2019.09.12 Lecture Notes Lecture 3 – StereoStatics



[Hiroshi Teshigahara film: ch.19 – Colònia Güell Crypt]

We have reached the moment in Gaudí's work, that I find the most intriguing, the late 1890s or more precisely 1898, the year in which multiple factors aligned. Two of which define some of his greatest contributions to architecture, the first one equilibrated structure we will be dealing with today and the second, warped forms, we will discuss next week.



Montserrat has been central to Catalan faith for centuries. It is a vital symbol of Catalan identity and independence. Every Catalan artist has respected its singular status – Picasso, Miró, Dalí. Catalan mythology believes the rocks of Montserrat formed by a geological explosion during the crucifixion of Christ. The Benedictine abbey (St. Maria de Montserrat Abbey) located on the mountain, enshrines the black Madonna (Virgin of Montserrat), the Patron Saint of Catalonia. The figure was taken to the mountain, to protect it from invading in Arab Muslims in Medieval times (718). Gaudí would take his builders to the mountain, to celebrate the completion of a project.



In 1887, Gaudí accompanies **Claudio, the Second Marqués de Comillas**, on a diplomatic visit to **Morocco**, with economic and political significance for Spain. In connection with this trip, in 1892 he designed a project for **a convent of Franciscan missionaries in Tangiers (1892-1893)**. The convent is set within a quatrefoil enclosure, with vertical towers. In the center a chapel in the shape of a Greek cross. An attempt to integrate African culture into Western civilization, in a mud structure. Just a couple years after he completed the **Saint Teresa convent** (1888-1890), Gaudí was eager to build a missionary convent of his own design, from its inception drawn from the sacred stones of Montserrat. But, it was never realized and became his biggest regret of his many projects left unfinished. He kept a drawing of this project hanging on the wall of his studio at Sagrada Familia.

"To obtain the largest space possible with the least amount of solid is certainly the problem that has had to be solved by every style of architecture, when it has been necessary to build for the public. The crowd did not enter the Greek temples, and the citizens of the small republics of Greece assembled only in unroofed enclosures. While the **Romans** were the first to construct buildings in which great numbers were able to assemble under cover, the Medieval builders, in working out a similar problem, endeavored to reduce as much as possible the quantity of masonry. The materials which they possessed did not however permit them to exceed a certain limit, since these large buildings had to be vaulted. As they were not able to employ wrought or cast iron of considerable dimensions, it was only by contrivances of masonry, a system of equilibrium of thrust and counterthrust, that they succeeded in erecting spacious buildings such as our great cathedrals. But we possess those appliances which were wanting to them. Iron allows feats of construction hitherto unattempted, provided that material is employed with due regard to its nature." This is a passage from Viollet-le-Duc's 2nd Lecture on Architecture, published in 1863.

The Barcelona School of Architecture was strongly influenced by Viollet-le-Duc's ideas and one of his biggest admirers was Gaudí's teacher and mentor **Juan Martorell** y Montells, who was one of the most cultivated and travelled of the architects of his generation, his Neo-Gothicism derived not so much from the books of Viollet-le-Duc as from the actual buildings in the south of France. Gaudí learned much from Martorell, working in his office while in school and later receiving work from him, including a recommendation that Gaudí become the architect for the Sagrada Familia (1883).



One of Viollet-le-Duc's tenants was that "there is not a form or a process that is not produced by the necessity of the organism". Gaudí continued this argument, by criticizing the use of buttresses as crutches. They could only be seen as evidence for the imperfection and weakness of the organism. In Gothic architecture, lateral thrusts were contained by the use of buttresses.

Gaudí saw such methods as an artificiality. He gathered justification for such reasoning by studying the growth of trees, the lean of trunks and the inclination of branches as they proportionally support and distribute forces and weights. Direct observation of natural laws formed a critical assessment of the weakness of the Gothic style. He said, "Have you ever observed that when someone leans on a cane, to do so he inclines it? Thus the inclined columns are stone canes in which, as anyone can see, the technique of following the lines and curves of pressures is even more refined."

