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CHARACTERIZATION AND CONDITIONS ASSESSMENT
OF THE
SACRISTY WINDOW
MISSION SAN JOSÉ Y SAN MIGUEL DE AGUAYO
SAN ANTONIO, TEXAS

Katherine Ann McDowell

A THESIS

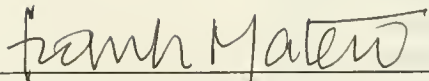
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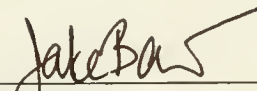
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Supervisor and Graduate Group Chair
Frank G. Matero
Associate Professor of Architecture



Reader
Jake Barrow
Project Manager
Conservation Program
National Park Service

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INTRODUCTION

The carved stonework at Mission San José y San Miguel de Aguayo in San Antonio displays the height of artistry associated with the Spanish missionary period in Texas. The decorative facade of San José is one of the finest examples of carved mission stonework in the American Southwest. After 200 years of exposure, weathering and repair, the carved stonework remains in remarkable condition. Nevertheless, specific active decay can be observed. This study was undertaken to better understand the composition of the stone, its condition and deterioration mechanisms, and how repairs and previous treatments have affected the stone. This was accomplished through investigations including documentary research, analysis and characterization of the stone and previous repairs, and the documentation and analysis of past and existing conditions at the site.

Historical research has encompassed all of the carved stonework at Mission San José. Treatments performed on one of the elements were likely used on others as well, given the overall nature of the repair campaigns undertaken in the past. This research was based on conservation methodologies that require an understanding of the maintenance history of a structure: what products and techniques were used and their effects over time. The more detailed analysis of conditions and materials characterization has focused on the Sacristy window as a smaller case study, representative of the basic material issues for the entire facade. Careful documentation of the existing conditions of the Sacristy window was made so that a record would exist of its present condition and the method of documentation could be field tested for possible use on the stonework of the principle facade. Material analysis was performed on a limited number of samples in order to

generally characterize the stone and better understand the observed weathering phenomena documented in the conditions survey. From this point, a decision can be made as to whether or not the stone merits remedial or preventive treatments, such as water repellents, and/or consolidation. It is hoped by the author, that these investigations will assist in the initiation of a conservation plan for the stonework of Mission San José.

CHAPTER 1. CONSTRUCTION HISTORY

1.1 Founding and Construction of Mission San José

Mission San José y San Miguel de Aguayo was founded on February 23rd, 1720, on the east bank of the San Antonio River, approximately 3.5 miles south of Mission San Antonio de Valero, by Franciscan missionaries from the Apostolic College of Our Lady of Guadalupe of Zacatecas. The founder, Father Antonio Margil, saw the advantage of a second mission at San Antonio, because the presidio, mission and settlement there were strained to accommodate the Zacatecan missions in East Texas.¹ Thus, San José served as a midway point between San Juan Bautista in Coahuila and their missions near Nacogdoches. Sometime prior to 1727, the site of the mission was moved to the west bank of the San Antonio River. There is some debate as to whether the site of the mission was moved again in 1740. The construction of what was likely a flat roofed earthen church (*iglesia de terrado*) began around this time.² This church was torn down about 1765 to make way for the new church.³ The site was cleared and new foundation trenches were excavated in the approximated location of the old church. By the winter of 1767, the foundations had been completed and the above grade construction of the stone church was ready to begin.⁴

¹ Chipman, Donald E., *Spanish Texas*, 120.

² Habig, Marion A., *The Alamo Chain of Missions*, 89; Smith, Harvey P., Important dates of San José Mission, 1936, San José file, SACS Library. Ivey states that the term “iglesia de terrado” was incorrectly translated by Habig and others to mean “a church made of earth” when it means “church with a flat earthen roof.” Ivey suggests that the walls of this church were stone, because a portion of the first church survives at the juncture between the east wall of the present church and the Convento. (1990:180)

³ Ivey, James E., et al. *Of Various Magnificence, The Architectural History of the San Antonio Missions in the Colonial Period and the Nineteenth Century*. Volume 1 Santa Fe: National Park Service Southwest Regional Office Cultural Resources Center, (1993)117; Habig, *The Alamo Chain of Missions*, 94.

⁴ Ivey, *Of Various Magnificence*, Vol.1, 117. From Solis 1768 in Leutenegger *The Zacatecan Missionaries in Texas: 1716-1834: excerpts from the libros de los decretos of the Missionary College of Zacatecas, 1707-1828*, 1973.

On March 19, 1768, the feast of St. Joseph, the mission's patron saint, Fr. Gaspar Solis blessed the foundations for the new stone church and the cornerstone was laid.⁵ Solis stated that at that time there was not a church, and that the arches of the *porteria* of the Convento had been closed and were being used as a temporary church.⁶ According to Solis' account, the church's dimensions were to be 50 varas by 10 varas (approximately 139 feet by 29 feet) and the church would have transepts.⁷ "During construction there were a series of revisions of the plans, resulting in the elimination of the transepts and the redesign of the Sacristy, the shortening of the church by 39 feet, and finally, the stopping of the work on the north bell tower when it reached the height of the present nave vault."⁸ The location of the present Sacristy is where the south transept for the church would have been. Supporting evidence for this redesign midway through construction was seen in the archeological work conducted inside the Sacristy.

This revealed that the Sacristy foundations abut the church foundations rather than being tied in to them. The above grade fabric is bonded construction, indicating the foundations were constructed at different times, but the above grade fabric was built at the same time.⁹

The combining of Mission Concepción and Mission San José in to a single system under the Zacatecan college in 1772, may have reduced the competition between the two missions, making it no longer necessary for such an elaborate church.¹⁰ In addition, the

⁵ Habig, *The Alamo Chain of Missions*, 94.

⁶ Ivey, *Of Various Magnificence*, Vol.1, 117; From Solis 1768 in Leutenegger and Habig 1978:145) *porteria*: The lodging for the guardian of the doorway or gateway.

⁷ Ivey, *Of Various Magnificence*, Vol.1, 117; From Leutenegger and Habig 1978:140

⁸ Ibid., 118

⁹ Ibid., 118; Archeological work conducted by Anne Fox of the Center for Archeological Research at the University of Texas at San Antonio.

¹⁰ Ibid., 118

finances of the missions were beginning to decline which may have also contributed to the simplification of the design. This re-design probably occurred in 1769.¹¹

In 1777, by the time Fr. Juan Agustín Morfi arrived, Mission San José was nearing completion. He remarked that San José “...is, in truth, the first mission in America, not in point of time, but in point of beauty, plan, and strength, so that there is not a presidio along the entire frontier line that can compare with it.”¹² He reports that by this time the Sacristy had been completed and was being used as the church.¹³ Morfi added that the facade was very costly because of the statues and ornaments which were used to adorn its main portal. He added, “In a word, no one could have imagined that there were such good artists in so desolate a place.”¹⁴ From this information, it is a reasonable deduction that all the carving was made locally, which would have been an incredible feat for a frontier outpost.¹⁵ Fr. Morfi does not include a description of the Sacristy window in his 1777 account. Because of this omission, Habig (1968) suggests that the Sacristy window was not completed until the church was finished in 1782.¹⁶ The date of 1782, for the completion of the church, is supported by several different sources.¹⁷

The Sacristy window was completed by 1785 when Fr. Josef Agustin Falcon Mariano made a detailed inventory of the mission. He describes the Sacristy as having three vaults, two doorways of sculpted stone, and a large sculpted window with an iron grating, glass

¹¹ Ivey to McDowell, personal correspondence, January 22, 1997.

¹² Habig, *The Alamo Chain of Missions*, 97. From Juan Agustín Morfi, *History of Texas, 1673-1779*, 2 vols. (Albuquerque: Quivera Society, 1935); Chabot, F.C. *Indian Excerpts: Memorias for the History of the Province of Texas*. (San Antonio: Naylor Printing Company, 1932) 61.

¹³ Ibid., 98; Morfi, *The History of Texas 1673-1779*; Translation by F.C. Chabot, 63.

¹⁴ Ibid., 98; Morfi, *The History of Texas 1673-1779*; Translation by F.C. Chabot, 63.

¹⁵ Schuetz, *Indians of the San Antonio Missions*, University of Texas Master's thesis, (1980) 279.

¹⁶ Habig, *The Alamo Chain of Missions*, 99.

¹⁷ Ivey, *Of Various Magnificence*, Vol. 1, 120.

and an iron grill.¹⁸ The church facade was described as “a very well-done carved entranceway with six statues carved from the same stone.”¹⁹

¹⁸ Ibid., 127

¹⁹ Ibid., 126 (Mariano 1785) Note there are also inventories from 1786, 1794, and 1824.

1.1.1 Physical Description of Church

The church is rectangular in plan and measures 33 by 110 feet. It has a vaulted ceiling and hemispherical dome measuring 60 feet high at the interior apex. The church walls are smooth-faced tufaceous limestone laid in a lime mortar. The walls of the tower and principal facade are 4 feet, 9 inches thick. The side walls are 3 feet, 6 inches thick and are reinforced with buttresses. The first story of buildings of this nature were normally of greater thickness than the second which is usually setback, reducing the thickness of the walls in the upper parts.²⁰ The corners are ashlar quoins of the same calcareous tufa. One tower was built at the south side of the west facade.²¹



Figure 1. Mission San José y San Miguel de Aguayo, San Antonio, Texas, 1996

²⁰ Markman, *Colonial Architectural of Antigua Guatemala*, 33.

²¹ Ivey, *Of Various Magnificence*, Vol. 2, 377. Wall thicknesses measured by Robert Leon White in 1930. It is not known if the wall thins as it increases in height. The HABS drawings do not indicate a change in thickness from the first to second levels. White's thesis may have something to say about this or papers and drawings prepared by Harvey P. Smith.

The scarcity of timber, combined with the unsuitability of adobe for the roof, made stone vaulting necessary in most areas.²² The floor of the church, outside of the sanctuary, had a wood floor, according to Mariano's account from 1785.²³ A historical account indicated that by 1854 the floor of the church was earthen.²⁴ The exterior walls were originally plastered and decorated with quatrefoil geometric designs in primary colors, known as *ataurique*.²⁵ The principal opening of San José faces west and is a portal of elaborately carved stone similar to the Sacristy window. The *Convento* is located at the eastern end of the church and today is preserved as a ruin. Approximately fifty percent of present church is original, including the facade, the south and east walls, and the Sacristy. The remaining precinct areas were rebuilt in the major restorations of 1934-1936 and 1947-52. The dome and the eastern two-thirds of the vault were rebuilt with modern materials by Harvey P. Smith in 1936.

²² White, Robert Leon. *Mission Architecture of Texas*, 72.

²³ Ivey, *Of Various Magnificence*, Vol. 1, 126.

²⁴ Ivey, *Of Various Magnificence*, Vol. 1, 223.

²⁵ Schuchard Collection, San Antonio Missions, Daughters of the Republic of Texas Library, San Antonio; Term *ataurique* from Markman, *Colonial Architectural of Antigua Guatemala*, 34.

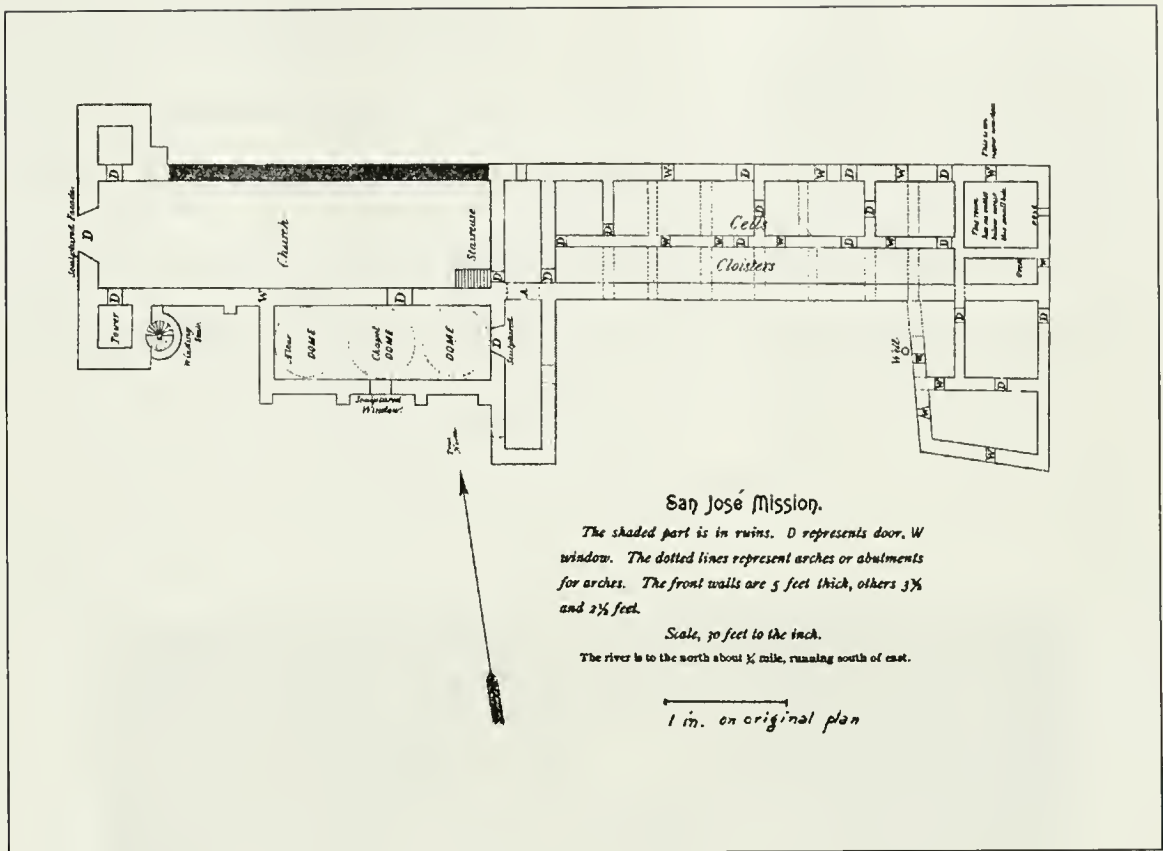


Figure 2. William Corner's plan of Mission San José from 1890. (From Habig, Marion A., San Antonio's Mission San José, San Antonio: Naylor Company, 1968.)

1.1.2 Physical Description of the Sacristy

The Sacristy, which is connected to the south side of the church, measures approximately 22 feet by 64 feet. The Sacristy, served as a small chapel and a storage space for sacred vessels and vestments. The walls and vaults of the Sacristy are also constructed of a calcareous tufa. Three small domes make up the roof of the Sacristy. High parapet walls on the exterior partially conceal the domes from view. *Canales*, or water spouts, are placed at the certain valleys on the roof, in an effort to drain water and to divert it away from the walls of the Sacristy. The *canales* are also made of a cut stone, similar to the

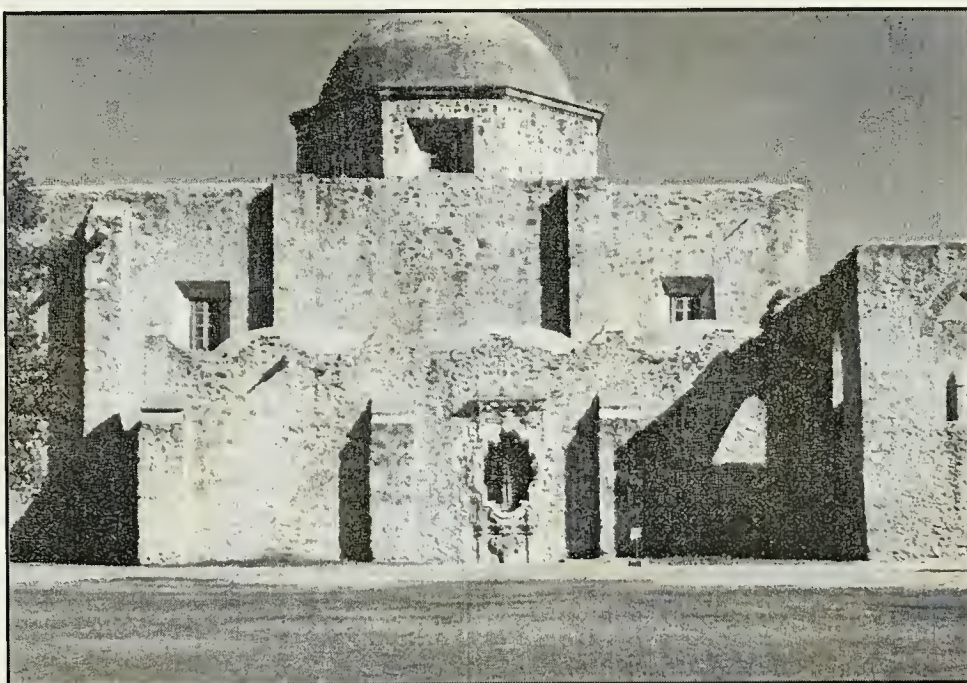


Figure 3. Sacristy of Mission San José y San Miguel de Aguayo with church dome in background, showing the relationship of the Sacristy window to the canales and parapets.

facade portal and Sacristy window. The Sacristy window, is located on the south facing wall. The carved window surround measures approximately $5\frac{1}{2}$ feet wide, at its widest dimension, by 10 feet high, with the window opening approximately 3 feet wide by $4\frac{1}{2}$

feet high.²⁶ An excavated trench, measuring approximately 5 feet square and 2 1/2 feet deep, lies immediately in front of the window, which shows the original grade level. The Sacristy is the only structure which resisted total or partial collapse in the mission complex. The interior plaster was removed and replaced in 1981-1982.



Figure 4. Section through Nave and Sacristy. (From White, Robert Leon, Mission Architecture of Texas: Exemplified in San Joseph de San Miguel de Aguayo, Unpublished Master's thesis, University of Texas, Austin, 1930.)

²⁶ Dimensions from HABS drawings in DeLong, David G. (ed.) *Historic American Buildings, Texas*. New York: Garland Publishing, Inc., 1979, xiv. (Delinated by Zeb Rike, TEX-333, 1936)

1.2 Carved Stonework

The carved stonework at Mission San José includes the facade of the church, the Sacristy window, the doorway from the church to the Sacristy, and the doorway from the Sacristy to the Convento. Robert Leon White in his thesis titled, *The Mission Architecture of Texas* states, “The rich and lavish use of cut stone ornamentation around door and window openings is peculiar to the Texas missions.”²⁷ The missions of New Mexico



have much more planer facades and do not have this elaboration around openings. The sculptural features around openings are more closely related to churches found in Mexico. At San José, it is likely that all of the carved stone elements were carved by the same person.²⁸ The Sacristy window is known locally as the “Rose Window” even though it does not assume the correct placement or design of a true rose window.

Figure 5. Sacristy Window

²⁷ White, Robert Leon, *Mission Architecture of Texas: Exemplified in San Joseph de San Miguel de Aguayo*, Unpublished Master's thesis, University of Texas, 1930, 70.

²⁸ Ivey to McDowell, personal correspondence, January 22, 1997

1.2.1 Architectural Significance of Carved Stonework

The carved stonework at Mission San José represents the finest carved mission stonework in the American Southwest. The church of San José is an extraordinary example of the baroque style of architecture and decorative arts fashionable in Mexico in the second half of the eighteenth century, incorporating classical and Moorish motifs.



Figure 6. Facade of Mission San José y San Miguel de Aguayo.

The quality of design and stone carving shows no provincialism in the use and execution of the style.²⁹ The time of construction of Mission San José is contemporaneous with the height of the baroque in Mexico. The elaboration of the doors and windows, parallel the 17th century Spanish mode known as Churrigueresque.³⁰ According to some, no finer example of this decorative style is to be found outside the larger cities of Mexico.³¹

²⁹ Ivey, *Of Various Magnificence* Vol.2, 367.

³⁰ DeLong, David G. (ed.) *Historic American Buildings, Texas*. New York: Garland Publishing, Inc., 1979, xiv.

³¹ Ivey, *Of Various Magnificence* Vol.2, 377.

Regarding San José, Morfi remarked in 1777 that there was no equal in all of New Spain.³² An account from 1890, says of the Sacristy window,

The south window of the Baptistery [Sacristy] is considered by good judges the finest gem of architectural ornamentation existing in America today. Its curves and proportions are a perpetual delight to the eye, and often as the writer has seen and examined it, it is of that kind of art which does not satiate, but ever reveals some fresh beauty in line or curve.³³

Mission San José is also has the distinction of being the most authentic surviving example of this baroque mode in America and the first fully developed Spanish Baroque church facade in colonial America.³⁴ “San José’s church, with its fully developed Spanish baroque facade and rose window carved in exuberant high relief, is the most aspiring of the provincial manifestations of the style.”³⁵ The mission architecture and decorative stonework of San José had far reaching effects on the Spanish Colonial Revival of the early 20th century in California and the Southwest. In San Antonio, the imagery of the Sacristy window, or what is locally referred to as the “Rose Window”, has been loosely copied and adapted in several 20 th century buildings.

³² Ivey, Vol.1, 119; From Morfi, *History of Texas* (1935) 227-28.

³³ Ivey, Vol. 1, 265.

³⁴ Pierson, *American Buildings and Their Architects: The Colonial and Neo-Classical Styles*, 176.

³⁵ Thurber, Marlys Bush, “Building the Missions of San Antonio.” *Texas Architect*. Vol. 36, No.3 May-June (1986) 54-59, 54.

1.2.2 Master Masons

The nomadic native tribes of Texas did not possess a permanent building tradition, therefore it was necessary for the Franciscans to import builders for their churches and to train the local laborers. The San Antonio missionaries functioned more as planners than as actual builders.³⁶ The Franciscans were capable of conducting much of the construction associated with the building of the mission, however, any construction requiring an arch, vault, or dome was usually contracted to a professional mason, or it was not built.³⁷ By the time the Franciscans expanded into Texas, they had greater access to financial and architectural expertise than they had in New Mexico, and could plan churches on the frontier like those which were built in the more central areas of New Spain, such as the cathedrals at Oaxaca, Auguascalientes, and Zacatecas. The cathedral at Zacatecas, which was originally the parish church built between 1718-1752, has the finest popular decoration which New Spain produced.³⁸ The missionaries, who were based there, may have been inspired by the decoration of the church at Zacatecas and tried to duplicate a similar grandeur on the frontier. In order to accomplish this, the Franciscans imported master masons from Mexico to build their churches.³⁹ By the 18th century, the construction sequence had also been secularized. Skilled workers were hired to train the Indians in the building trades and to supervise their work.⁴⁰ Master masons

³⁶ Thurber, Marlys Bush, "Building the Missions of San Antonio." *Texas Architect*, Vol. 36, No.3 May-June (1986) 54-59 56.

³⁷ Ivey, 18.

³⁸ Weisman, Elizabeth Wilder, *Art and time in Mexico: From the Conquest to the Revolution*. New York: Harper & Row, Publishers, 1985, 153.

³⁹ Ivey, 19.

⁴⁰ Thurber, 56.

eventually passed on their knowledge and techniques of stone cutting and construction to the point where one Indian was in time recognized as *maestro* himself.⁴¹

In spite of all the documentation; one feels far from knowing exactly who did what when. The following research, conducted by NPS Historian Jake Ivey and others, describes who may have designed and carried out the carving of the stonework.⁴² Estevan Losoya, an Indian from Aguascalientes, probably designed the new church at San José about 1766. He was master mason for the Queretarean missions, which included Mission Concepción and Mission San Antonio de Valero, from about 1765 until his death in 1767. He worked principally at Valero, where in 1766 he was called *maestro de la obra de la Yglesia*, master of the church project, and in 1767 he was called *maestro de albañil*, master stonemason. Losoya probably directed the demolition of the old flat roofed church at San José in 1767, and laid out the foundations of the new church late that year; however, he died at Valero in 1767 and was buried there. It is likely that the excavation of the foundations at San José was still underway when he died.

After Estevan Losoya's death in 1767, the master mason and stone-carver Dionico Gonzales apparently continued work on the new church at San José. If so, he completed the foundation in early 1768, and began work on the above-grade construction of the walls after the ceremony dedicating the cornerstone on March 19, 1768. Soon afterwards, when the walls were perhaps two feet above grade, Gonzales changed Losoya's original design, as physical evidence in the Sacristy as mentioned before suggests. It is likely that this redesign happened about 1769. The facade of the church, the Sacristy window, and the other stone carving of the first fifteen or twenty feet of the church were all probably

⁴¹ Schuetz, *Indians of the San Antonio Missions*, 300.

built between 1770 and 1773, so Gonzales is most likely to have carved and assembled them all.

If not, then the master mason Antonio Salazar, who became the director of the mission construction sometime during 1773-1779, certainly did. He was described variously as an Indian, *mestizo*, or *criollo* (a Spaniard born in the New World), born about 1733 in Zacatecas. He apparently trained in Zacatecas, and probably arrived in San Antonio about 1773, hired to replace the aging Dionico Gonzales; but he does not appear in the records until 1779. Salazar was in charge of the construction of the present church through its completion about 1782. About 1780, Salazar was responsible for the final changes to the San José design that stopped work on the second bell tower at about roof height, and substituted a parapet with embrasures and false cannon in place of the top of the tower, a further cost-cutting decision.⁴³ Salazar is listed as a master mason at San José from 1785-1793.⁴⁴

Pedro Huizar, who legend credits with the carving of the Sacristy window, does not appear to be its creator, according to the research of Ivey (1990), Schuetz (1980) and others. Pedro Huizar was listed in church records as both a servant and a *carpenterio*, but never mason or *maestro*. Antonio Salazar, who appears to have executed the carving of the facade and window, was godfather to Pedro's three children and may have passed on some of his skills to Pedro.⁴⁵

⁴² Ivey to McDowell, personal correspondence, January 22, 1997.

⁴³ Ivey to McDowell, personal correspondence, January 22, 1997.

⁴⁴ Schuetz, Indians of the San Antonio Missions, Unpublished Master's thesis, University of Texas, Austin, 1980, 299.

⁴⁵ Schuetz, Indians of the San Antonio Missions, 305.

A construction agreement between Dionico Gonzales and Fr. Joseph Lopez in 1767 for the facade of Mission San Antonio de Valero is a good example of the arrangements made between the masons and the missionaries. The contract states that the mason was responsible for acquiring the stone for the facade and the mission would supply the iron tools.

Mission San Antonio, September 27 of the year 1767

I, Dionico de Jesus Gonzales, state that I pledge myself, my person, and possessions, owned and to be owned, to completely finish the facade of the Church of San Antonio, as it is on the plan, placing to my cost the cut stone; and lastly, that for this I should suffer litigation nor dismissal, for which I place myself [open] to all [just] retribution so that I may be made to complete this my obligation--And the mission obligates itself in the same manner to pay be the quantity of 1100 pesos in reales, and the iron tools with which I should additionally be supplied, leaving me free supervision, and in order that it be clear, it is confirmed with the minister of the said mission on the said day, month, and year.

Dionico de Jesus Gonzales [rubric]

Fr. Joseph Lopez [rubric]⁴⁶

⁴⁶ Ivey, Vol.1, 42; Translated from Spanish. Manuscript collections at OSMHRL 4:5220.

1.3 Construction Methods

1.3.1 Building Stone

Since stone was available and more durable to the abundant rainfall in the region than adobe, it was the building material of choice for large structures such as San José. “In the particular region of San Antonio, stone was to be had in abundance, though of a quality not considered suitable for better building purposes today.”⁴⁷ The church is constructed of a combination of three different building stones. The rubble walls were constructed mainly of calcareous tufa and in some areas an impure limestone, which contained high percentages of quartz sand. The carved elements were sculpted of a softer and more compact white limestone.⁴⁸ Ferdinand Roemer, the first trained geologist to make observations about Texas, traveled to San José in 1846, and made the following account.

