with utter appropriateness, emerald green. The Connemara dates from the Neoproterozoic Era–probably in the range 650-750 Mya (University College Cork).

- While granite is most usually a light-toned rock, Massachusetts's **Quincy Granite** shows a much darker and gloomier tone in the exterior of architect Louis Sullivan's superb Ryerson Tomb, in Graceland Cemetery on Chicago's North Side (Library of Congress). It is also known as the Railroad Granite because its quarry used what was reputedly the first railroad ever built in the U.S. (Granite Railway Company). This stone dates from the early Paleozoic Era, roughly 450 Myo. Like the Mount Airy Granite cited above, it is found in plutons produced by a long-vanished East Coast subduction zone during the Taconic Orogeny (United States Geological Survey).

- No other ornamental stone found in Chicagoland's built environment can match the amazing geologic origin of the **Vermont Verde Antique** on display in façade panels and entrance columns of the Postmodernist-style office building at 333 West Wacker Street (Vermont Verde Antique). The Verde Antique is a *serpentinite* - a rare rock type that began, remarkably enough, as ultramafic igneous unit in the deep ocean crust or upper mantle. This subterranean source rock and surrounding ocean-floor deposits were altered into their current forms when they were thrust onto the ancient margin of North America during the collision with an volcanic island arc, during the Taconic Orogeny of the middle Ordovician Period, ca. 450 Mya. Now mined in Rochester, in the heart of Vermont's Green Mountains, the Verde Antique is a rich, dark green shot through with white and pale-green veins of calcite.

Conclusion

As the foregoing survey of brick, terra cotta, and ornamental stone demonstrates, the modern built environment of northeastern Illinois and adjoining Wisconsin both occupies its own profoundly significant geologic setting and offers many doorways into other landscapes, seascapes, and even Earth's deep interior. A morning's stroll down Michigan Avenue and through the Loop, or a day's drive in the suburbs, can result in a much deeper understanding of an often unexpected interplay between architectural artistry, science, and the natural world. Exposed in Chicagoland's human works are many signposts to the suprahuman: an immense fund of time, a huge palette of histories and materials, and the legacy of massive geologic forces acting both close at hand and in many remote locales.

Acknowledgements

The author gives his special thanks to Jerry Vinci, Executive Vice President of the Illinois Brick Company; to Roger Matile, Director of Oswego's Little White School Museum; and to Michael Lambert, Preservation Planner for the City of Geneva. All three gentlemen took time out of their busy schedules to share their considerable technical and historical expertise.

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