It was a rule of respectable architecture that all load forces should be verticalized by the time they reached the ground. The inclined column suggested a measure of impermanence and insecurity. Tilting or propping may be satisfactory for the common lean-to or tent, but it was not within the etiquette of fine architecture.



In Lecture 12, Viollet-le-Duc states "the use of rigid shafts or cast-iron columns as oblique supports is a means of which our builders have not yet thought, ...substituting oblique for vertical resistance is a principle which...may assume a very high degree of importance." A new architecture may be found by relying on such "novel principles of structure". Gaudí working in brick and later stone, simply transferred Viollet-le-Duc's idea for the oblique metal columns.



Inspired by the construction methods of his homeland, the Catalan vault (the 'volta d'escala' and the 'revoltó'), within this ancient vernacular tradition with origins found in the vaults of Mesopotamia and Egypt, Gaudí derived the use of the parabolic arch. Gaudí said, "the board vault (bóvedas tabicadas, in Catalan) is the most precious element of our construction, it permits us to execute with simplicity and rapidity the most complex forms, it does not require falsework (while it is being built), and it has great resistance in relation to its lightness and to the simplicity of its components."



Referred to as a board, because the tiles (rajoles) of the vault acted as a cohesive unit, like a monolithic board. This was a result of the quick acting, high-strength mortar, bonding the tiles together to function like pot covers or a carriage spring exerting very little lateral thrust, as opposed to keystoned arches and vaults held together by compression. These broad and thin, lightweight terracotta tiles, laid in a zig-zag patchwork, alternating in successive laminations of two or three layers, without metal re-enforcing, beginning in the corners where the first tile can be attached on two sides, with the following tiles cantilevering out, also bonded on two sides to the tile alongside and the tile before it.



In this way, these vaults could be laid continuously and without temporary scaffolding or supports (senza armature). The use of these brick vaults began as floor and roof structures, when traditional wood joists became scarce, resulting from increased construction and deforestation. Masonry bricks were easy to handle, could be made on site and unlike wood, able to span floors with a non-combustible material. The innovative method of constructing without temporary scaffolding was also a result of the scarcity, and therefore higher cost, of lumber.



However the defining feature for Gaudí, was that these Catalan board vaults in section scribed an inverted catenary, the natural curve formed by a chain hanging by its ends. Not a geometrical curve, the parabolic catenary curve is a natural state of equilibrium, where the forces of gravity act evenly along its arc, thereby bringing the structure into a state of rest. Unlike the traditional post and beam structure, where the beam acting primarily in tension laterally transfers loading to the posts supporting it in compression vertically, the parabolic arch has a continuous transmission of the loads without division between the lateral and vertical.



And unique to the parabolic arch, differing from the **Roman circular arch** or the **Gothic pointed arch**, as the legs of the parabolic arch splay outward, they do not meet the ground in a 90 degree right-angle. Their inclined position naturally resists the lateral thrusts that needed diagonal buttresses to resist in circular and pointed arches.



(Güell Bodegas, 1895-1899)

And most importantly, it does so within the profile of the arch structure, the architectural form and structural engineering are unified as one, no distinction between the two, what Gaudí called the equilibrium principle. And as such, it stands on its own, naturally, like a tree.

He said, "Creation works ceaselessly through man. But man does not create, he discovers. Those who seek out the laws of Nature as support for their new work collaborate with the Creator."

Gaudí was more than a Viollet-le-Duc Rationalist, for he was deeply religious and believed that material qualities of architecture must be the outer manifestations of a spiritual order. Intuitively, he found the presence of this order in the structures of nature, which he felt to be a direct reflection of God's mind. The laws of nature were not those of physics, but were evidence of the Creator. And the parabola, with its beautiful economy of an Equilibrated Structure, was more than a correction of the imperfect Gothic pointed arch, it was a sacred symbol, to restore a purity that had been lost.