The material used in the construction of this building [San José] as well as the other Missions is composed of two kinds of stone. The one is a light, porous, tufaceous limestone or travertine, which is also found in many parts of Germany,...where it is valued highly as a building material on account of its lightness. This stone formation finds its particular origin in the deposits of springs containing lime. The cupolas and arched ceiling of the churches in the Missions are built of this material.

The other stone used is a greenish gray limestone, containing clay, which has the peculiar property of being almost soft enough to be cut with a knife when taken from the quarry, but later hardens when exposed to the air. This peculiar mineralogical product is mentioned in several writings as being found in the region of San Antonio. This limestone, whose geological age can be determined by the numerous fossils, - particularly species of the family *Exogyra*, - enclosed in it, belongs to the Cretaceous formation and is found in several places in the neighborhood of San Antonio. The peculiarity noted above, of hardening after exposure for some time to the air, is simply due to the fact that the water which is

⁴⁷ White, Robert Leon, *Mission Architecture of Texas: Exemplified in San Joseph de San Miguel de Aguayo*, Unpublished Master's thesis, University of Texas, 1930, 68.

⁴⁸ Brackin, Anne, *A Comparative Study of the Effects of Applying Acrylics and Silanes in Sequence and in Mixture, with a Case Study of the Column in the Convento of Mission San José y San Miguel de Aguayo*, Texas, 98.

enclosed in it mechanically, and which produces a slight condition of mobility among its particles, evaporates and thus makes this limestone especially adopted for sculpturing. For this reason it was used for the sculptured portal of the church of San José Mission.⁴⁹

The merits of tufa or tufaceous limestones as a suitable building stone has been known since Roman times. Vitruvius' *Ten Books of Architecture* mentions a white tufa, which could be cut with a toothed saw, which has similar properties to the stone Roemer describes. Vitruvius writes,

All these soft kinds [of stone] have the advantage that they can be easily worked as soon as they have been taken from the quarries. Under cover they play their part well; but in open and exposed situations the frost and rime make them crumble, and they go to pieces. On the sea coast, too, the salt eats away and dissolves them, nor can they stand great heat either.⁵⁰

⁴⁹ Roemer, *Texas* 1935, 128-129. [The Geological Preface in the translation of *Texas* indicates that in the above reference "the modern geologist would say that the water in the pore spaces of the rock contain lime or other minerals in solution and that the evaporation of the water caused the precipitation of those minerals and therefore produced cementation of the constituent grains and the "setting" of the rock which Roemer describes." p.vi]

⁵⁰ Vitruvius, *The Ten Books on Architecture*, Book II, Chapter VII.

1.3.2 Quarrying

Morfi's account from 1777 indicates information on where one quarry for the mission's stone was located.

The whole structure is admirably proportioned and strongly built of stone and mortar, chiefly of a sandy limestone that is light and porous when freshly quarried but in a few days hardens and becomes one with the mortar....This stone is obtained from a quarry near the Mission of Nuestra Señora de la Concepción.⁵¹

The stone which Morfi mentioned as being quarried near Concepción is a calcareous tufa and was the stone used to construct the principle walls. The stone used to construct Mission San José must have come from as many as three different quarries, since a calcareous tufa, a red sandstone, and a fine textured white limestone are all utilized in its construction. It is also likely that some of the stone was secured from former buildings which were at one time associated with the earlier missions of San José.

No historical documentation has been found which describes where the stone which makes up the carved elements was quarried. This stone is also similar to the facades of Mission San Antonio de Valero and Mission Concepción. A publication by the South Texas Geological Society claims that the stone used in the construction of Mission San Antonio de Valero (The Alamo) came from the Austin chalk quarry at what is now the bear pits at the San Antonio Zoo, in Brackenridge Park, based on the physical similarity of the stones and the foraminifera found within them. The stone is described as a soft, chalky, laminated limestone mainly from the Austin Chalk Group (Upper Cretaceous), with the more sandy, argillaceous stones being from the Anacacho Limestone, an upper formation of the group. This source also mentions other geological

⁵¹ Habig, *The Alamo Chain of Missions*, 98; Morfi, *Memorias for the History of Texas*, 1932; Translation by Frederick Chabot, 62-63.

formations which crop out in the vicinity of the Alamo which could have also provided sources for the stone. They include Pecan Gap Chalk, Escondido Sandstone, and possibly Edwards Limestone. However, fossil oyster shells and shell fragments from the *Gryphaea* identified in the walls and in microscope slides of stone samples suggest the Austin Chalk as the major source of stone.⁵²

An adjacent quarry, which now holds the Japanese Sunken Gardens, served as the quarry for the Alamo Portland and Roman Cement Works, the first Portland cement factory west of the Mississippi, established in 1880. Stones examined by the author in the original factory buildings and kilns, closely resemble the stone used for the carved stonework at Mission San José. Similar qualities include: large fossil inclusions, surface patination, pyrite staining, and biological growth on elements exposed to direct contact with water.

⁵² Hudson, Joy. "The Alamo." preface in *Contributions to the Geology of South Texas*, edited by Wilford E. Stapp, San Antonio: The South Texas Geological Society, 1986, i; "Remember the Alamo." *Earth Science*, Vol. 37, Winter 1984, 20-21.



Figure 7. Austin Chalk quarry at the Alamo Portland and Roman Cement Works now the Japanese Sunken Gardens, San Antonio, Texas



Figure 8. Limestone used in the construction of the kilns at the Alamo Portland and Roman Cement Works, San Antonio, Texas. The stone closely resembles stone from the Sacristy window at Mission San José.

In addition to the San Antonio Zoo and the Japanese Sunken Gardens, other Austin Chalk outcrops along the Balcones escarpment were examined by the author. These areas include: San Pedro Park, Trinity University, and Incarnate Word College. It is not known if the stone for the carved elements could have come from these quarries, however, they form a series of outcrops, along the Balcones escarpment, producing the availability of the Austin Chalk Formation nearest to the missions. The road which at one time served as the principle connection between Brackenridge Park and downtown to the south, North St. Mary's, at one time was known as Quarry Road.⁵³ A source claims that the Spanish quarried stone in present day Brackenridge Park in the 1700's, however, no citations are given.⁵⁴ An account concerning Valero from Fr. Mariano de los Dolores in 1762 states, "Although the church of this mission has been completely finished including a tower and Sacristy, it fell to the ground because of the poor skill of the architect; and another harmonious design is now being built with quarried stone which is found almost on the spot."⁵⁵ It is therefore plausible that the stone used for the Valero walls and facade came from a location closer to the mission than Brackenridge Park.

Early builders often took stone from outcropping formations where the rock was easily located.⁵⁶ The quarries were most likely worked by the Indians, who were enlisted for the labor of quarrying and carting the stone to the site. Because of limited working facilities and equipment, stone was quarried near the surface, and was therefore of an

⁵³ Hudson, Joy "The Alamo." preface in *Contributions to the Geology of South Texas*, edited by Wilford E. Stapp, San Antonio: The South Texas Geological Society, 1986, i.

⁵⁴ Spearing, *Roadside Geology of Texas*, 89.

⁵⁵ Habig, *The Alamo Chain of Missions*, 56.

⁵⁶ McKee, Harley J. *Early American Masonry*. Washington, D.C.: National Trust for Historic Preservation, 1973, 12.

inferior quality to what might have been found deeper in the vein.⁵⁷ Blocks of quarried limestone must have been determined by taking advantage of the natural bedding planes that characterize its formation. Thus the height of the block depended on the distance between the natural break lines.⁵⁸ The smallest blocks in the window range from 6 to 12 inches in height, as they were laid in the quarry, while their length is 30 inches or more. The blocks from which the window surround was originally carved are much larger, approximately 30 inches square.

Quarrying techniques in San Antonio may have resembled those in use by the Spanish in Florida in 1671, according to McKee (1973). “The quarry overseer kept the picks and axes going, cutting deep grooves into the soft...stone, while with bar and wedge the [Indians] broke loose and pried up the rough blocks.”⁵⁹ The contract between the mason Joseph Padron and the missionaries at San Juan Capistrano, stated that the mason was responsible for quarrying all of the stone; however, the mission would supply five bars and a pickax for this purpose.⁶⁰

1.3.3 Stone Carving and Tools

The initial shaping of blocks was usually carried out in the quarry. The rough quarried stone was given a shape which defined in a general sense its final architectural function.⁶¹ After, being transported to the site, the stone was carved according to the appropriate shapes and dimensions. Mardith Schuetz’s translation of *Architectural*

⁵⁷ White, Robert Leon, *Mission Architecture of Texas: Exemplified in San Josephe de San Miguel de Aguayo*, Unpublished Master’s thesis, University of Texas, 68-69.

⁵⁸ Rockwell, Peter. *The Art of Stoneworking*, 156.

⁵⁹ Ivey suggests the similarity between quarrying practices. McKee, Harley J. *Early American Masonry*. Washington, D.C.: National Trust for Historic Preservation, 1973, 16 .

⁶⁰ Ivey, Vol.1, 48.

⁶¹ Rockwell, 96.

Practice in Mexico City: A Manual for Journeyman Architects of the Eighteenth Century, originally written sometime between 1794 and 1813, suggests how masons trained in Mexico during this period would have approached the carving of the stonework. The design of the frontispiece should have been made by a painter or master joiner, under the direction of the *maestro*.⁶² A *maestro de carpenteria*, or master carpenter, usually built the wooden structures for the master mason. A tracing floor was used to draw full-sized plans of arches, vaults or other structural components. These outlines served as templates for the cutting of the stones, which was a practice followed for centuries in Europe.⁶³ Stone cutters made finely dressed stones, including those tapered for arches which required some skill and mathematical ability, an art known as stereotomy. Traditionally, masons responsible for basic construction were called “setters” and “wallers”, while those responsible for the fine decorative carving were called “freemasons”.⁶⁴

Inventories of the period show that masons employed a large number of specialized tools and equipment.⁶⁵ These inventories included:

azadones, pickaxes
picaderas, small pecking hammer
planas or *cucharas*, trowels
plomadas, plumb bobs
niveles, levels
reglas, rules or straight-edges
mazos or *martillos para sacar piedra*, quarrying sledges or large hammers
baras de fierro para sacar piedra, quarrying bars
esquadradas de fierro, squaring templates
escoplos para la piedra, stone chisels⁶⁶

⁶² Schuetz, *Architectural Practice in Mexico City*, 43.

⁶³ Ivey, 48; From Risebero *History of Western Architecture*. 1979:64.

⁶⁴ Ibid, 48; From Risebero *History of Western Architecture*. 1979:65.

⁶⁵ Thurber, 57.

⁶⁶ Ivey, Vol.1, 48.

Once the rough blocks had been hauled to the site of construction, tools such as the square, rule, level, plumb bob and stone chisel were used to finish them. Finer carving of the stone to produce the intricate statues and floral decoration required a wider range of chisels, saws, and other finishing tools and were probably personal possessions of the artisans themselves.⁶⁷ Tooling evidence still extant on the pilasters and flat surfaces in between the pilasters of the Sacristy window suggest that a saw could have been used to cut the soft stone. Some of the statues or decoration that involved joining more than one piece of stone may have had the carving process divided at some point so that one part was carried out in a workshop and one part after the stone was placed in the wall.⁶⁸

1.3.4 Setting and Finishing

The stones blocks were laid in lime mortar which was manufactured by burning limestone in large kilns and then slaking the lime in vats. The foundation of San José, “was smoothly cut, squared stone laid in carefully excavated trenches, with mortar filling the narrow space between the stone and the face of the trench.”⁶⁹ The carved blocks of the facade and window were added to the building as its walls went up.⁷⁰ It is not clear whether pins or dowels were used to join stones together, although this is a common practice. Iron was typically used for this purpose and surrounded by lead, which provided a secure setting as well as preventing moisture from getting to the iron pin.⁷¹ Walls were laid with the aid of scaffolding which was probably left up for plastering. Wall openings

⁶⁷ Ibid.

⁶⁸ Rockwell, 153.

⁶⁹ Thurber, 57.

⁷⁰ Ivey, 64. As at Valero, where a report from Fr. Lopez in 1789 states, “In the front, its beautiful facade of sculptured stone has been completed to the same height as the walls...[because of the lack of mission Indians and for other reasons] it cannot now be carried on to completion.” from Habig, *The Alamo Chain of Missions*, 64-65.

⁷¹ Rockwell, 150.

were usually splayed towards the interior, in order to maximize the amount of light entering the opening. According to Carolyn Peterson, the mission's supervising architect, the lintel of the Sacristy window has a conche form carved into the stone, which was later covered by coats of plaster.

The Sacristy window was not mentioned in Morfi's account of 1777, however, he does mention that the Sacristy was being used as a church. Since the blocks were added as the walls went up, this might suggest that the limestone blocks which make up the window surround were not yet carved in their final state. Due to the intricacy of the design, much of the carving and finishing may have been left until the stones were in place. The facade of Orvieto Cathedral in Italy is one example of finishing being executed after placement.⁷² Rockwell suggests that, "Historically, a frequent solution to the fitting problem has been the practice of finishing in place."⁷³ However, due to the erosion of the tooled surfaces, the author found no tooling evidence which would confirm this theory. Morfi may have simply omitted a discussion of the Sacristy window from his description.

The porous tufa walls were plastered and the flat surfaces were ornamented with quatrefoil geometric designs in yellow, red and blue. Ernst Schuchard researched the remaining evidence of these designs on the exterior walls of San José and recreated the designs in an area on the south side of the bell tower in the 1930's. There is no evidence or historical documentation to support that the carved stonework ever received a polychrome finish although this is seen at Mission Concepción.

⁷² Rockwell, 92.

⁷³ Ibid., 152.

CHAPTER 2. RESTORATION AND MAINTENANCE HISTORY

2.1 Decline of Mission San José

While missions had been the key institution for expansion of the frontier under Spain, they began to decline in the late 18th century and their complete collapse occurred under independent Mexico.⁷⁴ Partial secularization of the missions occurred in 1794. In 1821, Mexico achieved its independence from Spain, and money and supplies were no longer being sent to the mission outposts. By 1822, many of the remaining friars were at the point of starvation.⁷⁵ It seems likely that the care and maintenance of the mission was of the little importance and by 1823 San José was in a state of deterioration.⁷⁶ Complete secularization occurred in 1824, and San José ceased to be a mission. Virtually all of the mission's structures, with the exception of the Sacristy, gradually fell into ruin during the latter part of the nineteenth and early part of the twentieth century.

Vandalism to the facade was a primary factor in its deterioration in the 19th century. After the Texas War for Independence, soldiers were periodically quartered at Mission San José. An account written in 1843, by William Bollaert, an Englishman, notes that, "The images of the saints and other ornamental parts had been sadly mutilated by the soldiery during the war."⁷⁷ A traveler's account just two years earlier had indicated that the statues on the facade had not been injured although the Texan troops had long been stationed there, which may indicate that the damage in 1843 was quite recent. The

⁷⁴ Weber, David J. *The Mexican Frontier 1821-1846: The American Southwest Under Mexico*, Albuquerque: University of New Mexico Press, 1982, 43.

⁷⁵ *Ibid.*, 44.

⁷⁶ Ivey, 139.

⁷⁷ Habig, Marion A., *San Antonio's Mission San José: State and National Historic Site 1720-1968*, San Antonio: Naylor Company, 1968, 143.

account adds that the church had recently been repaired and services were being held there.⁷⁸

The statues of the facade continued to be targets throughout the nineteenth century. John Russell Bartlett, a United States commissioner who surveyed the U.S. boundary after 1846 war with Mexico published his *Personal Narrative of Explorations and Incidents* in 1854 and made the following remarks.

The action of the weather has done much to destroy the figures; and the work of ruin has been assisted by the numerous military companies near here, who, finding in the hands and features of the statues convenient marks for rifle and pistol shots.

He adds that, “The most perfect portion of the church is an oval window in the Sacristy, which is surrounded with scrolls and wreathwork of exceeding grace and beauty.”⁷⁹

Bartlett describes this while he is making observations about the condition of the different building features. It is reasonable to conclude that the use of the word “perfect” suggests that the condition of the window was relatively good at this point in time. A book written in 1852 by Cora Montgomery, entitled *Eagle Pass: Life on the Border*, collaborates the accounts regarding the facade statues: “All these figures have been shot at, disfigured and mutilated by parties of Americans, who thus evince their dislike of bigotry by a bigotry still more intense.”⁸⁰ Another account tells that the statues were used for hitching posts and a frightened animal had carried away a head.⁸¹ Vandalism in the form of graffiti, also took its toll on the carved stonework. In 1868, a piece in the *San Antonio*

⁷⁸ Ivey, Vol. 1, 144.

⁷⁹ Bartlett, John Russell. *Personal Narrative of Explorations and Incidents in Texas, Mexico, California, Sonora, and Chihuahua, connected with the US Boundary Commission during the years 1850-53*. New York: D. Appleton & Co., 1856. (c.1854), 43.

⁸⁰ Ivey, Vol.1, 226.

⁸¹ Ibid.

Herald stated, “Everyone who visits this old mission, man or woman, seems to think they are honorably bound to carve their name in large letters for after generations to muse over.”⁸²

Fredrick Law Olmsted traveled to San Antonio in 1854, and recorded his impression in *A Journey Through Texas*. “We have no city, except, perhaps, New Orleans, that can vie, in point of the picturesque interest that attaches to odd and antiquated foreignness, with San Antonio.”⁸³ Of the mission ruins Olmsted writes, “They are in different stages of decay, but all real ruins, beyond any connection with the present - weird remains out of the silent past.”⁸⁴ Olmsted, however, mistakes the composition of the elaboration of the carved stonework at San José stating, “The decorations of the doors and windows may still be examined. They are of stucco, and are rude heads of saints, and moldings, usually without grace...”⁸⁵ Bartlett’s account in 1854 also suggests that the facade is composed of stucco. “The principle doorway is surrounded by elaborate carving, ...The material of this work has the appearance of stone; but we found on examination that it was a hard kind of stucco.”⁸⁶ Olmsted does, however, remark about the stone residences on the outskirts of town. “They are mostly of a creamy white limestone, which is found in abundance near by. It is of a very agreeable shade, readily sawed and cut, sufficiently durable, and can be procured at a moderate cost.”⁸⁷

In 1859, a Benedictine order from Latrobe, Pennsylvania moved into Mission San José and initiated some rebuilding in the Convento, as evidenced by the lancet arches and

⁸² Ibid., 288. From Everett 1975:15

⁸³ Olmsted, *A Journey Through Texas*, New York: Dix, Edwards & Co., 1857, 150.

⁸⁴ Ibid., 155.

⁸⁵ Ibid., 155.

⁸⁶ Bartlett, 42-43.

brick construction. There is, however, no indication that work was carried out on other areas of the church by the Benedictines. The Civil War and other factors, however, weakened the Benedictines' effort and they left Mission San José in 1868. The same year in which the Benedictines left, a part of the north wall of the church collapsed during a storm on December 10th. The wall's strength is said to have been undermined by treasure seekers digging under the wall.⁸⁸ The Sacristy, thus, had to serve as a church again for those who still remained at the mission. The dome of the church, which was left partially unsupported, collapsed on Christmas Day 1874, as midnight Mass was being celebrated in the Sacristy.⁸⁹

The late 19th century brought photographers to San José to capture the mission's picturesque ruins. Photographs taken at the turn of the century reveal that by this time, the statue of St. Anne is gone, head and arms of St. Joachim are gone, and the wooden doors are missing. Photographs from this period also indicate large structural cracks in the facade, that the keystone in the portal is slipping, and vegetation is growing in the nave of the church.⁹⁰ The final blow to the mission's structure came on March 9, 1928, when the south side of the bell tower collapsed. A spokeswoman from the San Antonio Conservation Society told the Express News,

With the falling of the belfry of San José Mission a crisis faces us. Citizens of San Antonio ought to feel that they should long ago have taken concerted action to save our historic, romantic and artistic monuments... May it spur us on to re-double our efforts.⁹¹

⁸⁷ Olmsted, 156.

⁸⁸ Habig, *San Antonio's Mission San José*, 149.

⁸⁹ Ibid.

⁹⁰ Ivey, 287; Photograph owned by SAMA 184/82; See Appendix: Photographic Chronology.

⁹¹ Fisher, Lewis, *Saving San Antonio*, 145; from "San José Tower Ruined," *San Antonio Express*, March 10, 1928.

2.2 Restoration Efforts and Conservation Studies at Mission San José

Some preservation work at San José had begun in the spring of 1902 under the initiative of Adina De Zavala and her chapter of the Daughters of the Republic of Texas. Cracks were repaired in the walls and stones replaced.⁹² It is not known if any work was done specifically to the facade or Sacristy window at this time. However, shoring framework was placed behind front door circa 1905. In addition, vegetation was removed and fences were taken down around grave plots. Donations to the project included lime, sand, and cement from the Alamo Cement Company.⁹³

In 1917, under the direction of Father Hume, the ruins at San José were stabilized and the debris was cleared from the interior of the church. Stone which had fallen from the dome was used to rebuild the collapsed north wall. “Workers used cement to repair the church roof against rain. They also repositioned and secured into place the keystone on the facade which had dropped several inches”.⁹⁴ Modern materials were used in the restoration efforts as evidenced in an article in the *San Antonio Light*. “To attempt to restore or rebuilt the mission as it was a hundred years ago would be impossible, simply because the material is not to be had.”⁹⁵ The Sacristy was reopened for services in 1918. “No other work of importance was done until the collapse of the main tower in March 1928,” wrote Rev. Gilbert. “Of this I can speak from personal experience since the whole

⁹² Fisher, Lewis, *Saving San Antonio*, 47. From “Preservation of Missions,” *San Antonio Daily Express*, February 5, 1902; “Women Will Preserve Missions,” *Sulphur Springs Democrat*, December 12, 1902.

⁹³ Fisher, 47. From “Bill for the Work and Material for repairing St. José Mission, San Antonio, Texas,” in Adina De Zavala Papers, Box 2M164, The Center for American History, The University of Texas at Austin.

⁹⁴ Ivey, Vol. 2, *Administrative History of the San Antonio Missions*, 17; Fisher, *Saving San Antonio*, 80.

⁹⁵ *Ibid.*, 15; From *San Antonio Light*, October 14, 1917

work of restoration was in my hands.”⁹⁶ A wholesale restoration of the entire structure did not occur until the WPA work of the 1930’s.

On March 9, 1928, the bell tower collapsed, which aroused great interest in the preservation of the mission and efforts were made to immediately rebuild. The Sacristy and its window were spared from destruction.⁹⁷ The facade’s carved portal also resisted collapse. Atlee B. Ayers was named chief consultant and he collected measurements, photographs, and drawings to reconstruct the tower.⁹⁸ Fritz Shutte was the contractor in charge of reconstruction. “Schutte used large quantities of steel and concrete, concealed in the thick walls to preclude any danger of future collapse.”⁹⁹ The exterior masonry closely resembles the original walls, however, the reconstructed tower is lower than the original.

In the 1930’s, Robert Leon White, an architecture student at the University of Texas, wrote a master’s thesis on the architecture of San José and made measured drawings of the mission. Work on the mission continued in the thirties. In 1934, under the Federal Civic Works Administration funds were funneled through the Bexar County Board of Welfare and Employment to pay labor costs for rebuilding San José mission walls and for other mission restoration work. When the Civic Works Administration was replaced by the Works Progress Administration the requirements changed, and neither the Conservation Society nor the church could qualify for federally paid workers. An arrangement pioneered by Congressman Maury Maverick in 1935 allowed the work at

⁹⁶ Ibid., 16; Letter from Rev. Gilbert to Erik Reed, Jan. 24, 1949, NPS.

⁹⁷ Ibid., 17.

⁹⁸ Ibid., 17.

⁹⁹ Ibid., 18.

San José to continue. The arrangement permitted the state of Texas, the Catholic Church and the National Park Service to play equal roles in mission work while allowing the Catholic Church to keep title to the church. The National Park Service would help Harvey P. Smith, a local architect in charge of the reconstruction of the mission, with history and archeology. An allotment of \$20,000 to the project by the Texas Centennial Commission helped to complete the restoration of the dome and tower. The Catholic Church renewed its own effort in 1936. The church was re-dedicated on April 18, 1937.¹⁰⁰ Notes from Harvey P. Smith in 1936 gives recognition to those involved in the reconstruction of San José. He writes, “Mr. J.E. Harston, geologist and civil engineer, assisted in locating original quarries of the same stone used by the Padres...”¹⁰¹ HABS drawings and photographs were made in 1936.¹⁰²

In 1947, the First Annual Assessment of Conditions was conducted by Erik Reed, of the National Park Service. Regarding the Sacristy Reed stated,

The roof is in poor condition, and the tops of the walls, forming a parapet around the roof, need some attention. In particular, one of the dips in the parapet, directly above the right or east side of the famous Rose Window, is scarcely higher than the two canales, or drains, of ornamental stone, from the roof through the parapet, at either end of this south wall. Reroofing of the Sacristy and treatment of parapet walls (after raking and repointing), using wire mesh, cement plaster, and asphalt, are needed and are outlined in Mr. Smith’s specifications.”

He indicated this should correct the problem of water damage to the Sacristy window, if the following two conditions were met: the inward tilt of the parapet wall and the slanting

¹⁰⁰ Fisher, 163-166.

¹⁰¹ Smith, Harvey P. “Important Dates and Data of Mission San José, 1936.” S. José Mission-Conservation File. San Antonio Conservation Society Library. The collection of Harvey P. Smith papers held by the NPS were not researched due to time constraints, however, they likely contain valuable information.

¹⁰² Delong, David G. (ed.), *Historic American Buildings, Texas*. Delinated by Zeb Rike. Photographs by Al Stewart. Catalogued as TEX-333.

of flat portions of the roof toward the *canales*. Reed objected to Harvey P. Smith's specifications calling for a flagstone canopy over the Sacristy window for added protection. As an alternative to re-plastering the exterior, he suggested "cement grouting of cracks and holes and application of a spray coat of "colorless exterior waterproofing.""¹⁰³

In 1947, a piece of stone weighing approximately 10 to 12 pounds fell from the stone frieze of the carved facade portal. The Archdiocese noted that the stone throughout the facade was absorbing water causing it to disintegrate and this caused them to take action. Chemical applications were suggested, however, the contractor, Rufus Walker objected until more extensive work was done to the facade. "The corrosion of the mortar has gone too far to allow any successful attempt at water-proofing until the damaged portions have been pointed up.""¹⁰⁴

In 1948, Ernest Lenarduzzi of the Southern Monument Company of Houston, was called in to restore the missing elements of the facade. He used an enlargement from a glass slide taken by H.L. Summerville in 1876, which showed good representations of most of the figures largely intact. The figures were replaced using "Austin Stone" and then waterproofed with an application of Hydrozo®. Before and after photographs were taken in 1947 and 1949. (See Lenarduzzi contract in Appendix I and Chapter 2. Materials Used in Restorations and Maintenance Campaigns for more information.)¹⁰⁵

¹⁰³ Ivey, Vol. 2, 213; Reed's original photographs which accompanied this assessment are intact with captions, as per Ivey.

¹⁰⁴ Letter from Fr. Rihn to Archbishop Lucey, December 23, 1947, ASA.

¹⁰⁵ Contract between Lenarduzzi and Archbishop Lucey for work on facade at Mission San José. March 2, 1948, San José Building File, ASA. The contract doesn't mention that the base of the facade was replaced, however, work was done to it at some point. It is not evident from the before and after pictures of the restoration that a change has occurred. The base may have been replaced in the 1930's restoration.