[Gustave Eiffel was the first to use the parabolic arch in bridge design, with the bridge on the Douro, Portugal, 1875-77, followed by the Garabit bridge in France, 1880-84.]

[The first appearance of the parabolic arch in architecture is in the Palau Güell, Barcelona (1885-89).]



From Gaudí's very first structure, the factory (1883) for La Obrera Matarónense cooperative, he has been refining the parabola.

In the garden of Casa Vicens,



In the dragon gate of Güell's country estate,



In Güell's palace residence in town that we saw last week,



And the St. Teresa convent,

Now in 1892, in his design for the **Tangier's missionary convent**, the parabola is taking form in a tower, a freestanding structure, no longer constrained as merely an architectural feature or structural system.



The symbolic parabola has become the sacred Montserrat.

[10 MINUTE BREAK]

In the great salon of **Palacio Güell**, is a mural portrait by **Aleix Clapés** of **Juame Balmes**, the first Catalan philosopher to look at the problems caused by industrialization, in a series of articles in 1843-4. He warned of radical and irreversible social changes, in particular a new class of industrial bourgeoisie was taking over from the old aristocracy of nobility. Their capacity to create wealth was dependent on conquering State power. At the same time, a working class was born alongside and presented the real danger to this new social order. The progress of science, technology and industry had to generate not only wealth, but a new morality. This new bourgeoise had to envisage the integration of the working class into social, political and economic institutions with shared interests or risk them organizing independently and ultimately begin a class struggle, violent conflict.

Writer **Prat de la Riba** developed Balmes theories further, into industrial colonies, "a population of workers with their managers, supervisors and foremen, their groceries, shops, medical care and even the cure of their souls, all under a single direction and under the imperative of a sovereign will." However, "the social question is not a merely economic question; it is not enough, then, to extend material well-being, it is not enough to guarantee the worker his daily bread: it is necessary to transform his soul, when it has been corrupted." The great urban concentrations generated by industry are the cause of that degeneracy, disease, not just biological, but moral and social, the greed of the worker, class resentments.

"The industrial colony combats the accumulation of the population in the cities, moves it to the countryside, disperses the population, in small isolated nuclei, helping in this way to re-establish the equilibrium of the social body." Where the remote State is incapable of establishing order, private enterprise can do so, by restructuring society into the rural industrial colony, "the faculty of permitting within his house only certain practices or customs, of expelling those who stray from these practices, of imposing on those who wish to live in his house observance of its rules." A circularity of every aspect of the life of the colony, to ensure its isolation and the dependence of its inhabitants, making it a microcosm was essential to sustain its success. During the 1880s, **Eusebi Güell's** textile factories had been rapidly transforming by the success of the new steam machinery. So in 1890, he decided to transplant his father's original factory to a new site at **Santa Coloma**, nine miles west of Barcelona. Catalonia was the largest brandy producing region in the world and Güell sought to remove his workers away from the ills of Barcelona, namely alcohol, atheism, and anarchism. He envisioned 150 houses for employees, services by shops, a social club and a church, based on the ideas of Balmes and a demonstration of Riba's ideal colony, the **Colònia Güell**. At its height in 1917, it numbered more than a thousand families.

"This is not a real Colony, it is a real family, under the loving action of a most intelligent patriarch." In 1905, a young factory worker accidentally fell into a vat of corrosive liquid, badly burning his legs. Only a major graft of skin from human donors could save him. Eusebi Güell's own children came forward as volunteers, together with 43 workers, and the boy was saved. If there is a re-created society, it is that in which prodigies are a mark of God's favor.



During the 1890s, this colony was built by Gaudí's young associates Berenguer and Rubió, and in 1898, Gaudí was to create the church, on the crest of a small hill, its vaults effectively crowning the life of the colony. "The temple of Jesus Christ" on a path leading into the little pine wood that guards the church in its heart, where it was forbidden to cut down a tree. The procession converts the road itself into a spectacle, the mechanisms that determined the built object.



The outer pillars inclined, springing from the ground, following the line of tension. Güell had given Gaudí the opportunity to explore his ideas for the Tangiers missionary, within this church for his workers' colony.



In the same year (1898), Gaudí began the construction of **Casa Calvet**, which we will get into next week. But of note, inside that building is found open brickwork vaulting of the stairways, using the traditional Catalan method. Stairs in the contemporary buildings of Barcelona are often supported by only one wall, the other side open to the center. The complexity of such stairs required specialist stairway builders (**escaleristas**), who obtained the curve for the staircase vaults by hanging a chain from two ends and then inverting this form. Here Gaudí found a method for studying the parabolic forms of his Tangiers Mission and in the church for the colony, he had the opportunity to develop a parabolic structure.



To do this, Gaudí (alongside **Francesc Berenguer** making adjustments, the engineer **Eduardo Goetz Maurer** offering specialist advice, practical advice from sculptor **Joan Bertran**, builder **Augustín Massip**, carpenter **Munné**, and sculptor **Llorenç Matamala**) developed a mechanical calculating machine, what he called a **stereo-static model**. In a workshop on the site where the church was to be built, a wooden board was mounted on the ceiling, with the floor plan drawn at 1:25 scale. From this hung a system of strings tied together representing the structural frame of pillars and arches, inverted by hanging upside down, so that the loading in a building that is naturally in compression has been also inverted to be in tension in this hanging model, the arches pulled on by gravity.

From the arches, at the intersecting points where pillars would sit atop or below, would be tied a small canvas bag filled with lead shots, proportionate to the weight that would be applied to the arch by the pillar resting on it. The tensile stresses applied to the strings, automatically assumed by gravity alone the inverted form for the structure of the church, while simultaneously determining the inclination angle of the pillars based on the direction of the terminal thrusts. In this way, the structure was instantaneously calculated, each adjustment to any element in the network would send a resulting through the entire assembly, from top to

bottom. The whole affected by each point, while at the same time each point was affected by the whole. Growing to 4 meters in height, Gaudí worked on this model for more than a decade, perfecting the design, by readjusting the model introducing or removing structural members in different locations, creating new variations of the design to be weighed carefully in consideration of the implications on the construction, functional use of the space, mechanical, as well as aesthetics. Experimentation was a slow and methodical study, an exhaustive analysis working on the model until he was convinced that the design could not be improved any further.



A string hanging to represent an arch, without any structural members attached or with a uniform load applied, would naturally take the shape of the most stable profile, a **catenary curve**, hanging freely under the forces of gravity as a sling. Same egg shape used by **Brunelleschi** to create his masonry **duomo in Florence**, nearly 5 centuries before (480yrs in 1418 AD). Properties of the arch could be manipulated, the span or depth, to create a shallow Catalan vault for example. And, when pillars were located atop, asymmetrically, the arch would be distorted and the adjoining **pillar inclined**, reacting to the displaced loads. This ingenious model became a machine for calculating an **equilibrated structure**, where the building forces coincide within the structural form and the whole structure balanced with the ground to which it is tied. In pursuit of **architectural synthesis**, where the distinction between supporting and supported elements dissolves, this model evolved in an organic sequence of natural growth, replacing traditional mathematical calculations with an empirical making by the hands. Not an instrument of the work, but a liberation of it. The model has become a

hyperconnected world, yet all the materiality of the church it represents is absent, only the structural mechanics are in focus. The web of strings outline the shape of space, the secrets of the structural loadings delineated, exposed.