Lenarduzzi proceeded to work on the Sacristy window and Sacristy doorway into the Covento, the latter which he fully replaced (with the exception of the cornice) and waterproofed. It is likely that waterproofing was also applied at this time to the Sacristy window, although it does not mention it specifically in the contract. An article entitled, "San Jose Lives Again", in the *San Antonio Express Magazine*, indicated the Sacristy window was repointed and waterproofed at the last restoration.¹⁰⁶ All of the reintegration work was completed under the direction of Rufus Walker, who owned a waterproofing company. The contract states that Hydrozo® would be applied with a brush to the facade and that the Sacristy doorway would also be waterproofed.

In the Annual Report for 1949-1950 by the National Park Service, landscape architect, Carl W. Alleman and architect, Erik Reed, noted that the general condition of the mission was "excellent" except for the deterioration of the Sacristy window.¹⁰⁷ Protection of the Sacristy window from tourists and the elements became a large concern at this point in time. A proposal in 1946, suggested that plans be drawn for "an artistic frame with plate glass to be placed over the Rose Window," to shed water.¹⁰⁸ Erik Reed also mentioned that Harvey P. Smith had installed copper flashing above the cornice of the Sacristy window presumably as an alternative to his original proposal for a "flagstone canopy".¹⁰⁹ Around this time, an article in the *San Antonio Express News*, stated that the National Park Board had authorized Harvey P. Smith to submit specifications for a plan

¹⁰⁶ "San José Lives Again." *San Antonio Express Magazine*, April 16, 1950. S. José Rose Window/S. Jose Conservation Files, San Antonio Conservation Society Library.

¹⁰⁷ Ivey, Vol. 2, 308. Annual Report. 1949-1950, NPS.

¹⁰⁸ Ivey, Vol. 2, 422.

¹⁰⁹ Notes from Annual Report. 1949-1950. S. José Rose Window/S. José Conservation Files, San Antonio Conservation Society Library.

to protect the Sacristy window from vandalism and the elements.¹¹⁰ Plantings and a cedar railing were suggested “to keep people away from the window.”¹¹¹

On September 9th 1950, the base of the Sacristy window was revealed under the existing grade. “(A) custodian, while excavating for new landscaping, found the design of the window had been obscured by two feet of dirt and stone.”¹¹² Erik Reed wrote, “For the first time in many years the entire Rose Window is in view.”¹¹³

In a letter dated March 19, 1970, the National Park Service, indicated that there was a large crack in the upper right-hand corner of the Sacristy window.¹¹⁴ General concern for the condition of all the missions lead to the Moody Foundation Grant Request in the early 1970’s which involved many parties and sought to bring in specialists to preserve the missions. Minutes from a meeting July 10, 1973 of the Old Spanish Missions Committee stated that Dow Chemical would be taking samples in August.¹¹⁵ No further documentation of this was found and it is not certain what they would be taking samples of or if this was ever carried out.

Giorgio Torraca, from the International Centre for the Study of the Preservation and Restoration of Cultural Properties (ICCROM) in Rome visited the mission in November 1973. Old Spanish Missions Board Minutes mentioned that samples had been taken back to Rome, however, Torraca’s full report was not located. Excerpts from Torraca’s report in Ivey et al. (1993) stated that “the high moisture content of the stone

¹¹⁰ From “Face Lifting at San José Mission Awaits Approval.” *San Antonio Express News*, date missing. San José Rose Window/San José Conservation File. San Antonio Conservation Society Library.

¹¹¹ Ivey, Vol. 2, 308; Minutes, March 17, 1950. San Antonio Conservation Society.

¹¹² Ivey, Vol. 2, 308; Newspaper and date unknown.

¹¹³ Ivey, Vol. 2, 308; Annual Report, 1950-1951, NPS.

¹¹⁴ Moody Grant Proposal Files, ASA

¹¹⁵ San Jose Building Files, ASA

masonry” was the most serious conservation problem at the mission, and that in many places the masonry was almost saturated to a height of 6-10 feet above ground level:

The deterioration processes of wall paints and plasters, salt efflorescence and occasional stone decay appear to be a direct consequence of the humidity problem... Restorations carried out in more recent times have frequently made the problem worse by use of cement plasters that retard moisture evaporation.¹¹⁶

Torraca continued that there was no drainage system around the walls of the mission and there was no place for the water to go. He also assigned a possible cause of deterioration to the presence of soluble salts in the wall moisture, evident in white efflorescence. Other problem included: the existence of an impermeable sub-soil layer, roof leaks, faulty roof drains and gutters, and condensation.¹¹⁷

Condensation takes part in the process of moisture accumulation but we must consider that it may be favored by the penetration of water from the ground. In fact water sucked through the soil not only increases the thermal conductivity of the masonry but also brings to the affected surfaces hygroscopic salts that favor the formation of a superficial water layer when the relative humidity of the air is high.¹¹⁸

It is not known whether or not Torraca’s recommendation to install moisture monitoring devices, record climate data, evaluate the building stone’s porosity, and perform analysis on the soluble salts were ever carried out. No documentation of this was found. Measures such as fixing roof drains, gutters and *canales* was addressed by the work Ford Powell & Carson did in the 1980’s. A preservation program was outlined by John W. Henneberger, NPS Associate Regional Director, based on Torraca’s recommendations, however, it is not certain how extensive this work was. One of the

¹¹⁶ Quoted in Ivey, 349-350; Torraca, Giorgio, “Visit to the Old Spanish Missions, San Antonio, Texas, November 12-15, 1973, ICCROM.

¹¹⁷ Ibid.

points in his plan was that ground photogrammetry of elevations should be done to provide highly accurate drawings and a basis by which to measure deterioration. This work pended funding from Old Spanish Missions and the Moody Grant if money was available. In addition, reference was made to the National Park Service funding tests for soluble salts, biological growth and chemical composition of building materials. However, there is no documentation that this work was ever carried out.

In 1977, Raba & Associates performed soil testing. The results of these tests indicated there was “minimal to non-existent surface drainage” at the mission. The report also noted that there was a “permanent groundwater condition” at San José.¹¹⁹ In a study conducted by the Soil Conservation Service and the National Park Service it was found that, “at the mission sites, water moves down easily through the permeable fine sandy loam surface soil but is trapped by the clayey subsoil. The trapped water lies against the limestone walls and slowly seeps through.”¹²⁰

The work that was carried out in the 1970’s and 1980’s under the Moody Grant was directed by architecture firm of Ford Powell & Carson in San Antonio. In a letter written by Killis Almond of Ford Powell & Carson to Monsignor Graham on February 19, 1975, Almond outlined the basic problems regarding roof repairs. In this report, it is noted that the parapet walls along the Sacristy had no waterproofing along their top edge, which had allowed water to enter the stone, helping to deteriorate the plaster and masonry work.¹²¹ In a letter signed by Killis Almond of Ford Powell & Carson to Monsignor Grahmann on

¹¹⁸ Ibid.

¹¹⁹ Ivey, Vol. 2, 350; Lewis, David A., et al. *Final Report, Geotechnical, Foundation and Soil Moisture Investigation at San Jose State Historic Site, San Antonio, Texas*. San Antonio: Raba & Associates, 1977.

March 26, 1975, Almond recommended to the Archdiocese that they go ahead with a proposal for the exterior walls and parapets of the Sacristy. This work included 1) cleaning all surfaces as designated by Ford Powell & Carson with hydroblaster and 2) watersealing same surface with two applications of Chem-StopWatersealant ®. The contract for this work was carried out and a check for the total contract amount of \$875 was dated June 11, 1975.¹²² This raises questions as to whether the Sacristy window was protected from the hydroblaster, which utilizes water under high pressure to clean masonry, or was treated like the rest of the Sacristy walls. (See Materials Used in Restorations and Maintenance Campaigns)

The observations of Torraca led to a study by Alvin Meyer & Kirk Brown, of the Engineering School at Texas A&M University in 1976. They conducted a study into the deterioration factors affecting the plaster in the Sacristy. Blisters were destroying the plaster and were attributed to water and the dissolved mineral salts. To determine the source of water, samples were taken at different heights in the walls and salt concentrations were measured. They concluded that water could be entering the Sacristy from all three directions, including 1) the foundations 2) the roof and 3) through the horizontal action of rain.¹²³

In 1977, Carolyn Peterson of Ford Powell & Carson made observations and recommendations regarding the leaks in the roof which were causing stains and cracks in the plaster. She noted that there was a cementitious finish on the spherical dome and

¹²⁰ Ivey, Vol. 2, 351, (Willard, Elvin L., "Soil Information Used to Preserve Historic Missions", *Soil and Water Conservation News*, June 1981.)

¹²¹ Archdiocese of San Antonio Archives, Mission San José Building Files.

¹²² Ibid.

¹²³ Meyer and Brown Study, Archdiocese of San Antonio Archives, Mission San José Building Files.

asphaltic material on the other roof surfaces which appeared to be deteriorating. The pendentives of the domes required water-proofing and flashing was needed at the intersection of the nave roof and dome.¹²⁴ The leaks in the dome do not relate directly to the deterioration of the carved stonework, however, it is worth noting that there has been water infiltration into the building other than from the ground. The system of domes, *canales*, and parapets on the Sacristy are more directly related to the deterioration of the Sacristy window.

In 1979, David Battle, Historical Architect, for the National Park Service wrote a preliminary draft of the conservation issues at Mission San José. Battle had sought the advice of Giorgio Torracca, six years earlier. Battle stated the primary problems with Mission San José are the slope of the grade, ground water, rising damp and plaster deterioration in the Sacristy. Regarding the church, he identified a problem with efflorescence inside the nave, which he attributed to rising damp, carrying salts which then crystallize at the interface between the wet and dry areas of the wall. Problems were also attributed to ground water, a high water table or high ambient humidity inside the church. He also noted that the stone *canales*, which function as gutters, had been attacked by biological growth, but still functioned. He also noted that an internal roof drain had been installed but failed in some places, contributing to a localized moisture problem.

Battle also described the deterioration of the stone walls. Since the church is constructed of a porous tufa, and no longer has the exterior plaster on its walls, water can easily enter the walls. Rain water can be blown back onto the walls from the *canales*,

¹²⁴ Archdiocese of San Antonio Archives, Mission San José Building Files.

especially in areas where they have been destroyed or are not functioning properly. The tufa also provides a ready repository for biological growth, whose growth can contribute to the break down of the lime in the mortar and the stone. Battle also noted “considerable deterioration of the fine stone carving” of the facade and Sacristy window.¹²⁵

In 1980, the question was addressed regarding acid rain as a contributing factor to the deterioration of the facade at Mission Concepción which is worth mentioning. City Public Service claimed that the effects of acid rain were negligible and that the near by power plants used “low sulphur coal”. Marlys Bush Thurber, an architect with the National Park Service, named other possible causes for the damage without ruling out acid rainfall.¹²⁶ The problems with the facade at Concepción were linked rather to the fact that the stone was face bedded, which allowed water to enter in between the layers of sediment, causing the stone to delaminate. Documentation of the carving and then complete replacement of the stone was suggested as part of the work carried out under the Moody Grant.¹²⁷ This work on the facade at Concepción does not appear to have been carried out.

In the early 1980’s, Carolyn Peterson, of Ford Powell & Carson, conducted a moisture study of the walls in the Sacristy to determine if moisture levels were satisfactory before replastering proceeded in the interior of the Sacristy. The Moody Grant request mentions this was also done in order to determine if the correction of roof leaks had been effective. There was an acceptable moisture level, so in 1981 the

¹²⁵ Preliminary Report, David Battle, National Park Service Archives, San Antonio Missions National Historical Park. 1979

¹²⁶ Ivey, Volume 2, 353.

¹²⁷ Moody Grant Proposal Files, ASA

replastering job proceeded.¹²⁸ The replastering of the Sacristy was viewed by David Battle, of the National Park Service, as a remedy to the effect rather than the cause and he predicted it would fail within a few years.¹²⁹ His prediction has proved to be true. As of the summer of 1997, blistering plaster and white efflorescence can be observed in the interior of the south wall of the Sacristy and baptismal font.



Figure 9. Blistering plaster and efflorescence on the interior of the south wall of the Sacristy. (Same wall as Sacristy window.) Photographed by Katherine McDowell, June 1997.

In 1981, a study was conducted by Todd E. Rutenbeck, a structural engineer from the Western Archeological and Conservation Center. Rutenbeck began monitoring a crack in the upper right corner of the Sacristy window to determine if there was any structural movement. After a period of consistent monitoring, it was determined that

¹²⁸ Moody Grant Request, Archdiocese of San Antonio Archives; Meeting with Carolyn Peterson, Ford Powell & Carson, October 1996.

¹²⁹ Battle, 1979, 7.

there was an insignificant amount of movement. He recommended regular inspection of the gauge.¹³⁰ This monitoring gauge is still present in the interior of the window but it is not being actively checked at this time.

Work specified under Phase Two of the Moody Grant Funds noted that the walls of the Sacristy had suffered from improper pointing of mortar joints. The proposal suggested that the cement mortar should be carefully removed and replaced with softer, more compatible material.¹³¹ This work is indicated by the tan colored lime mortar used in repointing the walls by Ford Powell & Carson.¹³² The proposal also mentions that the upper part of the Sacristy window had settled and appeared to be partially supported by the decorative iron grill. This situation may have been caused by water entering at the roof and parapet, a problem that was addressed in Phase I of the Moody grant. Two cracks in the Sacristy window, one on each side, were grouted and compensated with a mortar of a similar color to the stone. The mix of this mortar was not mentioned by the architect and specifications were not available.¹³³ Work to the Sacristy window by Ford Powell & Carson also included the insertion of two steel columns, or shoring, in the wall of the Sacristy at either side of the window to reinforce the stone lintel which appeared to be slumping.¹³⁴ This work was undertaken while the replastering job was in progress. Carolyn Peterson stated that construction drawings or documentation of this work does not exist because it was not decided upon until the plaster was removed from the Sacristy.

¹³⁰ Ivey, Vol. 2, 354.

¹³¹ Moody Proposal Phase II, Archdiocese of San Antonio Archives; Ivey, Volume 2, 450-454.

¹³² Notes from meeting with Carolyn Peterson, Ford Powell & Carson, October 15, 1996.

¹³³ Ibid.

¹³⁴ Ibid

Work on the Sacristy also included replacing of the roof, replastering the tops of the parapets and the buttresses, and lining the *canales* with copper. At the same time a plaster seal was also established at the top of the molding above the carved facade.¹³⁵ In 1982, the Sacristy was re-opened after re-plastering job. The total amount spent for this phase of the Moody grant totaled \$250,000. Of this, \$14,000 was dedicated to the stabilization of the Sacristy window.¹³⁶



*Figure 10 . Roof of Sacristy circa 1981 showing recently completed work under the Moody Grant.*¹³⁷

¹³⁵ Moody Grant Proposal photographs

¹³⁶ Moody Grant Proposal File, ASA

¹³⁷ Moody Grant Proposal File, ASA.

In 1988, work to the Sacristy window continued with Phase IV of the Moody Grant under the direction of Ford Powell & Carson. The scope of work included the installation of security bars on the existing steel shoring of the Sacristy window. The specifications included “anchoring loose masonry and installation of mortar in fissures” which may suggest a campaign of repointing or compensation of losses in areas of the base. (See 2.3 Materials Used in Interventions for more information regarding this campaign.)

2.2.1 Chronological Overview of Major and Minor Interventions related to the Carved Stonework at Mission San Jose y San Miguel de Aguayo

| | |
|-------------|---|
| 1859 | Benedictines renovate Convento |
| 1868 | North wall of Sacristy collapses |
| 1874 | Dome collapses |
| 1902 | Adina DeZavala and the DRT clear debris |
| 1917 | Father Hume, stabilization and partial rebuilding of north wall |
| 1918 | Sacristy reopened |
| 1928 | Bell tower collapses and is rebuilt the same year. |
| 1930 | Albert Steves replaces wrought iron bar which he took from the Sacristy window as a child in 1880. The presence of this bar may be helpful in dating photographs. Robert Leon White, master's thesis and measured drawings. |
| 1936 | WPA starts work on church. HABS drawings |
| 1937 | Mission was re-dedicated after work by WPA |
| 1938 | A replica of the Rose Window was sculpted by H. Pianta and sent to St. Anne's Catholic Church in Beaumont, Texas. (A replica of S. Jose exists in Waco.) A cast of the Sacristy window is still in the possession of the NPS and is in storage. |
| 1946 | First Annual Assessment of Conditions by Erik Reed, NPS. |
| 1948 | E. Lenarduzzi restoration of the facade, Sacristy window and doorway between Sacristy and Convento. Waterproofing with Hydrozo®. |
| 1956 | Water proofing of exterior by Harvey P. Smith |
| 1968 | Silicone waterproofing of exterior walls and dome by Kunz Construction Company |
| 1970 | Air-conditioning system installed by Mission Plumbing and Heating in the choir loft. |

| | |
|-------------|---|
| 1975 | Neogard Corporation installs a 1" urethane roof on the nave of the church Bentley Sheet Metal and Roofing Co. Inc. repaired the nave roof Hydroblaster used on Sacristy walls and waterproofed with two applications of Chem-Stop Watersealant ®. |
| 1981 | Sacristy interior replastered Steel shoring inserted to support slumping keystone in Sacristy window. Parapets and <i>canales</i> fixed on Sacristy Repointing of Sacristy walls and grouting and repointing of two cracks in Sacristy window. |
| 1988 | Securing of security bars on steel shoring |

2.3 Materials used in Restoration and Maintenance Campaigns

2.3.1 Austin Stone

The contract between Lenarduzzi and Archbishop Lucey for the restoration of the facade statues states that, “only select Austin Stone” would be used. Ethyl Harris and E. Lenarduzzi went to Austin to personally pick out the stone that was to be used.¹³⁸ Austin Stone refers to a local facies of the cream-colored and relatively soft limestone of the Walnut Formation in Travis and Williamson Counties. This Formation yields two types of dimensional stone. The fine- to medium- grained facies was originally marketed as Austin Stone but is now termed Cordova Cream. The other highly fossiliferous facies is marketed as Cordova Shell. These two facies are unique to the Walnut Formation in Travis and Williamson Counties and no similar stone has been found in other parts of the state.¹³⁹ This Formation is worked by Texas Quarries which opened in 1929.¹⁴⁰ Austin Stone (Cordova Cream) is an oolitic limestone from the Cretaceous Era, Walnut Formation. Oolitic limestones are composed of small rounded grains of calcium carbonate, precipitated in concentric laminates around a nucleus piece of calcium carbonate or silica.¹⁴¹ The contract for the replacement of the decomposed Sacristy doorway states that a new doorway will be carved out of the “approved Austin limestone”, which may also refer to Austin Stone.

Austin Stone may also have been used as a generic term to describe the chalky, white stone obtained from quarries in Austin, without specifically referring to stone from

¹³⁸ Lenarduzzi File, San Antonio Missions National Historical Park.

¹³⁹ Garner, Edwin L. *The Dimensional Stone Industry of Texas*, Mineral Resource Circular No. 84, Austin, Texas: Bureau of Economy Geology, University of Texas, 1992.

¹⁴⁰ Barnes, *Building Stones of Central Texas*, 169-170.

a specific quarry. The author is not certain what other quarries may have been competing with Texas Quarries in the 1940's. Texas Quarries, however, is the only commercial limestone quarry mentioned in *Building Stones of Central Texas*, which was written in 1945 and published in 1947, one year before the restoration. If the stone used in the reintegration project requires further examination, the arm of St. Joachim, the figure to the left of the doorway, which was replaced in 1948 and has since fallen (currently in storage at the Archdiocese) could be petrographically examined for confirmation.

2.3.2 Mortars

No documentation on the repointing mortars or composite patches was found, with the exception of the last campaign in 1988. Lenarduzzi's work on the Sacristy window included the "removal of the unsightly cement mortar around the borders of the window to be followed by the insertion of a mortar that will blend with the walls." However, he does not describe the mortar mix he used for repointing. (See Chapter 4. Mortar Analysis and Conditions Survey-Previous Repairs for more information on the various repointing and compensation campaigns.)

The mortar used in securing the security bars (grill) to the steel shoring followed these specifications: "Use of limestone aggregates to match color of existing stone. Hydrated lime: ASTM C207 Type S. Sand: ASTM C144; 1 pt. lime, 1 pt. limestone screening, 3 pts. sand."¹⁴² The acid soluble portion of this mortar would be approximately 40% by volume. The mortar analysis (in Chapter 4) performed by the author on the mortar from the base of the window had an acid soluble content of 58.47% by weight. The 1988

¹⁴¹ Boyton, *Chemistry and Technology of Lime and Limestone*.

¹⁴² Specifications from Bexar County Historical Foundation. In folder, Fr. David Garcia's Office- Missions (OSM) 1988. ASA.

specifications are probably based on parts by volume and the analysis is based on parts by weight. The aggregate from the mortar that was analyzed had a density of 1.4 g/ml, while a Type S hydrated lime has a density of approximately 0.5 g/ml. It would take more lime than sand to make up weight. Therefore, based on this data, the repair campaign at the base, which is discussed more in Chapter 4 can not be directly compared to the work done in 1988, although the visual character of the mortars are similar. The work at the base may have been done as an after thought by masons working on the project because this type of work was not mentioned in the specifications or other documentation.

2.3.3 Water Repellents

The application of water repellents has been the primary defense utilized in the protection of this stone since the 1940's. Over the years, several products of varying chemical composition have been proposed and used as coatings on the wall surfaces of the Sacristy and decorative carving. These include: Hydrozo ®, 1948; waterproofing product, not specified, 1956; silicone, 1968; and Chem-Stop Watersealant ®, 1975.

In 1948, Lenarduzzi waterproofed the facade, Sacristy window (likely) and doorway with Hydrozo ®, which was applied by hand with a brush. Hydrozo ® is a penetrating coating which does not contain silicones, but rather is formulated of a synthetic resin gum which will remain active and will not crystallize, but will continue to work into the subsurface.¹⁴³ Today, Hydrozo Clear ® is a mixture of silanes and siloxanes depending on the exact mix needed. The exact composition of Hydrozo in the 1940s was not found. In 1956, the exterior of the church was water proofed with an unspecified product. The

¹⁴³ Hydrozo product literature (Date unknown). Passes ASTM submersion test with a repellency of 98%. Water Vapor Transmission rate of 5.7 grams per 24 hours on a 100 sq. in. surface. Coating is resistant to acids, alkali, salt brine, moisture and sunlight.

contract for the job was signed by Harvey P. Smith.¹⁴⁴ It is not known if this application included the carved stonework.

In the Annual Report for 1966-1967 by the National Park Service, historical architect Thomas Russell Jones suggested using a test application of Pencapsula to protect “the rose window, which was again suffering the effects of exposure and age.”¹⁴⁵ Pencapsula is a polyurethane that was experimented with at Fort Union National Monument in the 1960’s.¹⁴⁶ It is unknown if this was pursued since no documentation has been found which would support it.

In 1968, a “silicone” was sprayed on the exterior walls and dome by Kunz Construction Co., Inc. The treatment was expected to last 3 to 5 years. Re-pointing of the mortar joints was done as necessary. Work was completed April 24th, 1968 for a total sum of \$2,346.¹⁴⁷ The specific type of silicone or brand name was not specified. It is likely that waterproofing was not limited to just the calcareous tufa, but was sprayed on all the walls, including the Sacristy window and the facade portal. Silicones typically render the substrate water repellent, but not water-proof. Therefore, water vapor can thus still escape from inside the pores of the stone.

In a letter signed by Killis Almond of Ford Powell & Carson to Monsignor Grahmann on March 26, 1975, Almond recommended to the Archdiocese that they go ahead with a proposal for treating the exterior walls and parapets of the Sacristy. This work included 1) cleaning all surfaces as designated by Ford Powell & Carson with hydroblaster and 2) watersealing same surface with two applications of Chem-Stop® Watersealant. The

¹⁴⁴ San José Mission, Building files, Archdiocese of San Antonio Archives

¹⁴⁵ Ivey, Vol.2, 320, Annual Report 1966-1967, NPS.

¹⁴⁶ Weiss, Norman. “Chemical Treatments for Masonry: An American History.” APT Bulletin, 13.

contract for this work was carried out and a check for the total contract amount of \$875 was dated June 11, 1975.¹⁴⁸ This raises questions as to whether the Sacristy window was protected from the hydroblaster, which uses water under high pressure to clean masonry, or was treated like the rest of the Sacristy walls. The use of a hydroblaster on tufaceous walls and the softer fine grained limestone would allow for large amounts of water to get into the porous stones and abrasion of the surface which may have resulted in the pitting observed in the Sacristy window. Chem-Stop Watersealant® is a non-breathable, modified sterate/acrylic based water repellent. This type of product is a film former and is known to entrap moisture within limestone.¹⁴⁹ The service life of this product is low and is very likely no longer present on the surface, however, if it was applied to the carved stonework, it may have been a contributing factor which aided in the deterioration of the stone by trapping water vapor within the pores of the stone.

¹⁴⁷ San José Mission, Building File (1961-1971), ASA

¹⁴⁸ Ibid.

¹⁴⁹ SWRI Clear Water Repellent Handbook; Hüls America technical support, John Slazyk

PART II. CASE STUDY: THE SACRISTY WINDOW OF MISSION SAN JOSÉ

3.0 Introduction to Case Study

3.0.1 Methodology

The focused research into the past and present condition of the Sacristy window at Mission San José involved several elements. The historical research was aided by Jake Ivey et al., *Architectural and Administrative History of the San Antonio Missions* (1990, 1993). Additional research of maintenance and photographic records was performed by the author on four visits to San Antonio, in August, October, December-January, and June during the 1996-1997 academic year. This included searching primary records at the National Park Service, the Archdiocese of San Antonio, and other libraries in San Antonio, as well as, meeting with the site's supervising architect at Ford Powell & Carson. Historical research was coupled with on-site investigations, which included a conditions survey, photo documentation, site analysis, and sampling. Quantitative and qualitative analysis was performed in the Architectural Conservation Laboratory and the Laboratory for Research on the Structure of Matter at the University of Pennsylvania, utilizing several techniques to characterize the stone, including gravimetric analysis, optical microscopy, thin section petrography, x-ray diffraction, energy dispersive spectroscopy, and scanning electron microscopy.

3.0.2 Sampling

Due to the importance of the original building fabric, it was not possible to take a large or even a representative number of samples from the Sacristy window. Sampling, analysis, and characterization was guided by an emphasis on field diagnostics based on a detailed conditions survey and documentation of past conditions and treatments and present conditions. Samples of the stone and repair mortars were taken from the Sacristy window on a site visit to the mission in October of 1996, with the permission of Father Balty Janachek, of the Archdiocese of San Antonio.

The primary sample (SW01, *Figure 11*) of stone was obtained from an area of delamination and black biological growth at the upper right side of the window. The sample was removed with a chisel and measured approximately 1 cm square. The white and tan areas represent interior surfaces; the black coated surfaces represent the side and top, while the appearance of green biological growth marks the back surface. This sample was taken from an area that was delaminating and it appears that the back surface had already begun to separate from the stone behind it. Biological growth was visible in this small fracture. The sample separated easily from the stone supporting it with one blow of the hammer and chisel. This sample (SW01, *Figure 11*) was used for thin section petrography, scanning electron microscopy (SEM) examination, and energy dispersive spectroscopy (EDS) analysis.

The second sample (SW02, *Figure 11*) obtained was a small piece, measuring approximately 1 x 1.5 cm, which was delaminating from the base of the window in an

area that was exhibiting delamination and flaking. This sample was divided for x-ray diffraction (XRD) and a confirmation chemical spot test for soluble salts.

Several small samples were taken from the base of the window which had already fallen to the ground as active delamination. The stone appears to be the same stone which composes the window due to its color and the fossil inclusions. These samples were weathered to the extent that it could not be determined which face represented an exterior surface and which part of the window they came from. It is likely that they all came from the base of the Sacristy window due to the high degree of deterioration and the similarity of the stone. The largest sample (SW03, *Figure 11*) was used to determine water absorption and weighs approximately 20 grams. Two smaller samples (SW04, *Figure 11*) were utilized for determining acid soluble fraction of the stone. Another sample was used for thin section petrographic analysis, SEM, and EDS (SW05, *Figure 11*). Soluble salts were also brushed from an area of visible efflorescence (SW06, *Figure 11*).

One large piece of a hard buff mortar was taken which had fallen from the lower right side of the window (SW07, *Figure 11*). Due to the hardness of this mortar, it had not experienced erosion and it was easy to determine the original location of the piece. The mortar has a smooth texture and shows evidence of being work by a trowel. The mortar is in good condition, with the exception of multiple hairline cracks, and appears to be much harder than the stone. The repairs which utilized this mortar, occurred sometime after 1950, when the base of the Sacristy window was excavated from the rising grade level. Due to the friability of the stone and the hardness of the mortar, it was not feasible to take more mortar samples without causing damage to the stone. This sample (SW07,

Figure 11), was used for gravimetric analysis of the mortar's overall composition and to determine the presence of soluble salts within the mortar.

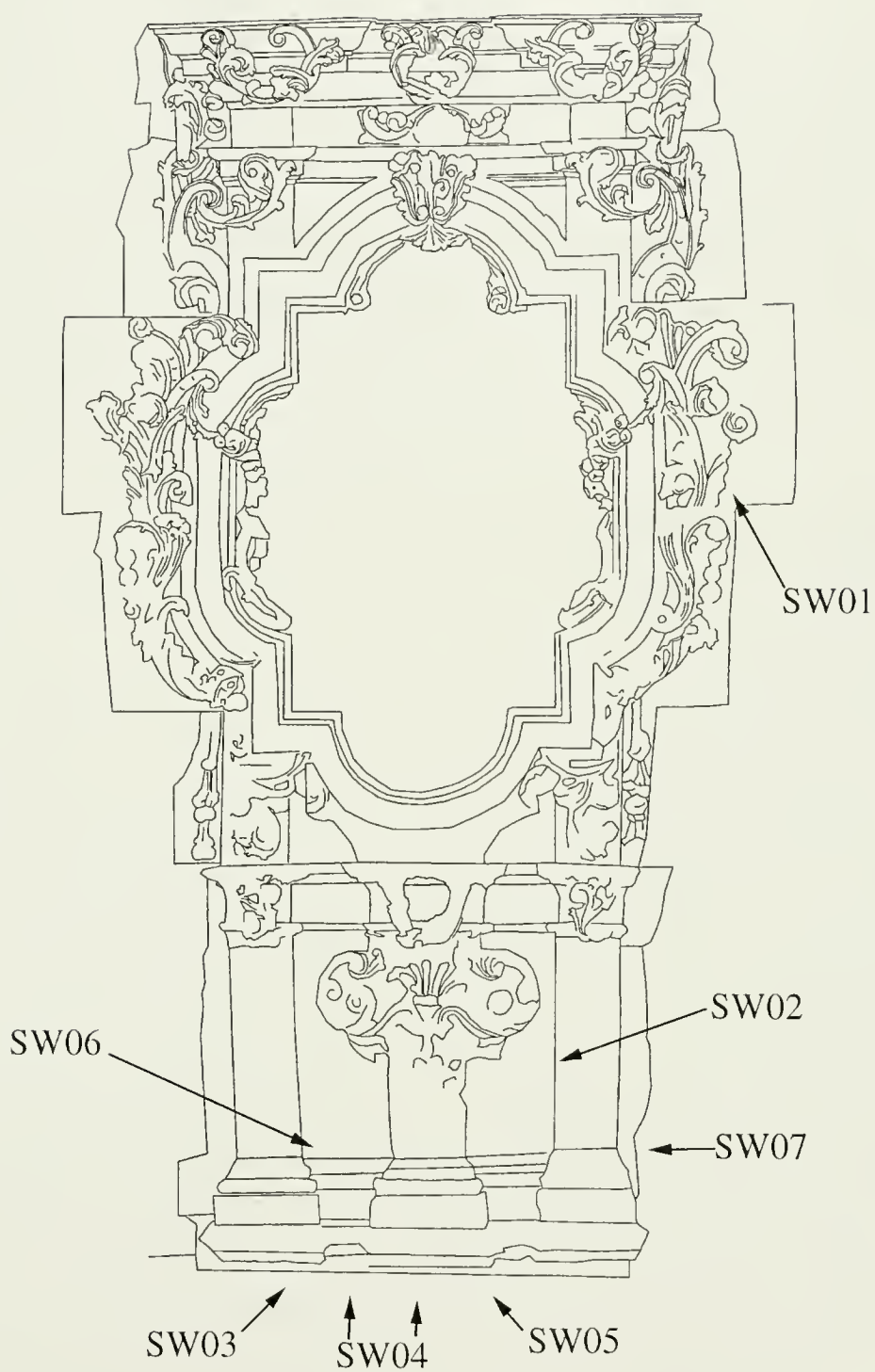


Figure 11. Diagram of Sample Locations. Arrow indicates where samples were taken.

CHAPTER 3. CHARACTERIZATION OF THE STONE

3.1 Characterization of the Stone

The stone samples taken from the Sacristy window at San José y San Miguel de Aguayo were characterized in order to identify general mineralogical composition, to ascertain physical and mechanical properties, and to gain an understanding of the deterioration mechanisms affecting the stone as evidenced in the documentation of the conditions over time.

3.1.1 Macroscopic Physical Description

The stone which composes the Sacristy window can be described as a soft white (Munsell 2.5Y/8/2) to yellow (Munsell 2.5Y/7/6) colored limestone. Some blocks have a rich buff colored surface which in some cases displays flaking, revealing a bright white stone beneath. Some areas show yellow staining which is possibly an alteration of the pyrites in the stone. Fossil skeletons are visible at the surface of some of the stone blocks. These “fossiliferous shells are more resistant to dissolution than the secondary fibrous and looser calcite grain cement”...and thus stand proud of the surrounding surface matrix.¹⁵⁰ The surface varies widely from smooth surfaces; to vermiculated, eroded surfaces; to chalky, disaggregating surfaces. The stones in the bottom third of the window contain more fossils and therefore have a more irregular surface. The window is composed of at least sixteen blocks of limestone, laid in both vertical or horizontal orientation, with joints of varying size from 1/8” to 3/4”. The conditions survey in Chapter 4 elaborates on the surface conditions of the blocks in greater detail.

¹⁵⁰ Winkler, *Stone in Architecture*, 20.

3.1.2 Mineralogical Composition

Two samples (SW01/SW05) were cut into thin sections in order to perform petrographic analysis of the stone.¹⁵¹ Thin section petrography was used to characterize the mineralogical and textural features of the stone, to determine modes of decay and their possible relation to particular mineralogical components, to identify susceptibility to weathering, and to determine the degree and depth of deterioration.¹⁵²

The stone examined is a limestone which was formed through the sedimentation of calcium rich organisms in waters 66 million years ago. The mineralogical content of the stone is principally calcite. Calcite is relatively soft, having a hardness of 3 on the Mohs Hardness Scale. Iron is present in the sections examined which can be attributed to pyrite or limonite. Glauconite grains also appear sporadically throughout the sections examined.

The analysis revealed that two types of micro-fabrics exist within the limestone sections that were examined. One is fine-grained, loosely cemented and white to yellow in color (Munsell 2.5Y/8/2 - 2.5Y/7/6). This fine-grained material contains many voids, especially in areas within the skeletal remains of fossil inclusions. The other material is a more compact, coarser grained limestone bound in a more opaque, well-cemented matrix. This micro-fabric may be linked to the more iron rich patination at the stone's surface. This material contains different kinds and sizes of fossils. A visible boundary exists between these two micro-fabrics (*Figure 12*).

¹⁵¹ the thin sections were not stained to test for calcite versus dolomite.

¹⁵² With the assistance of Dr. G. Omar in the Geology Department at the University of Pennsylvania.

The fine-grained material is easily eroded and prone to disintegration (*Figure 13*), while the coarser grained material is well cemented and shows little sign of decay (*Figure 14*). The stone is very heterogeneous in composition and therefore subject to differential erosion. The mineralogical composition of the stone is therefore an important factor in its decay. The surface of the stone reveals the differential weathering of the stone (*See Chapter 4-Conditions Survey*). Skeletal remains and vermiculation can be seen on the surface where the finer-grained material has easily eroded away, leaving the well-cemented matrix and calcareous skeletons behind. The calcium carbonate within the fossil shells was protected from being compacted during sedimentation, and is therefore not as well cemented as the areas which lay outside of these large fossils (*Figure 15*).

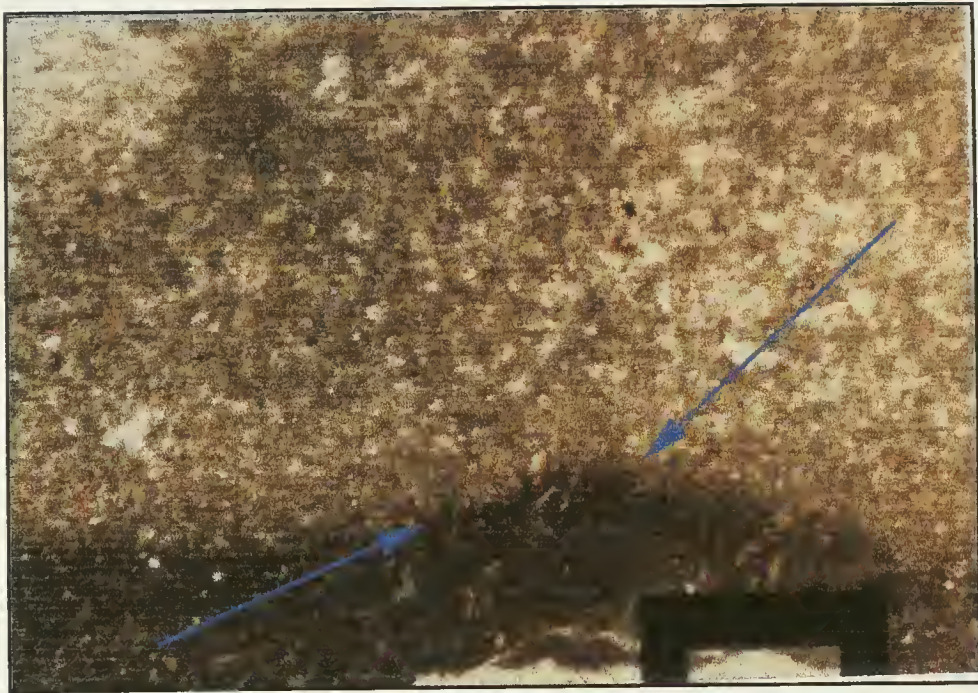


Figure 12. Thin section of SW01 showing the heterogeneous character of the limestone. A boundary exists between the fine-grained and coarse-grained, well-cemented brown matrix. Magnified 25x, Plane polarized light.

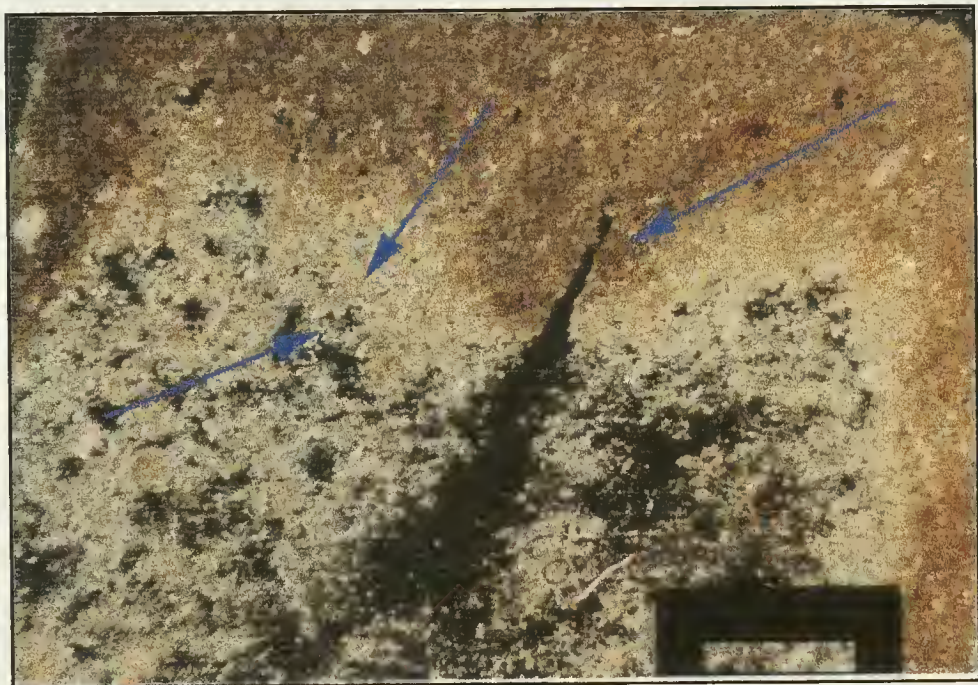


Figure 13. Thin section of SW01 showing the fine-grained and disintegrating matrix. Magnified 25x, Crossed polarized light.

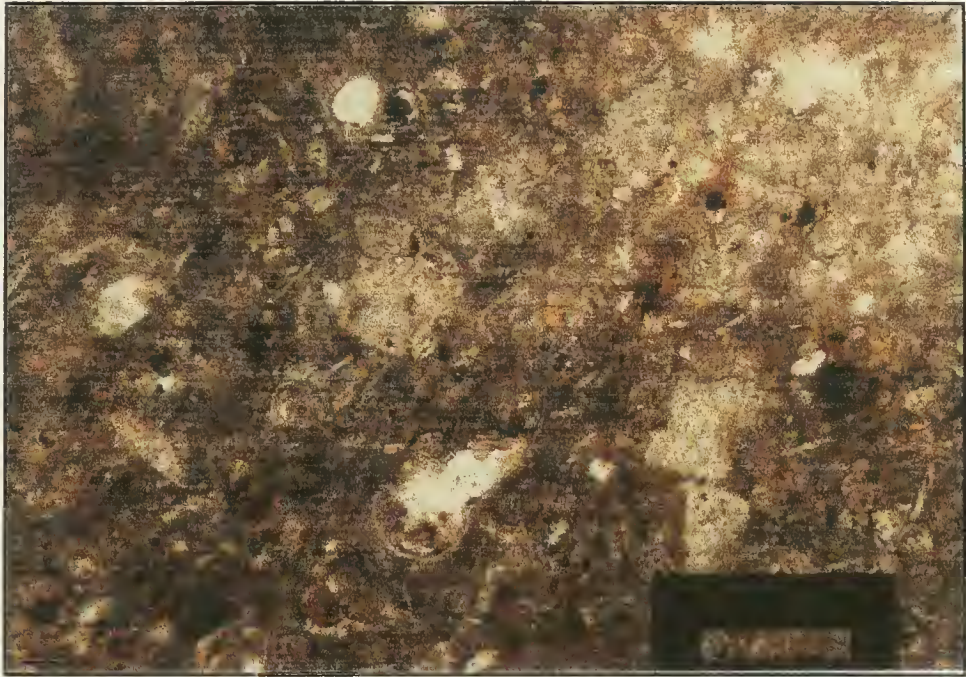


Figure 14. Thin section of SW01 showing the fossils in coarse-grained, well-cemented, more opaque matrix. Magnified 25x, Plane polarized light.

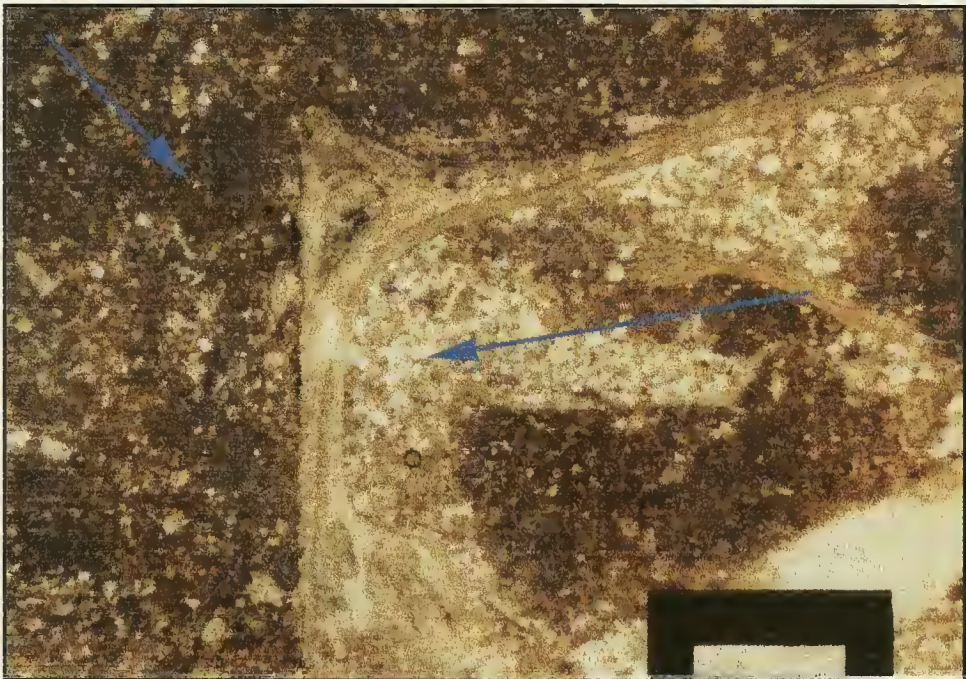


Figure 15. Thin section of SW05 showing the fine-grained material within the fossil and the well-cemented, more opaque matrix outside the fossil. Magnified 25x, Plane polarized light.

The limestone can be classified as a chalk because of its fine-grained texture and the multitude of microfossils, which require a high magnification in order to view (*Figure 16*). The limestone can also be classified as a biomicrite: a micrite matrix with skeletal grains forming the allochems. Micrite is defined as microcrystalline calcite with a grain size usually less than 4µm. Allochems are defined as particles or grains which in this case are composed of skeletal particles, or bioclasts, and are the remains, complete or fragmented, of the hard parts of carbonate secreting organisms.¹⁵³ The limestone may also be described as fossiliferous because of the great number of these skeletal particles.

3.1.2. 1 Chalk

Chalk is a soft, fine-grained fossiliferous form of calcium carbonate, varying widely in color, hardness, and purity.¹⁵⁴ Chalk is formed mainly from the shells of floating micro-organisms.¹⁵⁵ Austin Chalk in the vicinity of San Antonio is defined by the University of Texas, Bureau of Economic Geology as:

chalk and marl; chalk mostly microgranular calcite with minor foraminifera tests and *Inoceramus* prisms, averages about 85% calcium carbonate, ledge forming, grayish white to white; alternates with marl, bentonitic seams locally, recessive, medium gray, sparsely glauconitic, pyrite nodules in part weathered to limonite common, occasional beds with large-scale cross-stratification; locally highly fossiliferous; thickness 350-580 feet, thickens westward.¹⁵⁶

The analysis thus confirms that the stone in the Sacristy window is consistent with the Austin chalk Formation in San Antonio.

¹⁵³ Adams and MacKenzie, *Atlas of Sedimentary Rocks Under the Microscope*, 39.

¹⁵⁴ Boynton, Robert S., *Chemistry and Technology of Lime and Limestone*, New York: John Wiley & Sons, 1980, 9.

¹⁵⁵ Spearing, *Roadside Geology of Texas*, 398.

¹⁵⁶ San Antonio Sheet, *Geologic Atlas of Texas*, Bureau of Economic Geology, University of Texas, 1983.



Figure 16. Thin section of SW05 showing the presence of microfossils. Magnified 100x, Plane polarized light.

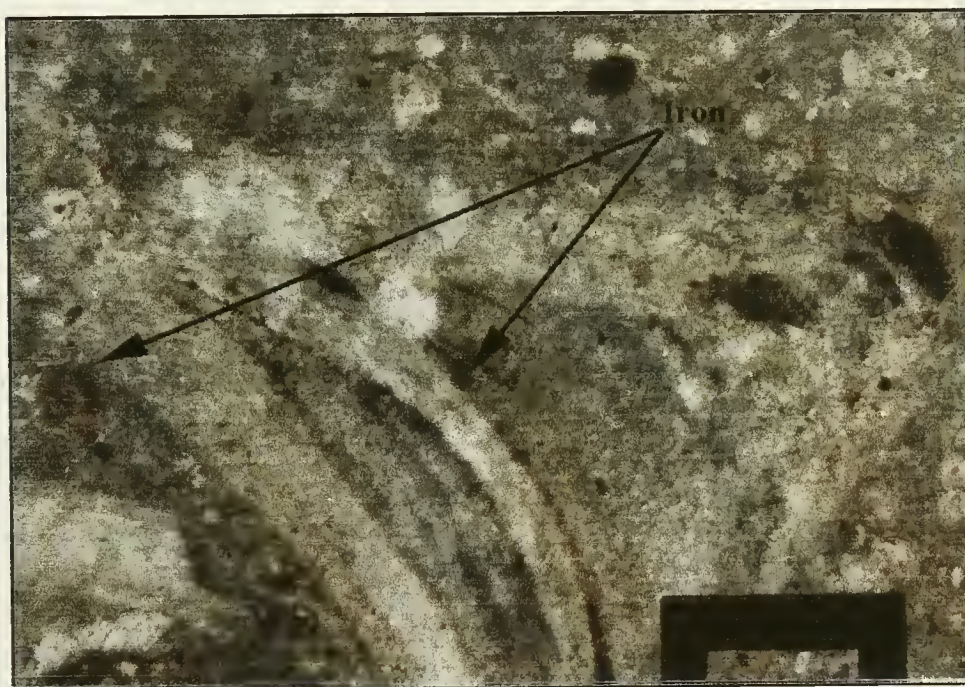


Figure 17. Thin section of SW05 showing iron deposits in the stone. Magnified 100x, Plane polarized light.

3.1.2.2 Iron

Iron is the primary accessory mineral in the stone as well as a colorant (Figure 17). The surface patination may be linked to the alteration of ferrous-to-ferric hydroxide components in the stone changing to yellow-ochre at the stone surface by oxidation and hydration of the ferrous iron in the stone.¹⁵⁷ According to Winkler, iron is the most common and strongest pigment in sedimentary rocks.¹⁵⁸ Iron oxides which are distributed heterogeneously may result from minerals such as pyrite, or limonite.¹⁵⁹ Winkler also states that “many gray limestones,...tend to change color readily to yellow of cream on buildings and in quarries. In nature, the carbonate rocks exposed of only recently remain gray or bluish gray.”¹⁶⁰

3.1.2.3 Glauconite

Glauconite, which is present in thin sections examined and is common to Austin Chalk, is a hydrous potassium iron alumino-silicate mineral which forms exclusively in marine environments, usually in fairly shallow waters (Figure 18). Glauconite commonly occurs as rounded pellets which are aggregates of many small crystals.”¹⁶¹ Winkler states that it is an important green colorant and defines glauconite as a “stable ferrous iron silicate of greenish color.”¹⁶²

¹⁵⁷ Winkler, 109.

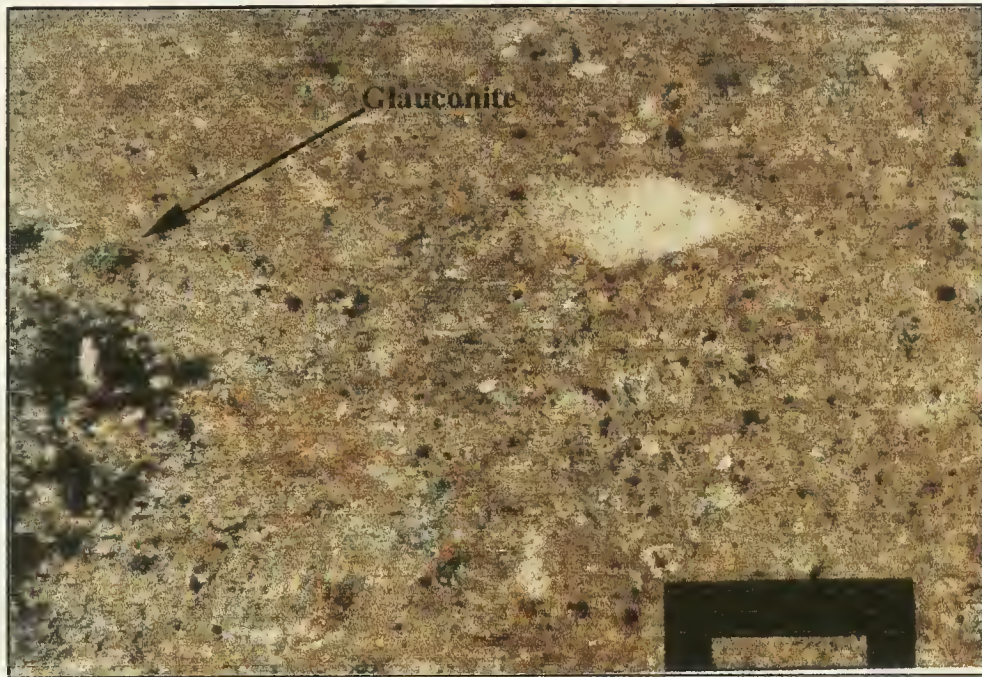
¹⁵⁸ Winkler, *Stone in Architecture*, 102.

¹⁵⁹ Boynton, *Chemistry and Technology of Lime and Limestone*, 17.

¹⁶⁰ Winkler, *Stone in Architecture*, 108.

¹⁶¹ Adams and MacKenzie, *Atlas of Sedimentary Rocks Under the Microscope*. 17.

¹⁶² Winkler, *Stone in Architecture*, 104.



*Figure 18. Glauconite grains present in sample SW01.
Magnified at 100x, Crossed polars.*

While a chalk may contain glauconite, in order for it to be classified as a glauconite chalk, the amount of glauconite must be sufficient to give it a gray, greenish or clearly green shade. “All the chalks belonging to this group are coarse-grained, both as an effect of the glauconite and of the accompanying mineral and organic constituents. Therefore, these chalks represent an environment of deposition entirely different from that of white chalk.”¹⁶³ The Austin Chalk is therefore still classified as a white chalk even though it contains glauconite.

¹⁶³ Cayeux, *Carbonate Rocks*, 32.

3.1.3 Chemical Composition

3.1.3.1 Acid Solubility of the Stone

The test was utilized to determine the acid soluble fraction of the stone, in order to see how much of the sample was composed of magnesium and calcium carbonate

Standard - Mortar Analysis: Simple Method, in *A Laboratory Manual for Architectural Conservators*, Teutonico, 1988.

Methodology - Sample SW04, which was a piece which fell from the window as active decay, was utilized to determine the acid soluble fraction of the stone. The samples weighed 22.80g and their visual characteristics were that of a white (Munsell 2.5Y/8/2) stone of a friable texture, with small fissures and fossil inclusions. During dissolution of the binder in 14% hydrochloric acid, white foaming and bubbling occurred; and the liquid turned a dark tan color.