Once the skeletal framework was resolved, a skin of thin cloth was draped over, to study the form of the church. Then photographed inside and out, so that the details in the wall fenestrations and furnishings could be drawn onto the photographic

2:25

prints, watercolors applied to visualize the finished church in full polychromic effect. Relying as much on trial and error as any guiding principles, thousands of hours painstakingly adding shotgun pellets, one by one, to the tiny canvas bags over 10 years. Set inside a makeshift hut, amongst the pines, it had become the most advanced architectural studio in the world. Then in 1908, construction began on the church, using this model to guide the work.

2:30



Exposing their shaft of a mix of bricks of different tones and textures, various types and jointing, mortar that retains all the roughness of elemental paste, the impression of a petrified tensed musculature. The inclined shafts as tree trunks, shimmering ceramic tiles as trembling leaves in the dense forest canopy. Not the imitation or extension of the pines found on this hill, rather the structure and forms are attempting re-naturalization. Their limbs following the strings of the model.



Structural materials exposed, revealing the manual work of the hands involved in the construction, an homage to an industrial colony of the working class. Primordial, Working process, Elementalism, Humbled, absence of vanity. Overfired, burnt bricks, personally selected by Gaudí for their imperfect, dispensable quality. Bearing a mark, trace of a past. Elevating their nature by their use for a sacred place, redeeming the materials and the hands that craft them.



Windows protected with hexagonal metal grilles made of needles from the weaving machines in the factory. Recycled, repurposed, redeemed.



The interior pillars circular, opening out in capitals with truncated conical forms or splay out in palmate system of brickwork ribs. Between the ribs are vaults inverted to appear hanging down like sail canvas, convex, suspended.



The bench pews were designed with a curve, so two people seated were slightly turn away from each other, discouraging conversation during the service.



The holy water at the entry was placed in a shell, with a metal framework shaped so that the lobes of the shell appear to be hanging, a reference to the tensile model.

2:35

According to Viollet-le-Duc, the Gothic was a "democratic style", a style of the laity. The architect, sculptor, and painter were "children of the people" and the building the result of "enfranchised labor". The Gothic of the early 13th century was "an awakening of the ancient national (Gallic) spirit", arising out of and expressive of "a desire for political consolidation", as it pioneered a route towards light and liberty. Gaudí conveyed these sentiments into Catalan nationalism.

The concept of guilds, economic ideas that promoted the entrepreneurial merchant classes above that of the landlord. From the start of the Industrial Revolution, architects sought a new architectural language for the sprouting villages and towns surrounding the factories. Gaudí fantasized about returning to the medieval feudal model, that could create a New Jerusalem, based on craft. The Colònia Güell represented unfinished business never completed with La Obrera Matarónense. Inspired in the beginning by the Poblet Monastery (1867), then joining the cooperative (1878), exploring its essence through a convent (St. Teresa, 1888), and again in Tangiers Mission (1892), now the Colònia Güell (1898), and soon in Park Güell (1900), with his final realization in Sagrada Familia Schools (1909). His cooperative views of his youth, had been replaced by a strict paternalistic leadership in the colony. The further he travelled away from the idealism of his youth and the stricter a Catholic he became and the more antiliberal, pessimistic and obsessed with suffering, the more glorious his architecture grew.

Spanish American War (April 21 – August 13, 1898) Changing/Stability The loss of Catalonia's colonial export market, after defeat in the Spanish American War, had serious economic repercussions on Barcelona. The slump in industry forced Güell to look for alternative investments and property development was one possible route out of recession.

In Park Güell (1900-1914), a housing plan developed on the outskirts of Barcelona, intended to nestle individualized aristocratic cottages in a natural setting. Güell took residence in an existing 18th century mansion on the property. In the end, only two houses were built, a model house which Gaudí moved into and second purchased by a lawyer friend. At the main entrance, leading from town, are two gatehouses embedded in a decorative wall. Inside, a shelter for horse drawn carriages, to the side of a formal processional staircase terminating in a hypostyle of 86 columns supporting a grand esplanade above, with panoramic views of Barcelona and Mediterranean Sea. With the semi-circular enclosure by the hillside to the rear, the open terrace plaza became the stage for a Greek theater, intended for performances and gatherings. One such event in October 1906, a Catalanist rally Garden Party marking the First Congress of the Catalan Language.