Results

| | |
|---|--------|
| Original weight of powdered sample after oven (W_1) = | 22.89g |
| Weight of filter paper (W_2) = | 2.22g |
| Weight of filter paper + dry fines (W_3) + | 3.99g |
| Weight of dry fines ($W_3 - W_2$) = | 1.77g |
| Weight of dry aggregate (W_4) = | .09g |
| % by weight of insoluble coarse fraction ($(W_4/W_1) \times 100$ = | 0.39% |
| % by weight of insoluble fines ($((W_3 - W_2) / W_1) \times 100$ = | 7.73% |
| % by weight of acid soluble fraction = | 91.88% |

Discussion of Results - The sample effervesced freely, releasing CO₂ in 14% hydrochloric acid. The carbonate portion of the samples measured 91.88%; of the non-carbonate material, 7.73 % remained as insoluble fines, which may represent clays, and less than 1% of the stone was composed of a coarser acid insoluble material. It should be noted that the calcareous skeletons which acted as an aggregate in the stone were dissolved with the binder as well. This test reveals that the stone has a high percentage of carbonate material and clays, with a negligible amount of quartz.

3.1.3.2 X-Ray Diffraction

X-Ray Diffraction (XRD) was used to determine the principle and accessory minerals in the stone. X-Ray diffraction works by measuring the distance between atoms with the same interatomic spacings. The bonds between each atom vary in length. By measuring these distances, a ‘fingerprint’ exists to characterize each type of material present in the sample.

Half of the sample obtained from the delaminating base of the window (SW02) was crushed into a fine powder in order to perform X-ray diffraction. The test was run for 30 minutes from 10 to 90 degrees, which may not have been long enough to obtain information on the trace minerals present in the stone. The peaks which formed corresponded solely to calcium carbonate and did not indicate any accessory minerals, including magnesium carbonate (Figure 19).

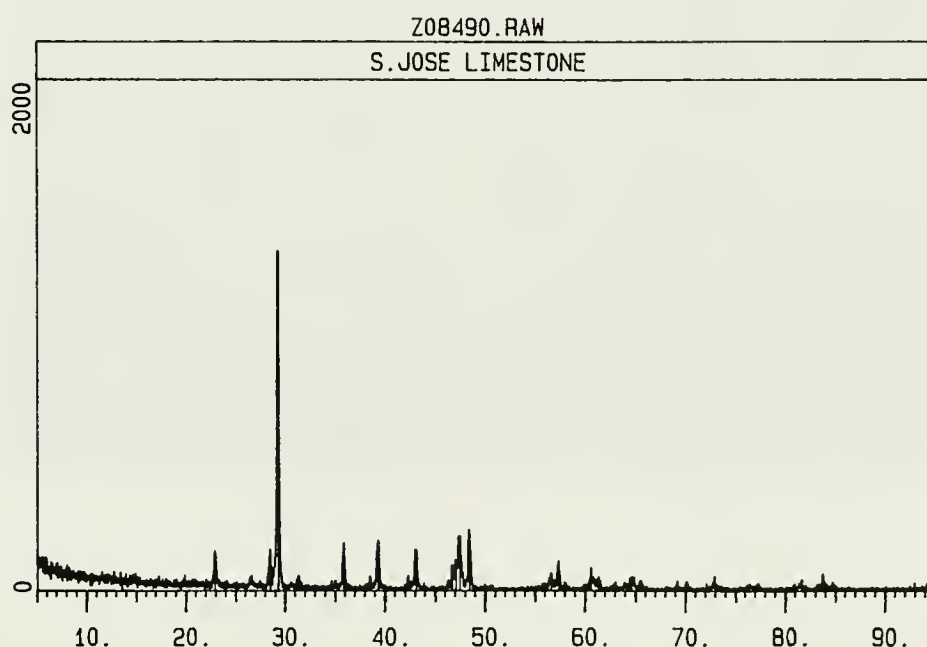
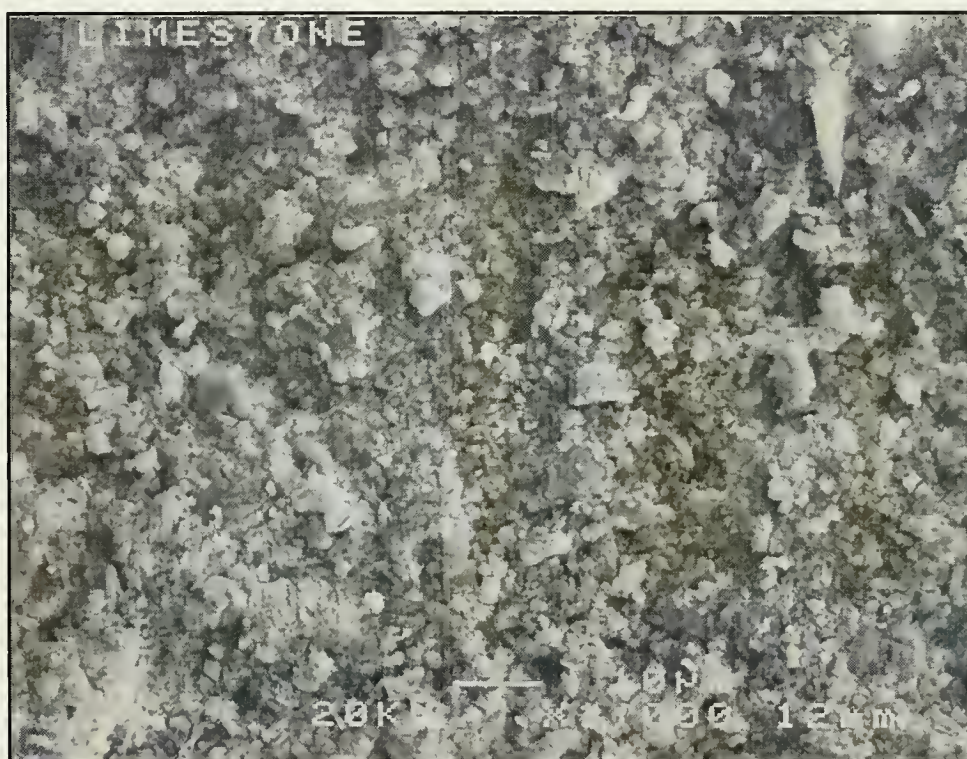


Figure 19. X-ray diffraction peaks corresponding to CaCO_3 .

3.1.3.3 Scanning Electron Microscopy/Energy Dispersive Spectroscopy

SEM/EDS was performed on two samples (SW01/SW05) from the Sacristy window with the assistance of Rollin E. Lakis, Ph.D., at the Laboratory for Research on the Structure of Matter at the University of Pennsylvania.¹⁶⁴ The first sample, from the upper right side of the Sacristy window (SW01)¹⁶⁵ revealed the presence of iron and organic growth on the stone. The micrograph, showing a magnification of 1000X, illustrates the fine-grained structure of this limestone (Figure 20). It was not visually apparent whether biological growth was causing any deterioration to the stone.



*Figure 20. Scanning Electron micrograph of sample SW01.
Showing fine-grained chalk magnified at 1000X.*

¹⁶⁴ Thanks to Dr. A.E. Charola, who allowed these samples to be run as part of her Advanced Conservation Science class at the University of Pennsylvania.

¹⁶⁵ Note: This is the same sample from which thin section (SW01) was cut.

This sample is composed of principally calcium carbonate and small amounts of silica and alumina which make up clays in the stone. Trace elements include magnesium, potassium, and iron (*Figure 21*). The iron in this sample can be seen with the naked eye in the distinct color change within the sample. This darker color also corresponds to the darker, well cemented matrix revealed through thin section petrography. The relative purity of this stone and its fine-grain further support its classification as a chalk.

The second sample (SW05) examined was a small piece which presumably fell from the base. This sample was primarily calcium carbonate, including alumina and silica. Small amounts of magnesium, phosphorous, sulfur, and potassium were also identified. Little to no iron exists in this sample (*Figure 22*). The high amount of silicon in some places may indicate a layer of water repellent. The presence of sulfur may correspond to the sulfates, i.e. soluble salts, in this area of the window; however, no salt crystals were seen with the scanning electron microscope. The lack of iron and the higher amounts of clays in this area of the window may indicate another factor affecting the deterioration.

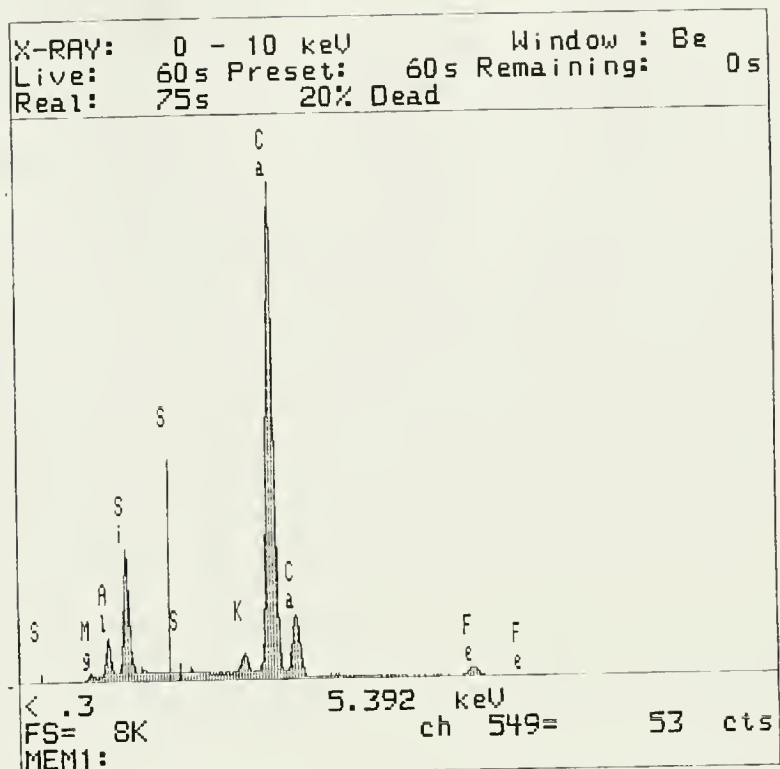


Figure 21. EDS Spectrum for sample SW01

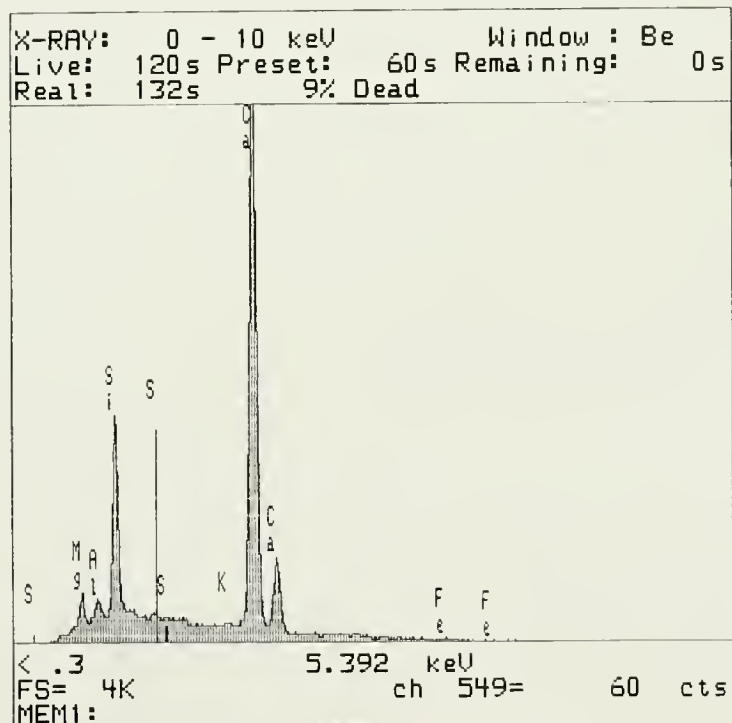


Figure 22. EDS Spectrum for sample SW05

3.1.4 Summary of Characterization

From the foregoing data, it is clear that the stone is a relatively pure calcium limestone, composed of primarily calcium carbonate with few impurities. Two types of micro-fabrics exist within the samples examined. One is a friable, fine-grained, and light in color, while the another is hard, coarse grained, and darker in color. Darker areas may include iron. The limestone contains some clay cementing agents. The stone is classified as a chalk due to its fine grain structure, and the multitude of microfossils present in the stone. Its color and the sparseness of glauconite further classify it as a white chalk. The relative softness of the stone, its formation through sedimentation, and the weak zones within the stone which lack a well cemented matrix contribute to the overall friability of the stone and the differential weathering observed.

Two types of chalks were utilized to construct the Sacristy window, one of which is more fossiliferous than the other. The upper right side of the window (in an area of carving) (SW01), displays a finer grained stone which does not contain large fossils. The sample (SW05) which came from the flatter areas near the base, has numerous fossil inclusions, which would be difficult to carve. A different quality of stone was presumably used for the lower portion of the window which would not receive the degree of ornamental carving as the upper section.

3.1.4.1 Typical Characteristics of Chalk

The following description from *Carbonate Rocks* by Luci n Cayeux, defines the characteristics of a typical chalk.

Typical chalk is a white, fine-grained, and soft rock, leaving a streak, staining fingers and easy to disaggregate. All these properties make the chalk quite different from the limestones *sensu stricto* which may contain the same minerals and the same organisms but are strongly cemented. The chalk is porous except for its varieties which have an appreciable clay content. Since chalk displays a weak coherence, its constituents, may be as easily separated as those of any *Globigernia* ooze.¹⁶⁶

Regarding the mineralogical composition of chalks Cayeux writes,

The calcareous groundmass which builds almost by itself all the white chalks, consists of calcite, excluding any aragonite. It contains in the average such a small number of detrital minerals that, in general, randomly oriented thin sections reveal no traces of them.¹⁶⁷

Organisms represent the essential constituent of the white chalk.¹⁶⁸ The predominant groups are the *Algae*(*Coccoliths*), which can't be identified in thin section, and *Foraminifers*.¹⁶⁹ "The finer the chalk, the lesser its content of *Foraminifers* and the higher its content on *Coccoliths*."¹⁷⁰ Regarding the cement of chalks Cayeux states,

A very predominant cement characterizes the finest chalks, whereas in the varieties richer in *Foraminifers* and other organisms, it is reduced to a very accessory role. The cement, whether cryptocrystalline or microgranular, remains always too fine-grained to allow any identification in thin section.¹⁷¹

As for the chemical composition, the calcium carbonate of typical chalk varies between 90-98%. Clay minerals are always present. "All chalks without any exception, contain

¹⁶⁶ Cayeux, Luci n. *Sedimentary Rocks of France: Carbonate Rocks (Limestones and Dolomites)*. Darien, CT: Hafner Publishing Company, 1970. Translated and updated by Albert V. Carozzi. Originally published in France in 1935. p.26

¹⁶⁷ Cayeux, 26. (Senonian white chalk in France)

¹⁶⁸ *Ibid.*, 27.

¹⁶⁹ *Ibid.*, 27.

¹⁷⁰ *Ibid.*, 27-28.

traces of manganese and an appreciable amount of P_2O_5 .”¹⁷² *Inoceramus* prisms which are found in Austin Chalk and the thin sections examined are further described by Cayeux, “The large-shelled *Inoceramus* which are known to be very abundant in the chalk, occur at all levels, even as isolated and generally broken prisms.”¹⁷³

3.1.4.2 Geological Name

The stone examined is consistent with the description of the Austin chalk Formation, an Upper Cretaceous unit in central Texas. The term Austin chalk was first used in 1860 by Shumard, who conducted some of the earliest geological surveys of the state, for the limestone typically exposed in Austin. It was also referred to as “Pinto” limestone in later surveys.¹⁷⁴ The Austin chalk Formation extends in a thin belt from a point north of Dallas to one southwest of San Antonio and is relatively consistent in character throughout this extent.¹⁷⁵ The belt generally follows the Balcones Fault line in central Texas. In the *First Annual Report* of the Geological Survey of Texas published in 1889, State Geologist, E.T. Dumble reported, “In the Austin chalk there are beds which furnish excellent building stone which is quarried for use in many places but a large portion of it is too chalky and not firm enough for general use.”¹⁷⁶ Formations from the Lower Cretaceous were found to be more favorable for their use in building.

¹⁷¹ Ibid., 30.

¹⁷² Ibid., 30.

¹⁷³ Ibid., 31.

¹⁷⁴ Sellards, *Stratigraphy*, 439.

¹⁷⁵ Gardner, Edwin L. *Limestone Resources of Texas*, Mineral Resource Circular No. 84, Austin, TX: Bureau of Economic Geology, University of Texas, 1994, 7.

¹⁷⁶ Dumble, E.T. *Geological Survey of Texas, First Annual Report, 1890*, liv.

3.1.4.3 Austin Chalk in San Antonio

In San Antonio, the excavations in Brackenridge Park represent the Austin chalk at levels between 100 and 150 feet above the base. The rock is evenly bedded in strata of from six inches to several feet in thickness. It is light gray tinged with yellow. Oxidized pyrite nodules are present. Near the base of the quarry, a layer rich in *Gryphaea* shells occurs. In this area the upper 200 feet of the Austin is a soft bluish calcareous clay or mud.¹⁷⁷ “It is usually of an earthy texture, free of grit, and on fresh exposure softer, so that it can be cut with a hand saw, but on exposure more indurated.” In thin section,

the material shows calcite crystals, particles of amorphous calcite, finely crystalline calcareous material, foraminiferan shells and fragments, fragments of the prismatic layer *Inoceramus* often in great abundance, debris of pelecypods, gastropods, echinoids, and other organic fragments. The material has the typical crystalline structure of limestone. Some slices show abundant glauconite specks; some show a sparse to medium amount of “spherical bodies”; and some show a finely crystalline texture almost devoid of organic material. Typical analysis show calcium carbonate 82 per cent; silica and insoluble silicates 11 per cent; ferric oxide and alumina 3 per cent; magnesia 1 per cent.¹⁷⁸

The water-filled subterranean chalky limestone is usually of a blackish-blue to bluish-gray color, as in most cores. The air-dried material is generally glaring white and of a matte texture....Some ledges become indurated and crystalline, others; less crystalline, weather into irregular small conchoidal flakes with an earthy fracture. Locally in more massive layers, there occurs a large conchoidal flaking, superficially resembling exfoliation. On prolonged disintegration, the Austin weathers into a black residual soil, characteristic of the Black Lands belt of east-central Texas.¹⁷⁹

¹⁷⁷ Sellard, et al. *Geology of Texas, Vol 1: Stratigraphy*, 448-449.

¹⁷⁸ Ibid., 446.

¹⁷⁹ Ibid., 446.

3.1.4.4 Quarry Provenance

Austin chalk outcrops become visible in the landscape north of central San Antonio, at the point where the Balcones Escarpment rises above the flatter land to the south. Several quarries were utilized in this area for the argillaceous limestone which produced a high quality cement. The Austin chalk is typically used for cement manufacturing in San Antonio, i.e., Alamo Portland and Roman Cement Works, due to the high clay content. It is likely that these uplifts provided the stone for the decorative carving at Mission San José, Concepción, and San Antonio deValero (See Chapter 1- Quarrying, for further discussion of this subject.).

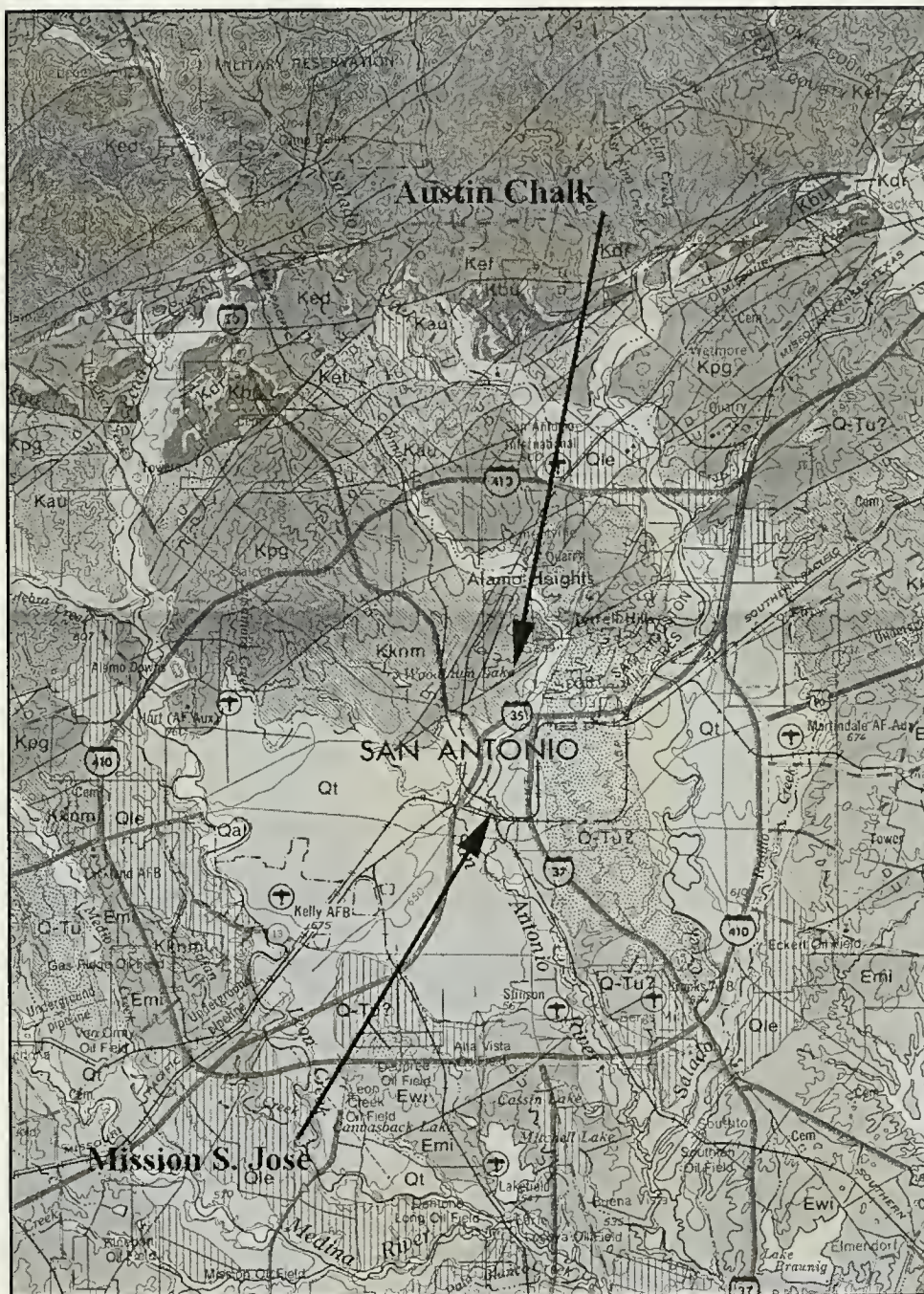


Figure 23. Geologic map of San Antonio, Geologic Atlas of Texas, San Antonio Sheet, 1:250,000, University of Texas, Bureau of Economic Geology.

CHAPTER 4. MECHANISMS OF DECAY AND CONDITIONS ASSESSMENT

4.1 Mechanisms of Stone Decay

4.1.1 Water

One of the major agents contributing to the decay of the limestone under investigation is water. Water can enter masonry in either the liquid phase (suction from wet materials, rainwater infiltration) or in the vapor phase (condensation, adsorption), however, it leaves the masonry almost exclusively in the vapor phase (evaporation).¹⁸⁰ The presence of CO₂ in water, mostly as carbonic acid accelerates the solution process, because solid calcite may either dissolve directly or be converted to the very soluble calcium bicarbonate.¹⁸¹ Water also transports soluble salts throughout the masonry.

4.1.1.1 Water Absorption by Total Immersion

Water absorption by total immersion measures the quantity of water absorbed by a material immersed in deionized water at room temperature and pressure, expressed as a percentage of the dry mass of the sample.¹⁸²

Standard Consulted - Normal 7/81, as reported in *A Laboratory Manual for Architectural Conservators*, Teutonico, 1988.

¹⁸⁰ Torraca, *Porous Building Materials*, 109.

¹⁸¹ Winkler, *Stone in Architecture*, 191.

¹⁸² Teutonico, Jeanne Marie. *A Laboratory Manual for Architectural Conservators*, Rome: ICCROM, 1988, 35. This test was performed on January 22, 1997.

Methodology - Since it was not possible to acquire enough stone for standard test cube samples, water absorption tests were performed on the largest sample available (SW03), which was found at the base of the Sacristy window. Due to the determined heterogeneous nature of the stone and its fossil inclusions, this can in no way be termed representative. The sample was washed in deionized water to rinse off powdered material from the surface. The sample was then dried in the oven for 24 hours at 110° C and placed in a desiccator to cool. The dry weight of the sample was 20.16g. The sample was then placed on glass rods in a dish of deionized water. Approximately 2 cm of water covered the sample. At intervals, the sample was removed from the water and blotted with a damp cloth and weighed.

Calculations - At each interval, the quantity of water absorbed with respect to the mass of the dry sample was expressed using the following calculations:

$$\Delta M / M_o \% = [M_n - M_o / M_o] \times 100$$

where M_n = weight of the wet sample at time t_n

M_o = weight of the dry sample

The Water Absorption Capacity (WAC) was then calculated using the following calculations:

$$WAC = [M_{\max} - M_d / M_d] \times 100$$

where M_{\max} = the mass of the sample at maximum water absorption

M_d = the mass of the sample after redrying at the termination of the test.

Results

| Time | Weight (g) | WA% |
|--------|------------|------|
| Mo | 20.16 | |
| 1 min. | 21.74 | 7.84 |
| 1 hr. | 21.84 | 8.33 |
| 2 hr. | 21.75 | 7.89 |
| 3 hr. | 21.84 | 8.33 |
| 24 hr. | 21.87 | 8.48 |
| 48 hr. | 21.9 | 8.63 |
| Md | 20.02 | |

Table 1. Water Absorption

$$\text{WAC} = [21.90\text{g} - 20.16\text{g} / 20.16\text{g}] \times 100^{183}$$

$$\text{WAC} = 8.63\%$$

Discussion of Results

After 48 hours the stone weighed 21.9 grams, absorbing 8.63% of its weight. The Water Absorption Capacity for the stone was calculated to be 8.63%. This reveals that the stone can be very porous and will easily take up water. It must also be noted that the stone was easily disintegrated in water and some of its mass was lost during the procedure. Before the test was run, all of the loose friable material was washed and removed with deionized water. Immediately after the initial reading after 5 minutes of submersion, the stone began to disintegrate, suggesting its susceptibility to dissolution in water.

¹⁸³ Note: The original dry weight of the stone was used instead of the final dry weight because some of the stone began to disintegrate in the water. If the final dry weight of the sample (20.02g) had been used, the WAC would be 9.39%.

The following chart compares the water absorption of the chalk relative to other limestones:¹⁸⁴

| Limestone | WAC% |
|------------------|-------------|
| Chalk (SW03) | 8.63% |
| Cordova Cream | 8.36% |
| Cordova Shell | 8.55% |
| Lueders | 5.40% |
| Indiana | 7.50% |

Table 2. Water Absorption Rates for Limestone

The Water Absorption Capacity of 8.63% for the chalk is slightly higher, but relatively consistent with the water absorption for other limestones used for building.

¹⁸⁴ Texas Quarries product literature provided data for Cordova Cream, Cordova Shell, and Lueders. The Indiana Limestone Company, Inc homepage at <http://www.ilco.com/tech.html> provided data on Indiana limestone. ASTM C97 was the standard employed for this data.