Constructed in the final years of the funicular studies, the columns between 1906-7, the entablature 1908-9, followed by the bench and trencadís tiles laid until 1914. Although Gaudí adhered very precisely to the Doric order in the modulations of the whole, he only approximated the individual elements to the proper proportions established by Vitruvius. Returning to the ancient source, Gaudí went even further back to evoke the archaic origins of architecture. Increasing the column diameters, reducing the number of flutes making the column appear less slender, made a greater sense of weight. At the cornice, doubling in size with undulations in plan, the perimeter columns are accentuated individually, with Gaudí's signature topheavy gesturing and inclined inward. The hypostyle of columns imbue the surroundings with the grandeur and solemnity of an ancient forest stand of trees, more of a temple than a hall or market as originally intended, a womb supporting the plaza above.

In fact, this was the case. The staircase processional is paired, divided by a casade of basins filled with water, flora and fantastical fauna, as if the earth had opened up to expose its entrails. At the top, the water is fed from the mouth of a colorful dragon and further up a tripod and finally a nymphaeum bench, behind which a column of the hypostyle on the central axis, denying a singular entry, as in Palacio Güell and we will see in Sagrada Familia. What is not visible, hidden under the hypostyle of columns is a grotto cistern, that stores rainwater collected on the open plaza and channeled down through the columns, with the overflow the dragon's mouth, just as Gaudí has designed for the fountain of the Güell country estate. All of this display, a cavern with interior lake, pouring out waters from fissures in the land, were images recognizable to the select group of guests attending the concert of Apollo hymns, played at Güell's palace in town a decade before. These are the myths and ritual artifacts of the sanctuary of Delphi, the Doric temple of Apollo located on the side of a hill, out of a cleft between two rocks flows the fountain Castalia, believed to be the mouth of Gaea, Mother Earth. Of her was born the serpent Python who sat atop a cauldron on a tripod, pronouncing the oracles stolen by Apollo. From the hymns sung in the salon, "You, son of the great Zeus, reveal to us mortals your imperishable oracles and take possession of the prophetic tripod guarded by the enemy dragon, multi-colored monster of tortuous folds." Here we have yet another metaphoric layer applied to the mythology of Eusebi Güell: Hercules conquering Dragon Ladon, Jaume I defeating the winged dragon, and now Apollo rescuing the oracles from the multi-colored dragon. And what was the maxim of the oracles? 'Know thyself', the longing of Catalans seeking autonomy, the restoration of their Catalan language and culture, the archeological excursions to uncover their Catalan history.

Before the hypostyle and esplanade, the first parts of the park to be constructed were the 3 kilometers of paths crossing the 15 hectacres of wooded hillside. And on these paths was coded Catalan mythology, punctuated by large stone balls representing Rosary beads, leading to a chapel in the shape of a rose, on the highest point of the park, figuratively the Virgin of Montserrat, Patron Saint of Catalonia. Symbols and inscriptions of her name are hidden amongst the fragments of broken tiles of the undulating bench, embodying redemption of the discarded waste materials. In fact, Gaudí sought out discontinued, unwanted tiles from the local manufactures, to be laid by the least skilled tile setters, asking them to bring from home broken dishes and plates so that the bench would be a record of their labors.



Along the contoured paths, **viaducts** were made as bridges, **porticos** as embankments, to take cover from the rain, wind or heat of the day, as if the caprice of nature has sculpted all of these fantastical forms clad in a pleasing rusticity.

In a time before mechanized construction equipment, to lay a path along a sloped incline took great effort. The Park Güell viaducts were a way to elevate the paths, simultaneously providing a second covered path for inclement weather, while also eliminating the labor necessary to cut into the hillside, excavating and removing all of the earth, then retaining what was left uphill.