4.1.1.2 Water Absorption Under Low Pressure

The Rilem Water Absorption Under Low Pressure field test is used to measure the quantity of water absorbed under low pressure by a definite surface of a porous material and after a determined time. The test is also used to determine the effectiveness of water repellents.

Standard Consulted - Rilem Test II.4 Water Absorption Under Low Pressure

Apparatus - This test utilizes a “Rilem tube”, a plastic tube which gauges the amount of water in cm^3 which the surface absorbs at time intervals. In addition, weather-stripping putty, a timer, and a squeeze bottle with a flexible neck were utilized in this test.



*Figure 24. Rilem tube. Rilem Test II.4, Water Absorption Test,
(Photograph by Katherine McDowell, January 1997)*

Methodology - Ten locations of the Sacristy window were field tested for their rate of water absorption under low pressure. The tests were performed on two mild days in January 1997. All ten surfaces on which the tests were performed were smooth, flat, and

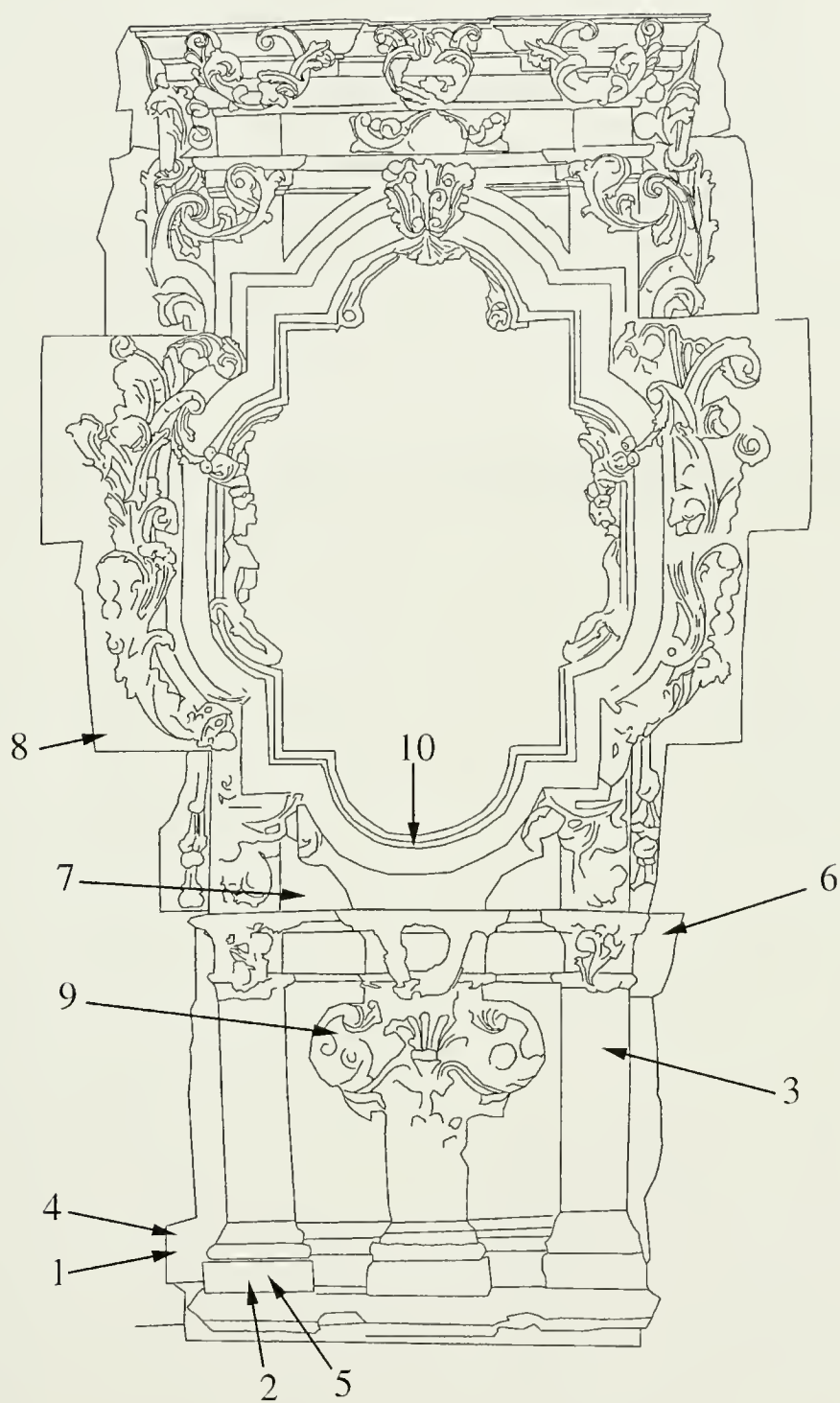


Figure 25. Test Locations for Rilem II.4, Water Absorption under Low Pressure.

did not display any disaggregation, however, all displayed some erosion of the surface.

Friable areas at the base of the Sacristy window were not tested because of difficulty in getting the putty to adhere to the tube successfully, without causing damage to the surface. The amount of water absorbed by the surface was recorded every 30 seconds.

Calculations - The water absorption rate is expressed in $\text{cm}^3/\text{minute}$.

Results - The following numbers represent locations tested: (See *Figure 25* for exact test locations.)

| Minutes | Test locations | | | | | | | | | |
|---------|----------------|---|------|---|--------|-------|-------|---|-------|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 0.5 | -0.1 | 0 | -0.2 | 0 | 0 | 0 | | 0 | | 0 |
| 1 | -0.1 | 0 | -0.2 | 0 | -0.1 | 0 | -0.1 | 0 | -0.15 | 0 |
| 1.5 | -0.1 | 0 | -0.2 | 0 | -0.1 | | | | | |
| 2 | -0.2 | 0 | -0.2 | 0 | -0.1 | -0.05 | -0.25 | 0 | -0.15 | 0 |
| 2.5 | -0.25 | 0 | -0.2 | 0 | -0.15 | | | | | |
| 3 | -0.3 | 0 | -0.2 | 0 | | -0.05 | -0.25 | 0 | -0.15 | 0 |
| 3.5 | -0.4 | 0 | -0.2 | 0 | -0.15 | | | | | |
| 4 | -0.5 | 0 | -0.2 | 0 | | -0.1 | -0.5 | 0 | -0.2 | 0 |
| 4.5 | -0.75 | 0 | -0.2 | 0 | | | | | | |
| 5 | -1.25 | 0 | -0.2 | 0 | -0.175 | -0.1 | -0.5 | 0 | -0.2 | 0 |
| 5.5 | -1.6 | 0 | -0.2 | 0 | | | | | | |
| 6 | -2 | 0 | -0.2 | 0 | | | | 0 | | 0 |
| 6.5 | -2.4 | | -0.2 | 0 | -0.2 | | | | | |
| 7 | -2.75 | | -0.2 | 0 | | | -0.75 | | | |
| 7.5 | -3.1 | | -0.2 | 0 | | | | | | |
| 8 | -3.4 | | -0.2 | 0 | | | | | -0.25 | |
| 8.5 | -3.65 | | -0.2 | | | | | | | |
| 9 | -4 | | -0.2 | | | | | | | |
| 9.5 | -4.2 | | -0.2 | | | | | | | |
| 10 | -4.5 | | -0.2 | | -0.2 | | -1 | | -0.3 | leak |
| 15 | | | | | -0.3 | -0.1 | | | | |
| 18 | | | | | -0.35 | | | | -0.35 | |
| 20 | | | | | -0.4 | | | 0 | | |
| 23 | | | | | -0.45 | | | | -0.4 | |
| 25 | | | | | -0.5 | | -3 | | -0.5 | |
| 30 | | | | | -0.6 | | | | -0.55 | |
| 35 | | | | | -0.7 | | | | -0.7 | |
| 40 | | | | | -0.8 | | | | | |
| 45 | | | | | -1 | -0.1 | | | | |
| 50 | | | | | -1.5 | | | | | |
| 55 | | | | | -1.9 | | | | | |
| 60 | | | | | -2.5 | | | | | |

Table 3. Water Absorption Under Low Pressure expressed in $\text{cm}^3/\text{minute}$

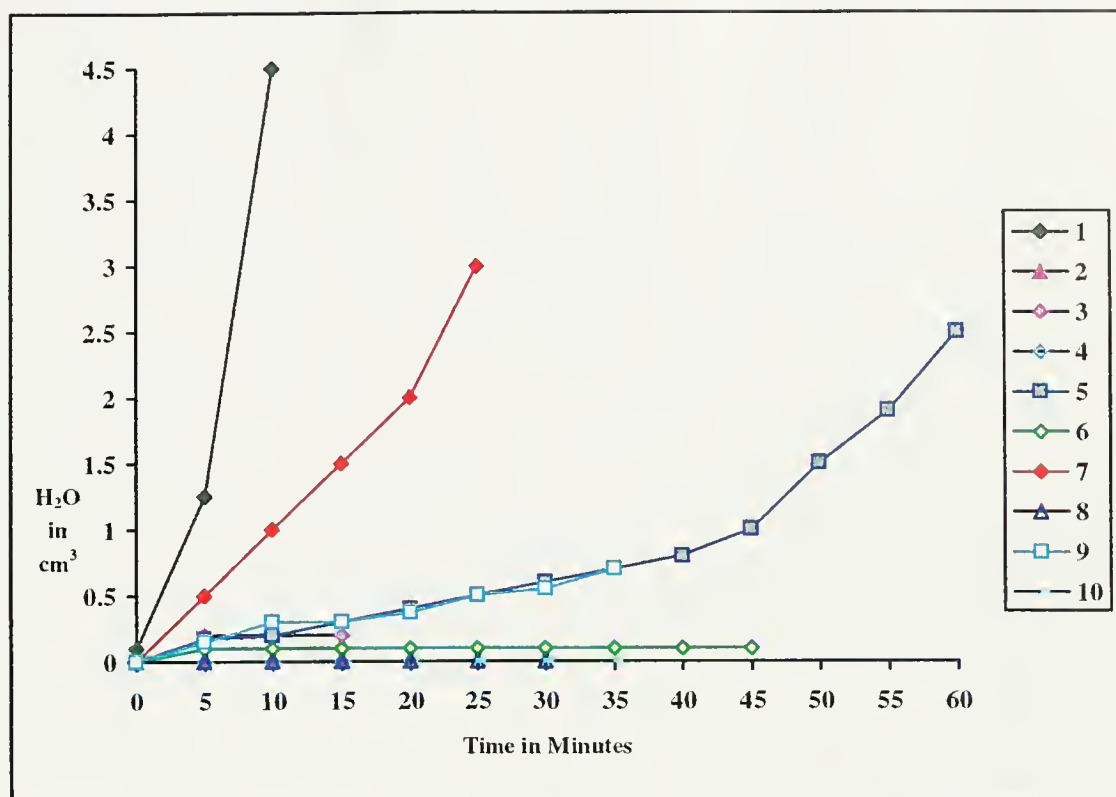


Figure 26 .Water absorption under low pressure. X-axis represents time in minutes. The Y-axis represents the volume of water absorbed in cm³

Discussion of Results

Of the ten areas tested, only three areas had a steady intake of water (Figure 26) while the other areas remained constant. These locations which absorbed water included locations 1, 5, 7 and 9. The rate of water absorption for each of these samples ranges from .02 - .45 cm³/minute. This might suggest that a water repellent is still active on the surface of much of the stone, since the stone is otherwise considered to be porous and permeable. However, the last record of a surface treatment being applied to the walls of the Sacristy was in 1975. The walls do not bead when wet; therefore, it is possible that the surfaces which were tested, which are all sound stone, have a higher density than the stone which was tested for water absorption. Cayeux has suggested that chinks which

contain an appreciable amount of clay are less porous than other chalks.¹⁸⁵ The clay content of this chalk may be aiding in its density and resistance to water absorption.

4.1.2 Soluble Salts

Since the base of the Sacristy window is below grade and the sub-soil layer is clay, the base of the window is susceptible to rising damp and salt crystallization cycling. Soluble salts cause decay to masonry in two ways. First, they attract liquid water or water vapor causing an increase in the critical moisture content of the stone thus retarding its ability to dry out. Soluble salts also can crystallize upon evaporation within the pores of the stone or on the surface of the masonry, causing flaking and disaggregation.

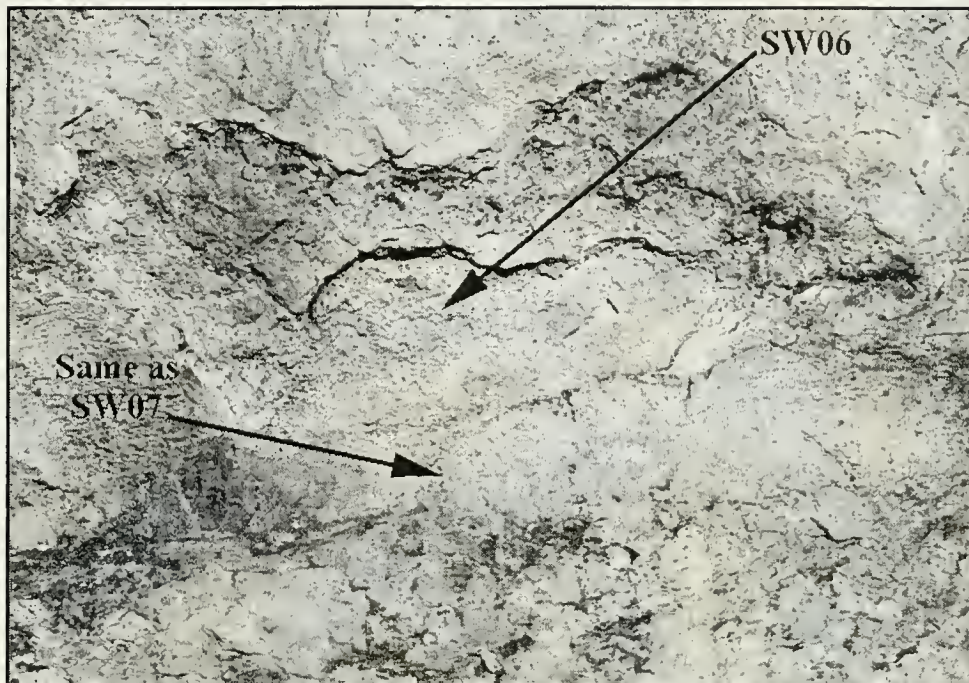
The capillary rise increases with time as soluble salts are carried by water into the masonry and become concentrated there when the water that carries them evaporates from the side surfaces of the wall. The increased concentration of soluble salts causes in turn another force of attraction for water, since it must diffuse from low salinity to high salinity regions. The result is that an equilibrium is never reached, and the capillary rise of water increases with the structure's age.¹⁸⁶

4.1.2.1 Qualitative Analysis of Soluble Salts

Analysis of soluble salts was performed on two separate occasions on salts (SW06) brushed from the areas of efflorescence with the same results. In addition, to the efflorescence salts analyzed, one sample (SW02), which was delaminating from one of the pilasters, was crushed and analyzed for soluble salts, as well as, a mortar sample (SW07). Soluble salt content was analyzed using qualitative chemical spot tests.

¹⁸⁵ Cayeux, 27.

¹⁸⁶ Feilden, Bernard. *Conservation of Historic Buildings*. 99.



*Figure 27. Salts in the form of efflorescence adjacent to previous repair, similar to that of sample SW07.
(Photograph by Katherine McDowell, October 1996)*

Methodology - Preliminary tests on efflorescence were conducted in the Architectural Conservation Laboratory in December 1996. Sample (SW06) was dissolved in H₂O, filtered, and divided into separate test tubes for each test.

Results

- The addition of HCl to efflorescence indicated the presence of carbonates.
- The addition of 2 drops dilute HCl (15%) and 2 drops of barium chloride (.25M) displayed some evidence of a white precipitate. The solution was cloudy but a solid precipitate did not form. HNO₃ was added. The test was positive for sulfates.
- 1 drop of sulfuric acid and 1 drop of diphenylamine solution
No blue color indicated the test was negative for nitrates.
- 1 drop ammonium molybdate in dilute HNO₃ was added to a spot plate. This produced a somewhat yellow tint but not a solid precipitate. The test was negative for phosphates.

- 1 to 2 drops dilute HNO_3 were added plus 1 to 2 .1M silver nitrate.
A whitish blue tint, but not gelatinous. Tests positive for chlorides.

Discussion of Results - The results indicated the presence of sulfates and chlorides in the sample examined.

Confirmation and Additional Tests for Soluble Salts -

Confirmation of previous results for soluble salts were conducted in the Architectural Conservation Laboratory on March 7, 1997. The samples for the second round of tests included: efflorescence salts (SW06) which were the same as those tested previously; a stone sample (SW02); and a mortar sample(SW07). (See Figure 11. Sample Location Diagram.)

Methodology - Each sample was ground until a uniform coarse powder was obtained. The samples were then placed in beakers with deionized water and stirred overnight with magnetic stirring bar. The suspensions were then filtered and the solution was used for the identification of soluble salts. (Tests were also run on blanks.)

Results

| Sample | | Result | Test |
|---------------|-----------|----------|--|
| Salts (SW06) | sulfates | positive | 2 drops 1:3 HCl; 2 drops .25M BaCl |
| | chlorides | positive | 2 drops 1:1 HNO_3 ; 2 drops 17% AgNO_3 |
| | nitrites | negative | 1 drop 1:5 H_2SO_4 ; 1 drop diphenylamine solution |
| Stone (SW02) | sulfates | negative | same as above |
| | chloride | negative | " |
| | nitrites | negative | " |
| Mortar (SW07) | sulfates | negative | " |
| | chlorides | positive | " |
| | nitrites | negative | " |

Table 4. Qualitative Analysis of Soluble Salts.

Discussion of Results - Salts brushed from areas of efflorescence revealed the presence of sulfates and chlorides in the stone, which confirms the results from the previous test.¹⁸⁷ Analysis of the mortar revealed only chlorides. Therefore, the sulfates cannot be attributed to the hard buff mortar, which is used in the area adjacent to where the efflorescence has developed. The sulfates may be attributed to original or other repair mortars or from the weathering of pyrite present in the limestone. It may be inferred that the chlorides are coming from the mortar, or that the chlorides are from aerosols or ground water and are equally affecting both the stone and mortar. Chlorides could be present in mortar as an additive to prevent freezing or from contaminated sand.

¹⁸⁷ One sample of stone at the base which had delaminated did not contain any salts.

4.1.2.2 Sulfates

The soluble sulfates most commonly found in masonry are calcium sulfate and magnesium sulfate. Possible origins include: 1) the stone itself 2) agricultural land 3) sea spray 4) mortars 5) micro-organisms 6) atmospheric pollution. Sulfates attack carbonates through dissolution by the action of sulfuric acid or sulfurous acid, and by the change of carbonates to calcium sulfate or calcium sulfite.¹⁸⁸ Sulfates are common after natural weathering of pyrite. Calcium dissolves from carbonate rocks and tends to form the sulfate gypsum in polluted air.

The damage produced by sulphates is not due to their water solubility but to their property of existing in different hydration states...Each hydration state is characterized by a specific volume, therefore each time that transformation from one state to another takes place, a change of volume occurs. The amount of damage resulting from the rhythmic contraction and pressure on the walls of the pores is dependent of the pressure of hydration.¹⁸⁹

This expansion within the pores of the stone causes them to break up. “Sulphates are generally less soluble and mobile with respect to other salts and can therefore move inside the porous stone only in the initial phase of formation, when they are still in solution.”¹⁹⁰ The sulfates therefore may be coming from the original or other repair mortars or from the weathering of known pyrite present in the limestone.

4.1.2.3 Chlorides

Chlorides are common in coastal regions since they are mainly of marine origin. Chlorides are principally deposited by sea spray. They can also be the result of impurities in the sandy material used to prepare mortars and plasters. Industrial activity which burns

¹⁸⁸ Winkler, 126.

¹⁸⁹ Fassina and Amoroso, 46.

¹⁹⁰ Fassina and Amoroso, 46-47.

pit coal can also result in presence of gaseous hydrochloric acid (hydrogen chloride anhydrous) in the atmosphere.¹⁹¹ Chlorides are also used as additives by masons during cold weather to reduce freezing temperature or from runoff acid or for deicing on pavements. Chlorides penetrate masonry from the soil by rising damp or marine aerosols transported by wind. "Chlorides are extremely dangerous because they are very soluble and hygroscopic and during condensation of water from the surrounding air are the first salts to be redissolved. Once in solution they are very mobile and thus they penetrate and break up many crystalline structures."¹⁹²

The hygroscopicity of chlorides allows them to absorb moisture from the air and to retain within the pores of the stone. When the salts crystallize they form very porous deposits which absorb water through capillary action. Their hygroscopicity allows them to absorb water and chloride solution from the surrounding pores. When they are dry, the salt crystals exert a high pressure on the walls of the pore in which they have grown. A slight change in the relative humidity or in the moisture content within the stone can cause the cyclic hydration and dehydration of salts or a renewal of crystal growth, exerting further pressure against the walls of the pore. If the water supply continues chloride crystals will re-dissolve and due to their transient nature, will be transported to other areas which favorable conditions for crystallization. Because of these qualities, chloride crystals can exert damage more quickly, to different areas within the stone.¹⁹³

¹⁹¹ Teutonico, Jean Marie, *A Laboratory Manual for Architectural Conservators*, Rome: ICCROM, 1988, 58-60.

¹⁹² Fassina and Amoroso, 47

¹⁹³ Fassina and Amoroso, 47. Mechanism valid only for calcium and magnesium chlorides which contain water of crystallization. Not applicable to sodium chloride, whose growth takes place only in the dehydration phase or evaporation.

4.1.2.4 Summary of Soluble Salts Analysis

Salts were found at the base of the window in areas of active delamination and flaking. In some areas efflorescence was adjacent to previous repairs. The analysis did not support the hypothesis that the sulfates are from the previous repair which was analyzed. However, they may be the result of other repairs or from the pyrite which is common to this stone. Pyrite staining is evident below areas of efflorescence on the one block which forms the base of the left pilaster. Chlorides, which were found in the stone and mortar, may be linked to aerosols in the air, additives in the mortar, or deicing salts. The pattern of salt damage is visible in the flaking and chalky white disaggregation found in the lower two to three feet of the window. This pattern may be linked to rising damp, activating and carrying the salts to higher regions of the stonework. The sulfate and chloride salts within the stone will continue to cause damage to the pores of the stone as they migrate to higher zones of the Sacristy window.

4.1.3 Previous Repairs

4.1.3.1 Mortar Analysis

Gravimetric analysis was performed on the sample of buff (Munsell 2.5Y/7/4) mortar repair which was taken from the lower right side of the window (SW07). The mortar's appearance before grinding and acid digestion in hydrochloric acid was very smooth and hard. Visual examination showed that the mortar contained a low percentage of aggregate compared to the binder (paste). The majority of color was contained in the paste.

Physical Characteristics- To the eye the surface finish coat appeared smooth. Closer examination with the microscope revealed a white matrix with clear and amber quartz particles; angular and sub angular, forming a small percentage compared with the paste. The brown coat was composed of a light tan matrix, and was more granular, with more particles than the finish coat; sub-angular and sub rounded of varying size. The original sample (SW07) weighed 11.51 grams.

Standard Consulted - Mortar Analysis: Simple Method, in *A Laboratory Manual for Architectural Conservators*, Teutonico, 1988.

Results and Calculations

| | |
|-------------------------------|------------------|
| Weight of container | = 1.59g |
| Weight of sample in container | = 13.49g |
| Weight of sample before oven | = 11.9 g |
| Filter paper (W2) | = 2.24 g |
| Dry weight (W1) | = 13.10g - 1.59g |

Dissolved in 14% solution of hydrochloric acid

Observations: solution yellow ochre color; bubbles, foam

| | |
|-----------------|---|
| Weight of fines | = 3.25 g - 2.24g (weight of filter paper) = 1.01 g + fines from sieving add additional 0.06g |
|-----------------|---|

| | |
|---------------|---------|
| Weighing boat | = 6.98g |
|---------------|---------|

| | |
|-------------------------|----------------------------|
| Weighing boat with sand | = 10.69 g - 6.98 g = 3.71g |
| Weight of sand | =3.71g |

Particle Size Distribution and Description of Aggregate

| Sieve | Size | Wt. | % Ret | % Pass | Description |
|---------|--------|--------|-------|--------|--|
| No. 8 | 0.0 | 0% | 100% | | |
| No. 16 | 1.18mm | 0.19g | 4.75% | 95.25% | sub angular, sub rounded, predominantly light tan color, clear quartz, pink feldspars and black |
| No. 30 | 600 um | 0.68 | 17% | 78.25% | sub angular and sub rounded, predominantly light amber and clear quartz; conglomerate pieces insoluble in HCl; light buff, and grey, rough, tuff-like pieces |
| No. 50 | 300 um | 0.1.76 | 44% | 34.25% | same as No. 30, just smaller, some bright orange particles, possibly brick dust |
| No. 100 | 150um | 0.94 | 23.5% | 10.75% | same as above, more of the gray, coarser particles presence of a few solid white particles, feldspars with iron streaks |
| No. 200 | 75um | 0.37 | 9.25% | 1.5% | same as above, addition of fine, gray conglomerates |
| Fines | <53um | 0.06 | 1.5% | ---- | fine gray particles only |

| | |
|--------------------------------------|-----------------------|
| Original wt. of powdered sample | = 11.51g |
| Wt. of dry fines | = 1.01 + 0.06 = 1.07g |
| Wt. of aggregate | = 3.71 g |
| % by weight of aggregate | = 32.23% |
| % by weight of fines | = 9.30 % |
| % by weight of acid soluble fraction | =58.47% |

Discussion of Results - The acid soluble fraction was 58.47% (by weight); the acid-insoluble fraction was 9.30% fines, high enough to suggest the possibility of cements clays, and/or mineral pigments, and 32.23% aggregate. Ratio of aggregate:fines:binder is 32:9:59; otherwise stated as a ratio of acid insoluble: acid soluble of 41%:59%, which is a high ratio of binder to aggregate. The standard ASTM Type “S” mortar is based on a 1:3 mix. Based on the physical characteristics of the sample and the resulting fractions obtained from the gravimetric analysis it would appear that this campaign of mortar repair to the stone consisted of lime-cement blends with pigmented additives and sand to match the stone in color.

4.1.4 Placement and Orientation of Stones

The placement and orientation of stones in the Sacristy window is also a contributing factor in the decay of the stone. Face bedding of stones, in which the units are laid perpendicular to their natural bedding planes is a primary factor in the decay at the base of the Sacristy window. This is why stone should be “quarry-bedded” in a building, i.e., laid as it is found in the quarry. Face bedding encourages macroscopic failure in the form of flaking and delamination due to the stone’s inability to resist the vertical pressures of the weight from above when the grain on which it breaks most easily is not at a right angle to such pressures.”¹⁹⁴ Face bedding also exposes the vulnerable bed planes to water penetration and delamination. The water and moisture at the bottom of the window in the form of rising damp from the grade below and any water collected in the excavated trench in front of the window exacerbates an already compromised situation of face bedded stones. The lower blocks appear to have been face bedded when their length needed to be exploited to achieve a certain height without having any joints, i.e., in the formation of the pilasters which are approximately 31 inches in height. There is also a failure of stones in the arch construction around the top of the window surround, caused by not placing the stone at right angles to the thrust of the arch. The problem of face bedding stones can also be seen at the base of the facade at Mission Concepción.

¹⁹⁴ Rockwell, 158.

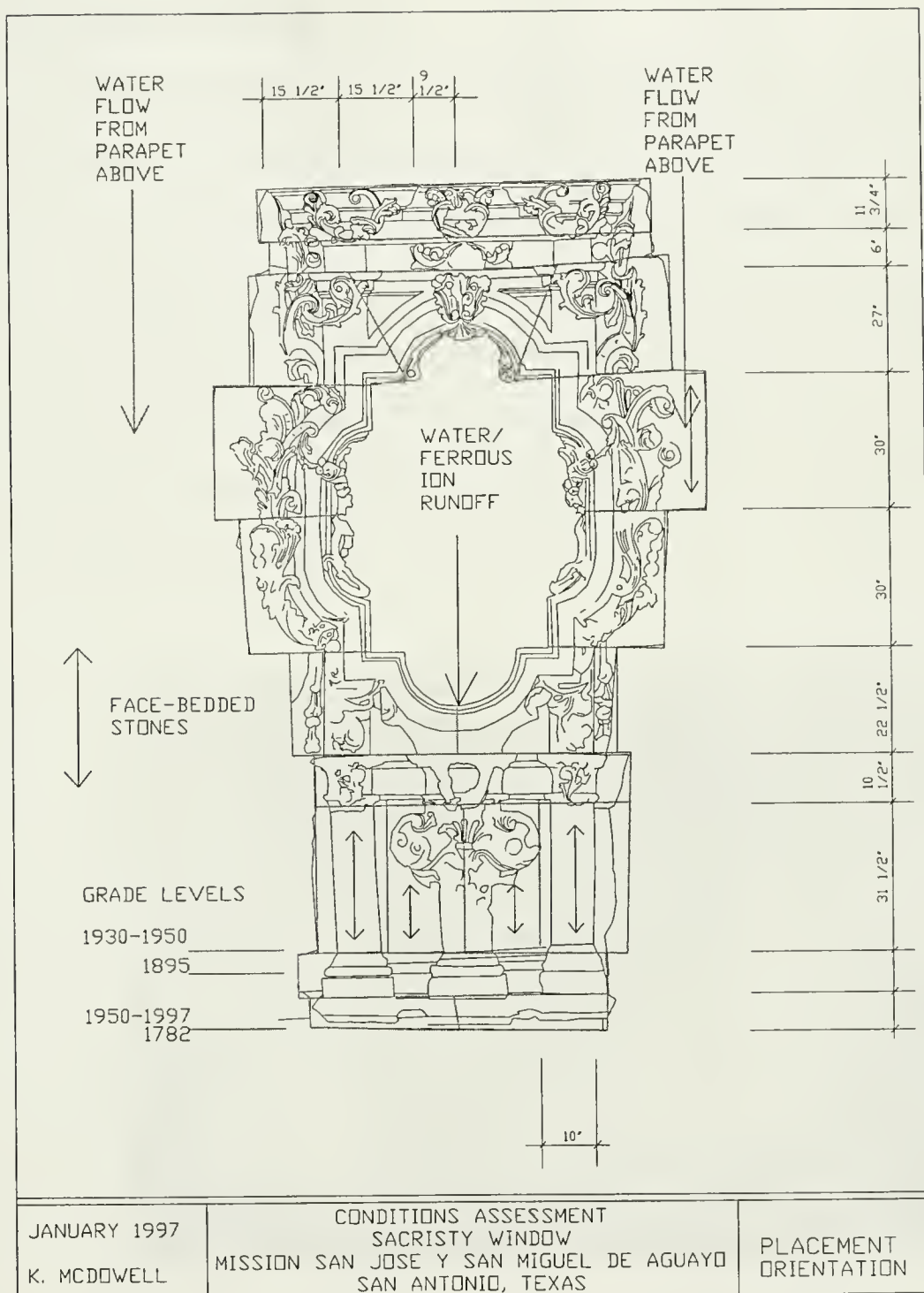


Figure 28. Stone Placement and Orientation Diagram.

4.1.5 Summary of Decay Mechanisms

From the above data it can be concluded that moisture (from all sources but primarily ground water), salts, previous repairs, and specific faced-bedded limestone blocks are all assisting in the selective decay of a soft and permeable stone of variable composition. The stone is subject to differential erosion due its heterogeneous characteristics. The natural action of weathering is able to dissolve the weaker zones of the chalk. The combined action of water in the form of rising damp, soluble salts, and the stress of mortars which are harder than the stone, are accelerating this natural decay as evidenced at the base of the Sacristy window.



Figure 29. Base of Sacristy window in December 1996.

4.2 Conditions Survey

The existing condition of the stonework which makes up the Sacristy window at San José varies from stone to stone. The variability in the conditions can be attributed to weathering factors, the heterogeneous properties within the stone, the location of the architectural and decorative elements, the placement of stones, and rising damp. The conditions at the base of the window are in general more severe than the rest of the window. The upper sections of the window are in good condition, with the exception of some localized areas.

The conditions survey of the Sacristy window has focused on the exterior stone from the grade level to the cornice. The conditions survey utilized HABS drawings, which were surveyed and drawn in 1936¹⁹⁵. 35mm rectified photography, was conducted by the author in December 1996 and was used to produce a more accurate photographic representation of architectural elements and conditions, than could be achieved using the HABS drawings. The rectified photographs served as the basis for a new composite image of the existing form and its detailed annotated conditions, generated using Adobe Photoshop 3.0, Spittin' Image, and AutoCAD R13. The computer generated drawing was reconciled with the proportions and dimensions of the HABS drawing. The computer generated drawing is more accurate with respect to the detail of the ornament, however, due to the three dimensionality of the stone carving, it was not possible to rectify the image completely. The scale of some areas may be incorrect, therefore, the estimated surface condition quantity should only serve as a general guide.

¹⁹⁵ Historic American Buildings Survey, Survey No. TEX-333, Sheet 6 of 6, Delinimator: Zeb Rike.

4.2.1 Condition Survey Terminology¹⁹⁶

The following terms, based in part on terminology standards developed at the Architectural Conservation Laboratory and standards developed by NORML, were used for the documentation and description of conditions observed at the site in December 1996.

| | |
|--------------------------|--|
| Biological growth | Presence of black or green microflora often found in association with cracks and delamination in areas of high moisture. |
| Cracking | Fractures of variable length, width, depth, and orientation. |
| Delamination | The detachment and often partial loss of one or more surface layers of stone parallel to each other and in association with bedding and stone orientation. |
| Disaggregation | Active detachment of grains resulting in a rough texture or granular appearance, overall friability of the stone surface, and loss of grain to grain cohesion. |
| Efflorescence | White crystalline surface deposits composed of water-soluble salts, often found in areas of water penetration.. |
| Erosion | Loss of surfaces, edges, corners, or carved details of stone resulting in the rounded and blurred details. |
| Flaking | The detachment or loss of small thin flakes of stone not necessarily in association with bedding or stone orientation. |
| Graffiti | Man made inscriptions carved into the surface of the stone or inscriptions made on the surface using graphite and ink. |
| Loss | Absence of original material as judged by the incompleteness of form or decoration. Aided by historical photographs. |
| Original Surface | Area of original tooling marks still extant on surface. |
| Pitting | Existence of small cavities in the stone. |

¹⁹⁶ Survey terminology compiled from Erder (1995); Grimmer (1986); Ashurst and Dimes (1990).

| | |
|-----------------------|--|
| Repairs | Subsequent alteration made for structural or aesthetic reasons, including replacement of stone, mortar fills, repointing, and protective finishes. |
| Surface Finish | Area of stone which appears to have a surface finish or darker surface patina. |
| Staining | Discoloration of stone due to metallic corrosion or the weathering of pyrites within the stone. |

4.2.2 Glossary of Carved Stone Conditions

The site conditions defined above are further described, quantified, and illustrated with photographs from the Sacristy window in the following glossary.

Biological growth

Surface Area: 1,184.22 cm²

1.43%

Presence of microflora often found in association with cracks and delamination in areas of high moisture. Black fungal growth occurs in the area of the cornice and at the upper right side in an area of moisture. This condition is linked to a faulty *canales* and parapet design, which has allowed water to run down the face of the Sacristy in this area. The biological growth may also be aiding in the delamination of the stone, as organisms grow in small fractures and pores taking advantage of trapped moisture found in them. Projecting elements, which have contact with water, display this black microflora. Austin chalk also blackens in the quarry wherever it is not protected by a projecting element.

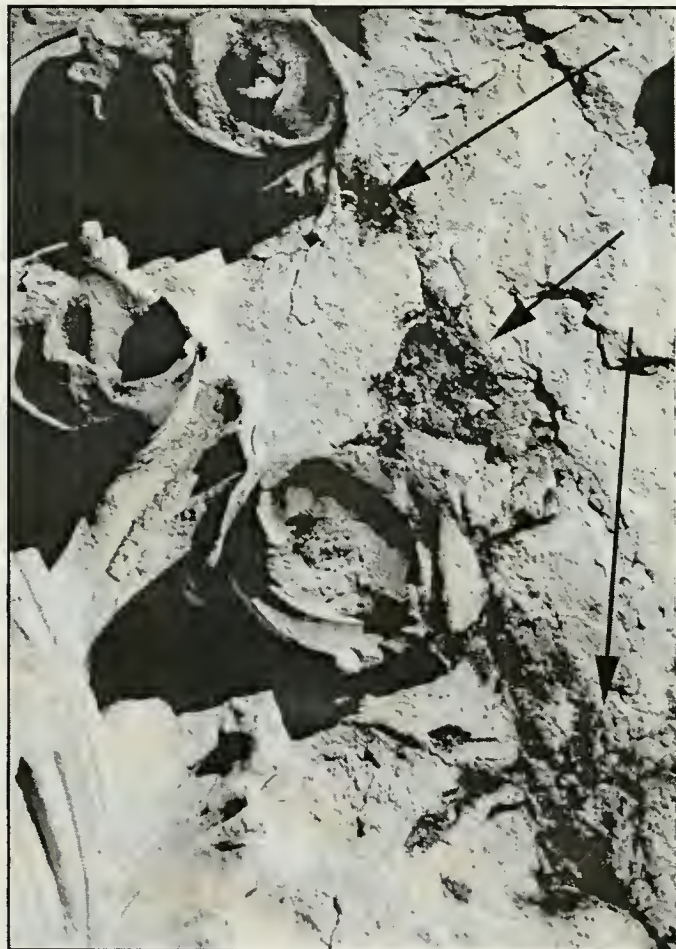


Figure 30. Biological growth.

Cracking

Two types of cracks exist in the stones:

(1) Narrow fractures (2 to 10mm in width) of variable length, width, depth, and orientation. Cracks occur predominantly in areas of active detachment.



Figure 31. Cracking

(2) Micro-cracking (less than 2mm wide): Localized cracks confined to a single block and linked to an inherent weakness within the stone, like the small fissures between bedding planes. Surface Area: 18 cm²

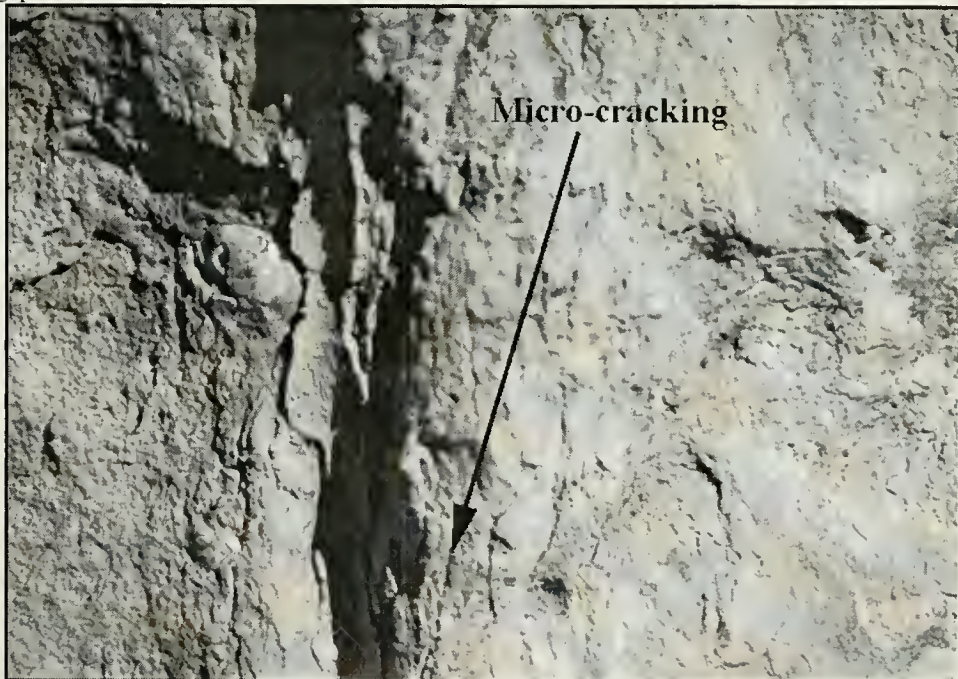


Figure 32. Micro-cracking

Delamination

Surface Area: 1,435.13 cm²

2%

The detachment and often partial loss of one or more surface layers of stone parallel to each other and in association with bedding and stone orientation. This condition occurs widely in the area in between the pilasters at the base of the window, where the stone appears to be “face bedded”, oriented at bedding planes parallel to the surface.



Figure 33. Delamination

Disaggregation

Surface Area: 454.08 cm²

less than 1%

Active detachment of grains resulting in a rough texture or granular appearance, and an overall friability of the stone surface. The condition predominates at the base and localized areas in the window surround. This condition is caused by moisture, salt crystallization, and wet-dry cycling.



Figure 34. Disaggregation occurring adjacent to ridges of bedding orientation.

Efflorescence

Surface Area: 183.18 cm²

less than 1%

White crystalline surface deposits composed of water-soluble salts, often found in areas of water penetration. The cause is normally the penetration and capillary rise of ground water and associated soluble salts through the stone. As the stone dries, these salts crystallize on or below the surface of the stone. Salts are also transitory, moving to increasingly higher areas of the window's base. The wet-dry cycling causes delamination and flaking due to the internal disruptive pressures of the crystallized salts in the stone pores. This condition occurs only at the base of the window in areas adjacent to cementitious repairs.

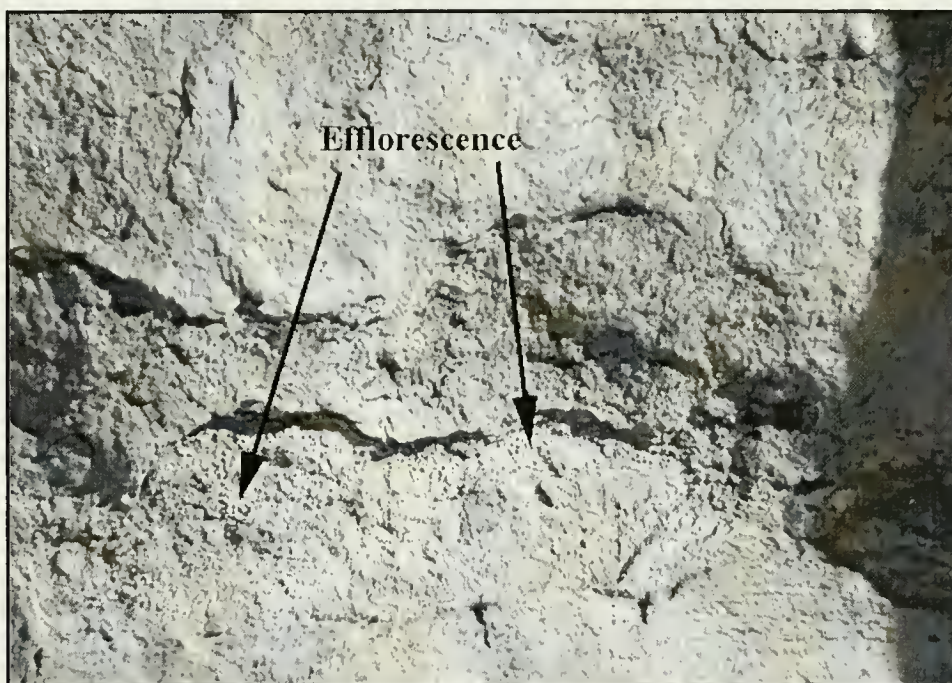


Figure 35. Efflorescence

Erosion

Surface Area: 1,758.92 cm²

2%

Loss of surfaces, edges, corners, or carved details of the stone resulting in rounded and blurred details. This condition occurs predominantly in the area of the pilasters.



Figure 36. Erosion

Flaking

Surface Area: 8,326.95 cm²

10%

The detachment or loss of small thin flakes of stone not necessarily in association with bedding or stone orientation. This condition occurs throughout the window surround in localized areas. The predominant area of flaking is at the base and pilasters. There is evidence of a surface patination which is flaking in all areas of the window revealing a whiter stone beneath. Flaking is linked to weak interfaces in the microstructure of the stone, the presence of water which erodes clay cementing agents, and salt crystallization.

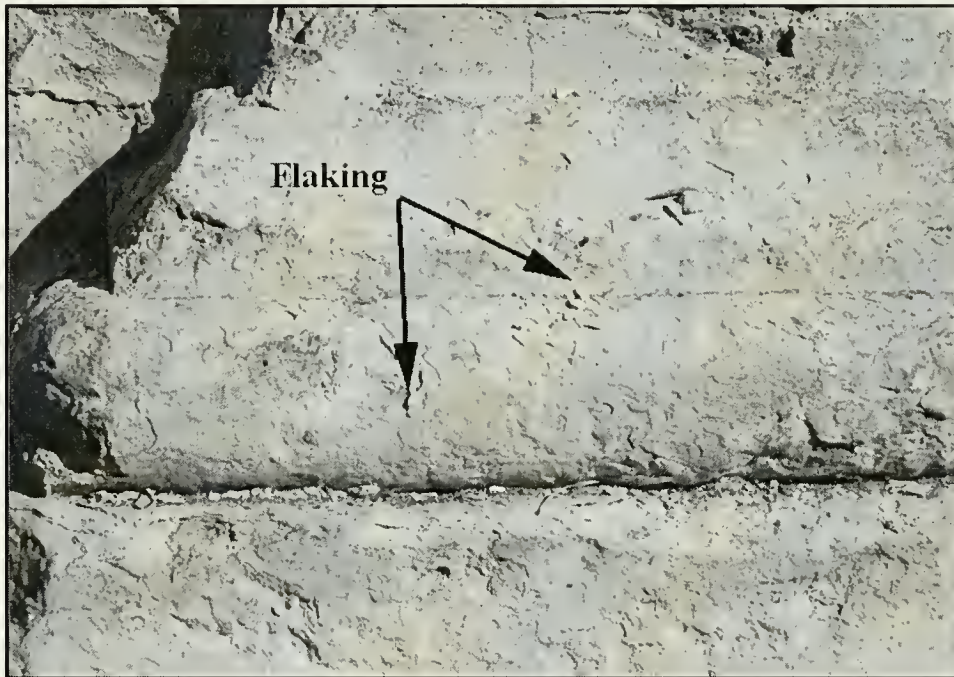


Figure 37. Flaking

Graffiti

Man made inscriptions carved into the surface of the stone or markings on the surface with graphite or ink. This condition occurs throughout the areas accessible without the use of a ladder, primarily on smooth surfaces in the lower section of the window surround.¹⁹⁷

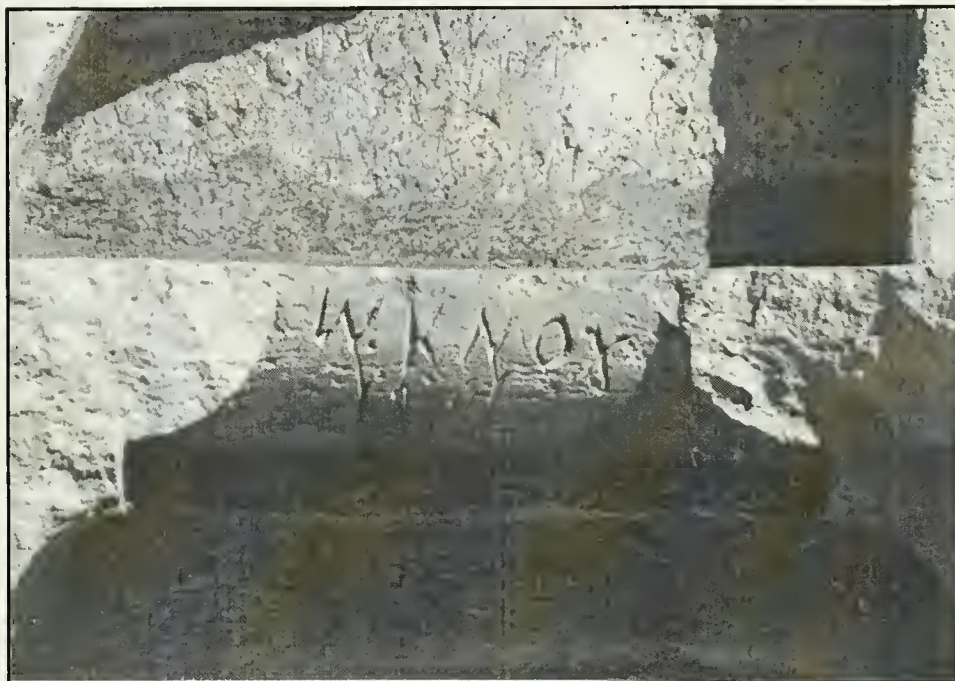


Figure 38. Graffiti

¹⁹⁷ Graffiti was not noted on the graphic survey and due to its nature can not be quantified.

Loss

Surface Area: 5,167.74 cm²

6%

Absence of original material as judged by the incompleteness of form or decoration. This condition occurs throughout the window's central section and is evidenced by missing corners of architectural molding, scrolls, flowers, other ornament and general loss of stone surface. This is a symptom regardless of cause.



Figure 39. Loss

Pitting

Surface Area: 2,620.64 cm²

4%

Existence of small cavities in masonry surface caused by a differential loss of individual components or the result of natural weathering or erosion. This condition may also be the result of a harsh abrasive cleaning method and the stone's microfabric. This condition occurs primarily as the differential erosion of the micro-crystalline matrix, leaving the harder calcium carbonate skeletons in the limestone behind. Pitting occurs predominately in the lower area of the window adjacent to the pilasters.

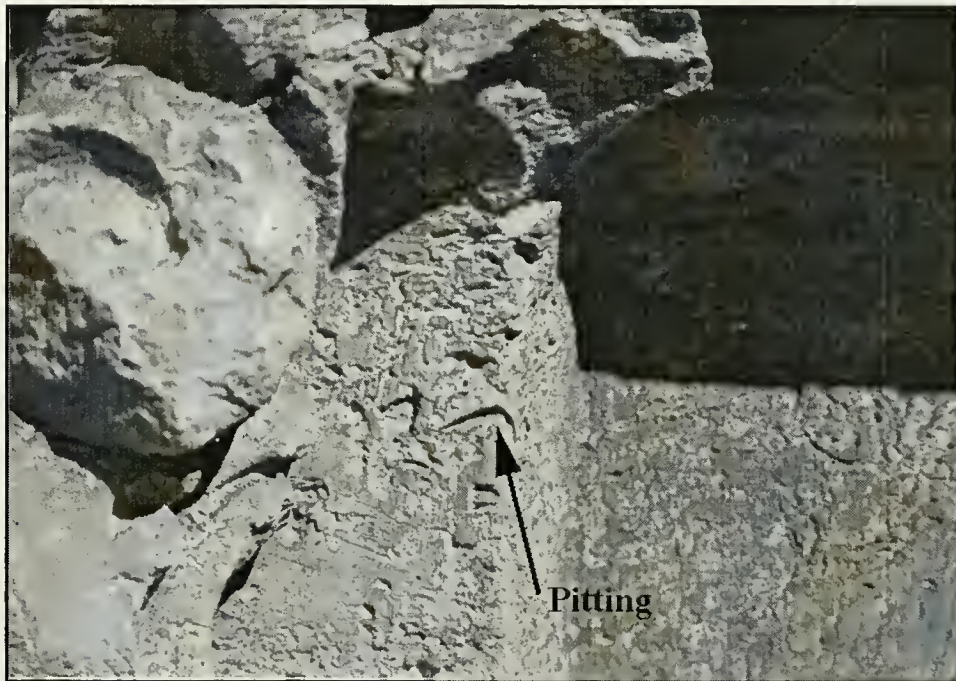


Figure 40. Pitting

Previous repairs

Surface Area: 5,919.81 cm²

7%

Subsequent alterations made for structural or aesthetic reasons, including stone replacement, composite repairs, repointing and protective finishes. Several repair campaigns have been noted for varying color and hardness, however, they cannot be linked with specific dates.

- (1) White composite repair which matches color of stone (Munsell 2.5Y/8/2) located throughout window surround; attributed to Lenarduzzi repairs in 1948.
- (2) Buff cementitious repair (Munsell pale yellow 2.5Y/7/4 to very pale brown 10YR/8/3); Should date to post 1950. Similar in character to the cementitious protective wash covering the pilaster bases. *See Chapter 4 - Mortar Analysis-(SW07).*
- (3) Gray repointing mortar- grainy, coarse; used only at pilaster bases; post 1950.
- (4) Red sandstone- similar to stone used for reconstruction of Indian quarters; post 1950.
- (5) White lime mortar, used only at right pilaster base; post 1950.
- (6) Dark gray cementitious repair- used only at left pilaster base; post 1950.
- (7) Buff repointing mortar- used to fill cracks at the top of the window; Ford Powell & Carson, early 1980's.
- (8) Repointing mortar-used primarily surrounding the window adjacent to calcareous tufa blocks, also used to repoint walls of the church; Ford Powell & Carson, early 1980's.

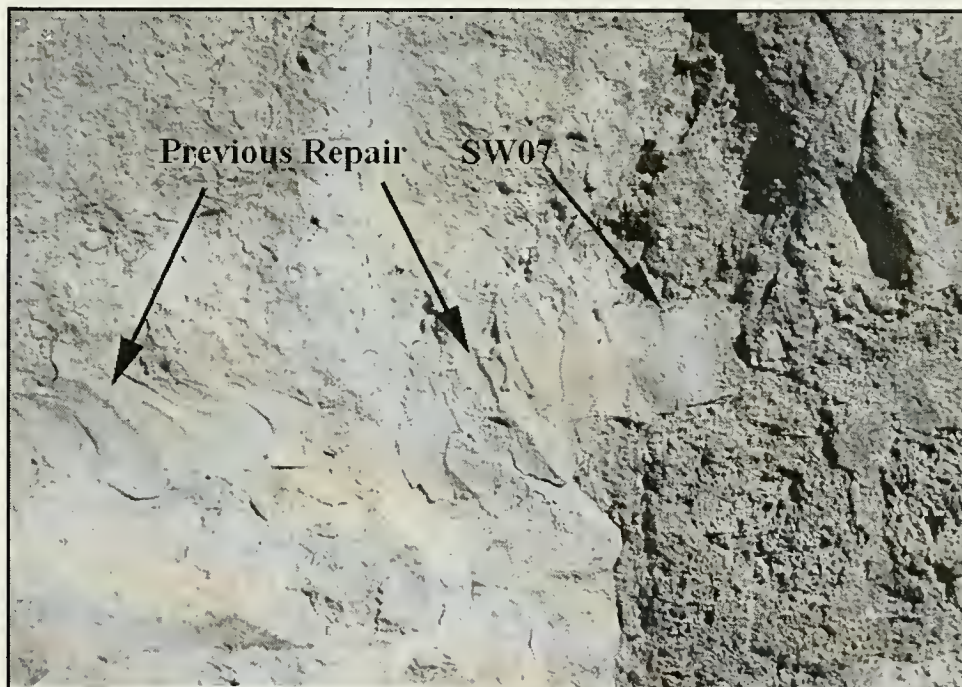


Figure 41. Previous repairs.