These voids creating porticos, in section are determined by the natural properties that give structure and weight to the earth. The principal problem for architecture through the ages, has been to achieve a continuity between structural form and the forces that pass through them. The varying solutions have defined architectural styles over the centuries. For example, in the circular Roman arch, forces are dealt with geometrically, not statically. Whereas in the pointed Gothic arch, the structures are reduced to a more refined elegance, however the forces must be transferred externally to buttressing supports. It is only when these forces coincide with the structural form that an equilibrium is achieved, an architectural synthesis. And, it is within the parabolic forms of Park Güell's portico viaducts, implementing thrust line theory through a graphic statics analysis, that a balance was achieved.

However, the true genius is in Gaudí's methods. Going beyond the rational calculations of engineers on a drawing board, Gaudí carried out his calculations on the object itself, where process and result are now like form and force – one in the same. Not speculative, but residing in action, experimenting with the material itself. No abstraction, dealing with the laws of nature directly, immediately and intuitively. In these parabolic sections, the earth thrusts and receives its own weight, determining form by its own measure, not the caprice of man. A sublime example of structural form produced by the forces of nature. Gaudí derives his knowledge and experience for construction directly from the earth, the source of all things material.



The Catalans are a practical people and although they engage in great endeavors, do so without losing contact with what is real and immediate. In the poetry of **Joan Maragall** (<u>Alma Catalana</u>, 1904), a close friend of Gaudí, he wrote that the soul of a people springs from the soil itself. The Catalans are "accustomed to triumph through work", this is because "the Catalan earth is hard, but grateful." And, in the portico viaduct found in Park Güell is the manifestation of the Catalan spirit.



(Woman in masonry trade)

Viaduct columns are made of stone quarried on site, agglomerated with concrete (produced by Güell's new cement manufacturing company), terminating in a capital opening to receive a tree, a buttress or portico vault. Each joined to the next, these hollow columns provided openings for the palm trees growing atop, roots spreading down through searching for nutrients. The man-made structures of Park Güell were not so much deriving from nature, as it is returning. Nature is more than an evocative image, it is the sacred beginning and end of all constructs. As if, these natural forms have become petrified, a symbol of return, the merging of man and nature, a time without temporality. A very specific atmosphere is concentrated in this blending of land and history.



It is no coincidence that the construction of the park commenced with the most naturalistic part, in the rocky forms of the portico viaducts the antiquity of the earth becomes evidence of sedimentation, stratifications, faults. A cave was discovered on the south part of the site, which contained considerable quantities of fossils, demonstrating ancestral reality, a sacral dimension more than symbolic, but tangible. "Dark openings made in the terrain like burrows dug there by some living being from troglodytic times and in the light of the flickering torches we have followed with cautious steps the rough and labyrinthine tracks of the cave." (Salvador Sellés, 1903) Plein air science, technology, bourgeois art and the total secularization, the grotto represents the search for a space and a light that are once more enclosed, once more sacred.



"The work of the medieval sculptor was not inspired by the Romans or Byzantine geometries, but from flora on the ground, examined curiously as a creation of nature." (Viollet-le-Duc, <u>Dictionnaire Raisonné</u>). Gaudí embodied the medieval sculptor and in the **crypt at Colònia Güell** (1908) he realizes that vision. Walls and pillars made of burnt brick, undressed stone, broken tiles, scavenged and discarded materials, unworked and untreated, with deliberate matter-of-factness, humble and honest, a cathedral for the working class. Not a degradation, but a celebration. Through revolutionary mechanics of structure, the most common materials are elevated, in a new light, born from the Industrial Age and a model for the future, of an equilibrated world.



And in two weeks, in Sagrada Familia (Passion façade, 1917), his final work, we will find not only an elaboration of the inclined column and equilibrated structure, but we will also see the evolution of this working class church into a cathedral for the entire world.