Staining

Surface Area: 206.4 cm²

less than 1%

Discoloration of stone due to ferrous ions in the rainwater runoff from the wrought iron grill above. Composite repairs under the window surround exhibit a purple staining of an unknown source. Metallic staining at the base of the pilasters may be attributed to accessory minerals such as pyrites or limonites in the stone, a characteristic of chalk from this region.



Figure 42. Staining

Surface Patina

Area of stone which appears to have a surface finish or patina of a darker color than the stone underneath it. This condition may be caused by the oxidation and hydration of ferrous iron in the stone.¹⁹⁸

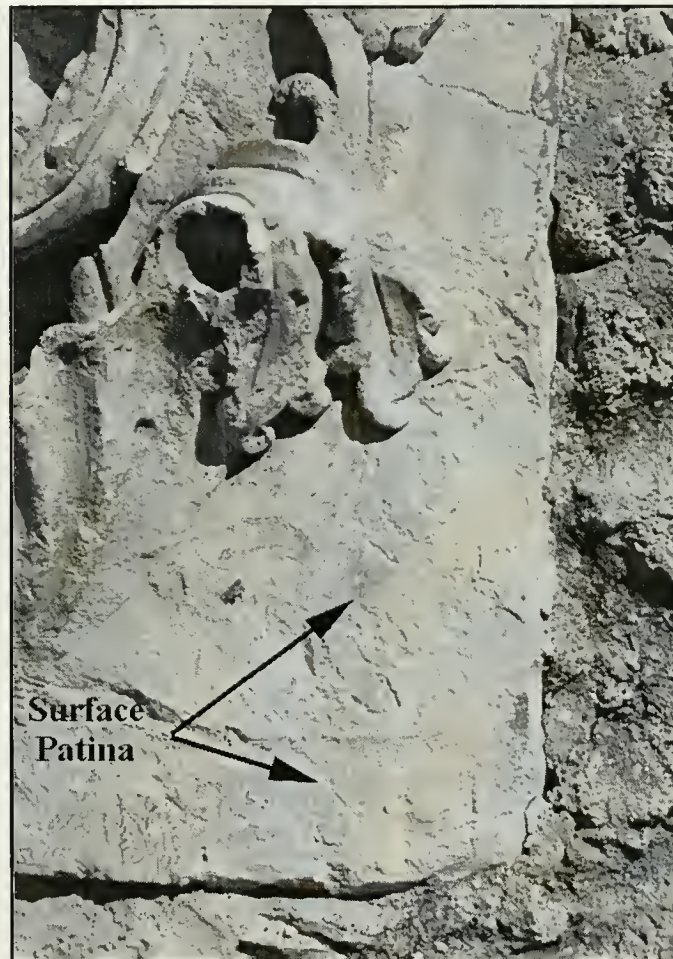


Figure 43. Surface Patina

¹⁹⁸ Winkler, 109. This condition was not indicated on the graphic survey.

Surface Tooling

Areas of original tooling still extant on the surface. Tool marks occur primarily in the flat areas between pilasters. Tooling marks suggest that a saw may have been used to cut the stone blocks.



Figure 44. Original surface tooling marks visible in the area between the center and right pilaster.

4.3 Condition Assessment

The overall condition of the stone in the Sacristy window is relatively good considering its age and the softness of the stone used in its construction. The upper areas of the window are in better condition when compared with base. Exceptions include localized delamination and biological growth on the elements which project primarily from the top of the window. The heaviest concentration of deterioration occurs at the base of the window. The base of the window exhibits flaking, delamination, and efflorescence due to migration of soluble salts. The high percentage of deterioration at the base is due in large part to the fact that approximately two and a half feet was below grade until 1950, which served to exacerbate conditions of water infiltration and rising damp. The excavation of grade also caused the masonry at the base to dry out, a condition favorable for the crystallization of salts. Efflorescence occurs only at the base which suggests that the salts are coming from a) the ground, b) impurities from repairs in this areas, c) pyrites in the stones below, and/or d) burials in the area. Most areas of efflorescence occur directly adjacent to previous repairs and could be occurring because the moisture is re-directed to the less dense and more permeable stone contiguous to repairs.

Several different repair methods were tried at the base of the window. Many of the mortar repairs, for repointing or compensating losses in the stones, used hard, dense materials, incompatible with the stone. Many different repairs were noted due to their varying color and hardness as outlined in the glossary. The predominant patching material which has been used extensively at the base of the window, is a buff cementious

mortar, which is considerably harder and denser than the stone around it. The mortar analysis conducted by the author to characterize its constituents, suggests that this a lime-cement based mix, pigmented to match the stone. Since the window is located on the south side of mission where it experiences wide ranges in temperature fluctuation, it is important to use materials with similar water absorption and thermal expansion coefficients . It is likely that the harder cementitious repairs are restricting the expansion of the softer limestone blocks and causing internal stresses within the stone. It also appears that this same repair mix was carelessly installed over areas below the pilasters after they had already achieved a considerable degree of loss. The application onto a delaminated substrate aggravated the problem. The intent of this cementitious wash may have been to protect the stone from further deterioration. The surfaces where this protective finish was applied are now delaminating, taking layers of stone off with it. It is likely that this hard surface coating is trapping water vapor and salts behind it, and will continue to cause further decay of the stone. Unfortunately, there is no written documentation of this repair, but its location suggests that it would have to have been applied after the 1950 excavation of the base of the window and there are similarities between it and a mortar specified in 1988.

The most serious condition observed at the Sacristy window is delamination. In all cases, delamination is due to face bedding of the stone, but is made worse by salt crystallization. Face bedding occurs predominantly in the four stone blocks which form the pilasters at the base of the window. Face bedding also occurs in other places as well, depending on how the size of the extracted stone could be best utilized in construction. Cracking and delamination may also be caused by freeze-thaw cycles. Although the

climate of San Antonio is relatively mild, freezes occur and there is often a significant fluctuation in daily temperatures.

Flaking is the most prevalent condition affecting the limestone. In some areas, flaking occurs directly adjacent to previous repairs. However, flaking has occurred chronically in the area at the right side of the window surround, which displayed losses as early as 1895. Therefore, its deterioration may be linked to an inherently weak stone and bedding failure, not just to the adjacent repairs. Flaking on the right side of the window may also be the result of water flow from the faulty parapet design above. While flaking at the base of the Sacristy window is related more directly to previous repairs, it is also influence by years of being below grade, absorbing salts from the ground, and being in contact with a clayey sub-soil which retains water.

Pitting, erosion and loss are also affecting the stone. Pitting is occurring in the recessed areas and is linked to the use of a more fossiliferous stone. Pitting occurs more in the fossiliferous stone used at the base just below the window surround. The loosely cemented matrix within the fossil is easily eroded as mentioned in the characterization of the stone in Chapter 3. The stone used in the upper portions of the window is composed primarily of micro-fossils and does not contain as many large zones of weakness which result from larger fossil inclusions. Erosion of the fossiliferous limestone occurs in areas which are not recessed or protected by protruding moldings. For example, erosion is occurring on the pilasters because they are protruding elements which are not sheltered from rainwater and wind. The pilasters are also face-bedded which exacerbates their deterioration. Losses are due in part to weak zones in the stone, but could also be linked to vandalism, as revealed in the historical documentation. Some areas where loss has

occurred appear friable and disaggregating, exhibiting a loss of grain to grain cohesion, while other areas of loss have regained a smooth surface texture. Abrasive cleaning methods on the Sacristy, which utilized water under high pressure, may have accelerated these forms of deterioration.

Minor surface conditions observed at the Sacristy window include biological growth and staining. Biological growth appears to be taking advantage of the presence of water and delamination caused by the face bedding of certain blocks, which allows growth to occur in between layers of the stone. Biological growth also occurs on the top of projecting elements which have more direct contact with water, i.e. the cornice and carved flowers. Due to the projecting profile of the cornice, biological growth is also visible in areas where rainwater flows to either side of the cornice. These areas, however, show no noticeable damage, except in the block which is also face bedded. In another example, the cornice appears to have been oriented correctly, and although it is adjacent to repairs and is covered with biological growth, it remains in sound condition.

Staining of the stone is linked to the ferrous ions in rainwater runoff from the wrought iron grill above where the staining is occurring. Staining at the base of the window, appears to be inherent in the stone itself, possibly pyrites within the stone, which are characteristically found in Austin chalk in this region. Although the conditions of biological growth and staining might be considered problems for aesthetic reasons, they do not appear to be causing serious damage. These symptoms, however, reveal factors, such as sulfate salts from pyrites, which may be causing actual damage.

The most serious problems, therefore, are directly related to the characteristics inherent in the composition and micro-fabric of the stone. The differential erosion is

linked to the heterogeneous composition. Different porosities, as revealed in the water absorption tests, reveals that some areas may have a higher content of clay cements which could influence the stone's density and durability. The orientation and placement of blocks also predetermined how well these blocks would weather environmental conditions. While face bedding is the most serious of these factors; whether the block is recessed or protruding, at the top or bottom of the window, and its relation to water flow from above, also greatly affects its resistance to deterioration. External conditions such as the rising and subsequent excavation of grade have also influenced the deterioration of the lower zone of the masonry.

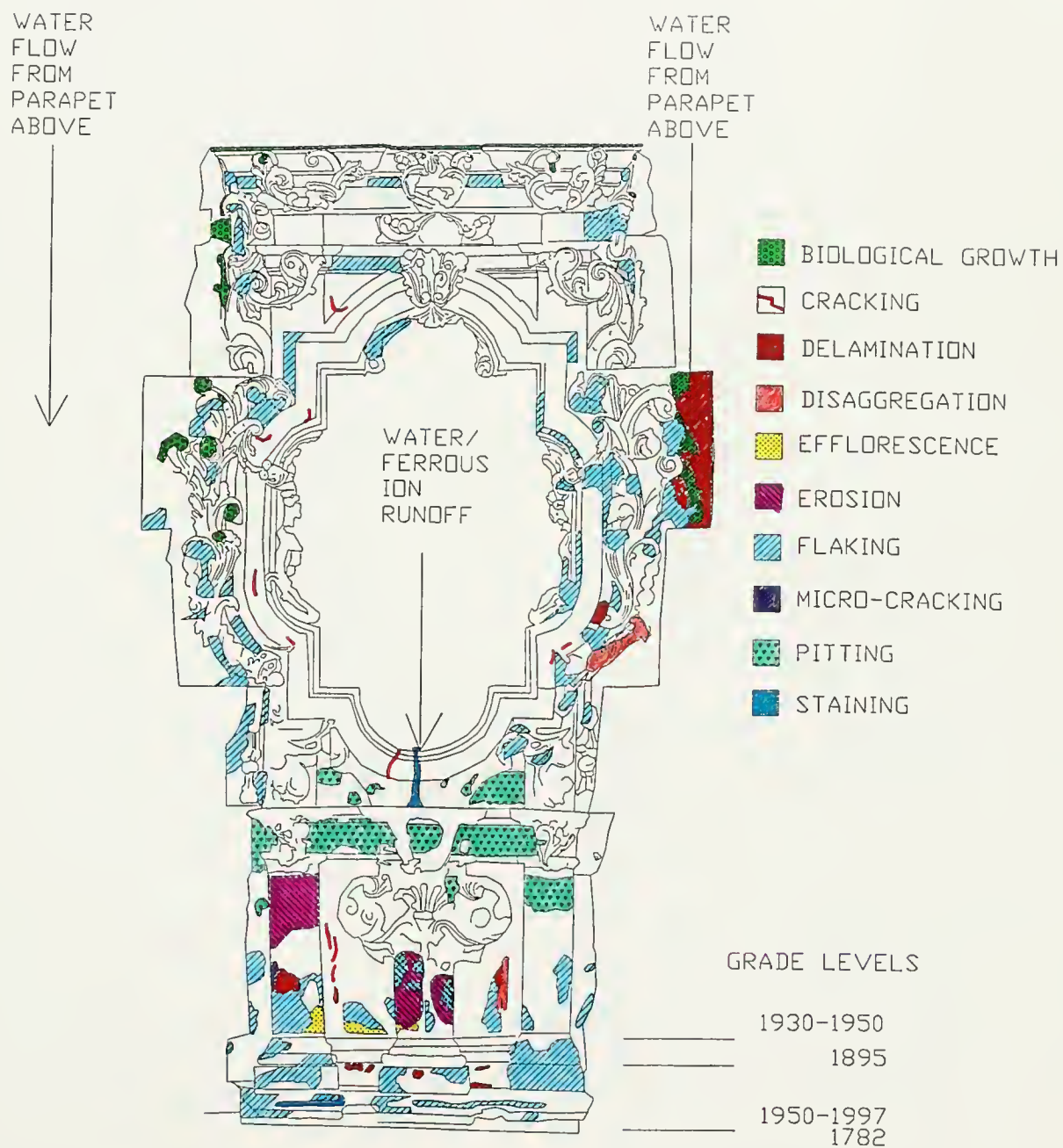


Figure 45. Graphic Documentation of Conditions in January 1997.

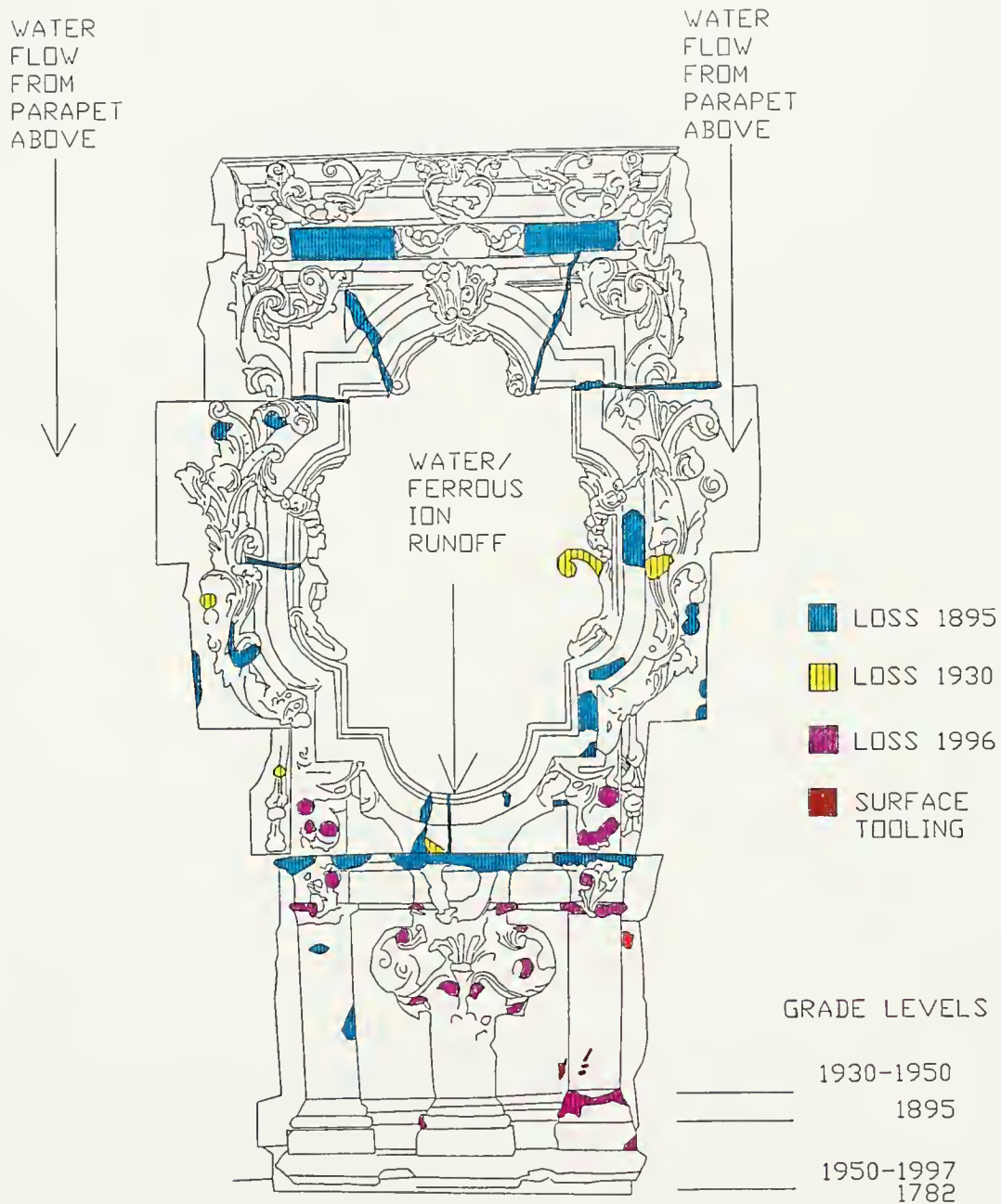


Figure 46. Graphic Documentation of Losses as of January 1997.

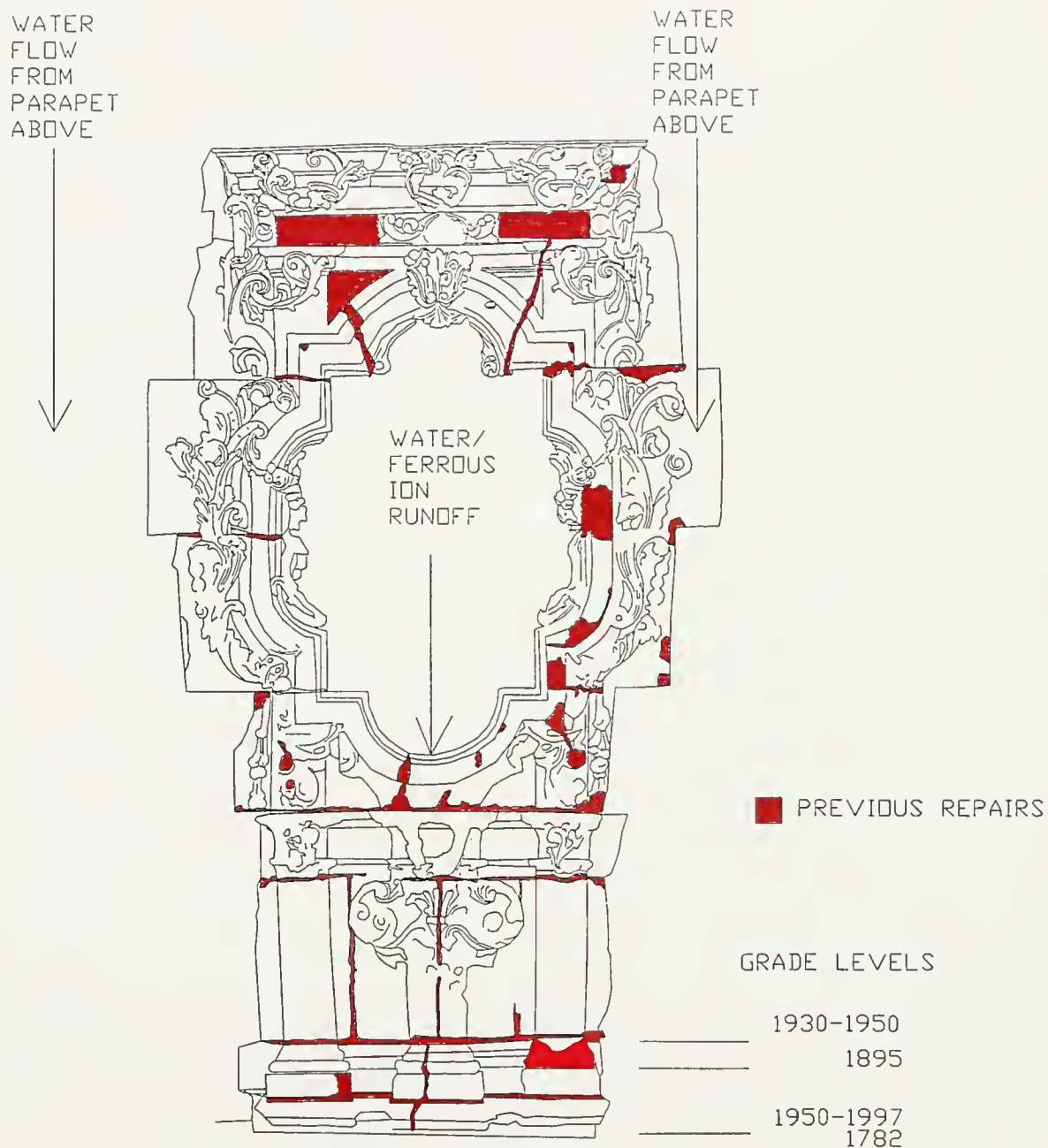


Figure 47. Graphic Documentation of Previous Repairs in January 1997.

CHAPTER 5. RECOMMENDATIONS

5.0 Introduction

The following recommendations are intended as a general programmatic guide to remedial and preventative treatments for the conservation of the Sacristy window. The research of specific treatments, such as materials and techniques for consolidation were beyond the scope of this investigation.

5.1 Emergency Stabilization

As soon as possible, areas where flaking and delamination are actively occurring should be temporarily stabilized with facings to avoid further loss. This could be accomplished with the use of wet-strength tissue which would be fixed with a reversible adhesive which is not soluble in water. Temporary facings in these areas would stabilize the active decay while conservation planning is underway. Overall protection from the weather could be achieved by constructing a temporary shelter over the window, however this option is probably not viable.

5.2 Conditions to be rectified before treatment

The issue of water infiltration should be remedied before proceeding with any treatments. The high water table, slope of the grade, and clayey sub-soil are problems which are difficult to remedy without a major intervention. Altering landscaping or slightly changing the grade on the south side of the mission could help moisture infiltration from rising damp. The problems which have occurred with the *canales* and parapets should be checked again to make sure that these forms of water infiltration have been corrected. Existing drains should be cleared out if necessary. Data and continued

inspections of the gauge which is monitoring the crack in the upper right corner of the Sacristy window may also be helpful information to have before continuing with treatments.

5.3 Treatment recommendations and future research

5.3.1 Cleaning

Cleaning of the stone should take place before treatment. However, if the surface is too friable, preconsolidation before cleaning may be necessary. Soiling is obscuring the surface of the stone and will effect treatments. Cleaning methods should be avoided which incorporate abrasives, chemicals, large amounts of water, and high pressure. Cleaning tests should be performed to determine what is the least amount of contact that will produce the desired result. The stone should be allowed to dry out before any treatments are applied. Poultices could be tested for their effectiveness in removing salts, biological growth and rust staining on chalk. These latter conditions do not appear to be a significant factor in the deterioration of the stone, but would be more for aesthetic reasons. Cleaning is very subjective, often resulting in a partial cleaning rather than a wholesale cleaning which is obviously more desirable.

5.3.2 Preconsolidation and Reattachment

Flaking is the predominant problem occurring with the Sacristy window, consolidation can not be accomplished, if it is deemed necessary, until the flaking is adhered to the surface. An adhesive should be used to adhere these flakes which will allow consolidation to continue afterwards, if it is deemed necessary.

In the conservation of the Convento column at Mission San José, Brackin (1994) successfully applied facings of Japanese tissue with 7%-15% solutions of an acrylic resin

(Acryloid B-72) in a 1:1 mixture of xylene and toluene to protect fragile areas. A 15 % solution was used to bridge microcracking. Friable surfaces were preconsolidated with the same solution applied in increasing strengths from 3.75%-7.5%. Consolidation then followed with an ethyl silicate (Conservare Stone Strengthener OH) and a methyl trimethoxysilane water repellent, Dow-Corning Z-6070 .¹⁹⁹ A similar phased process should be considered for the conservation of the Sacristy window, pending the success of laboratory and field tests.

5.3.3 Removal of Incompatible Repairs

The removal of previous repairs which are incompatible with the stone should also be considered. The fills, in the window surround do not appear to be causing serious damage, and the documentation indicates that there has been an effort over time to replace these with compatible mortars. However, the repairs, in the form of a cementitious wash over the base is of more concern. These repairs are trapping water vapor and soluble salts, causing the repairs to spall off. The hardness of this repair is also causing mechanical stresses on the stone. From a mortar sample which was taken from this area, it is clear that the friable stone surface is mechanically adhered to the mortar. The dry removal of this cement wash will clearly take stone off with it. The stone surface behind this repair has weathered past the original surface. Over the course of time, such repairs will eventually be lost and continue to cause spalling and the introduction of soluble salts. If mechanical removal of this repair is judged necessary, it must be done with the utmost care, damaging as little of the substrate as possible.

¹⁹⁹ Brackin, 106.

The removed fills should be replaced with a soft lime mortar which has a porosity similar to that of the stone and which is easy to remove. They will, however, need to be maintained in order to remain effective. The additional use of a lime shelter coat and various techniques of lime treatments could be an alternative to chemical consolidants and organic polymer water repellents.

5.3.4 Desalination

Because salts are a major factor in the deterioration in the exterior and interior of the Sacristy, desalination techniques should be explored. Areas of efflorescence should be monitored and techniques such as water poulticing applied where salts appear as these will continue to recrystallize and cause damage. Consolidation treatments which allow salts to be drawn out after treatment is a primary factor to consider.

5.3.5 Surface Treatments and Future Research

Consolidation of the stone may only be necessary at the base and localized areas where the most serious damage has caused a loss of grain to grain cohesion within the stone. If consolidation is a consideration, a testing program should be initiated which tests the effects of consolidants on chalk, since it is a subject which is not represented well in the literature. Samples of Austin chalk from the San Antonio area should be compared with the stone that was characterized for this study. If they are similar in geological and chemical composition, samples of this chalk could be used to further characterize the stone, i.e., porosity, water vapor transmission, depth of penetration. An experimental testing program should be carried out on this stone, because is also applicable to other cultural resources in San Antonio, including the other mission facades. Samples of chalk could be treated with consolidants and left on the site for a minimum of

one year to monitor advantages and disadvantages to their use under local weathering conditions after they are proven in the laboratory.

The application of another surface protector, in the form of a water repellent is a quick solution which has been tried before, but raises several questions. What are the residual effects of several maintenance coatings over time? If the problems of rising damp and water infiltration are not stopped, water will continue enter and cause the crystallization of salts. Water repellents rarely help friable stone surfaces, which is a characteristic of much of the Sacristy window. They may cause more damage or make little improvement in these cases. Some surface treatments only penetrate a thin layer of the stone. If a surface treatment is judged necessary it should have good depth of penetration while allowing for the transmission of water vapor. It should not change the optical qualities of the stone as well.

5.4 Maintenance and Monitoring

Provisions should be made for regular inspections and documentation of the Sacristy window, in the form of photographic documentation and conditions survey. If any treatments are implemented, they should be monitored at appropriate intervals. Since water is a primary cause of deterioration, drains, gutters, flashing, roof membranes, and cornices should be checked regularly. A maintenance system must be established which is well defined. Regular maintenance is the most effective strategy for preserving the life of a building but only after the cumulative damages of past weathering and deferred maintenance are corrected. A preventative maintenance plan should be initiated rather than waiting for active damage to occur.

5.5 Conclusion

As of June 1997, two areas which were previously noted for cracking and delamination of stone are now losses. It is not known exactly when the pieces fell, however, the pieces at the base of the window had weathered significantly. The largest piece, which fell from the left pilaster, measured approximately four square inches and ranged from 1/2 to 1 1/4 inches thick and weighed 222.20 g. The smallest piece weighed 70.35 g. The left pilaster is composed of a highly fossiliferous stone which would have larger zones of weakness than the stone in the upper portions of the window.



Figure 48. Active decay found at base of Sacristy window in June 1997.

The newly exposed surface is covered with efflorescence, further illustrating the damage active salt crystallization is causing to the stone.

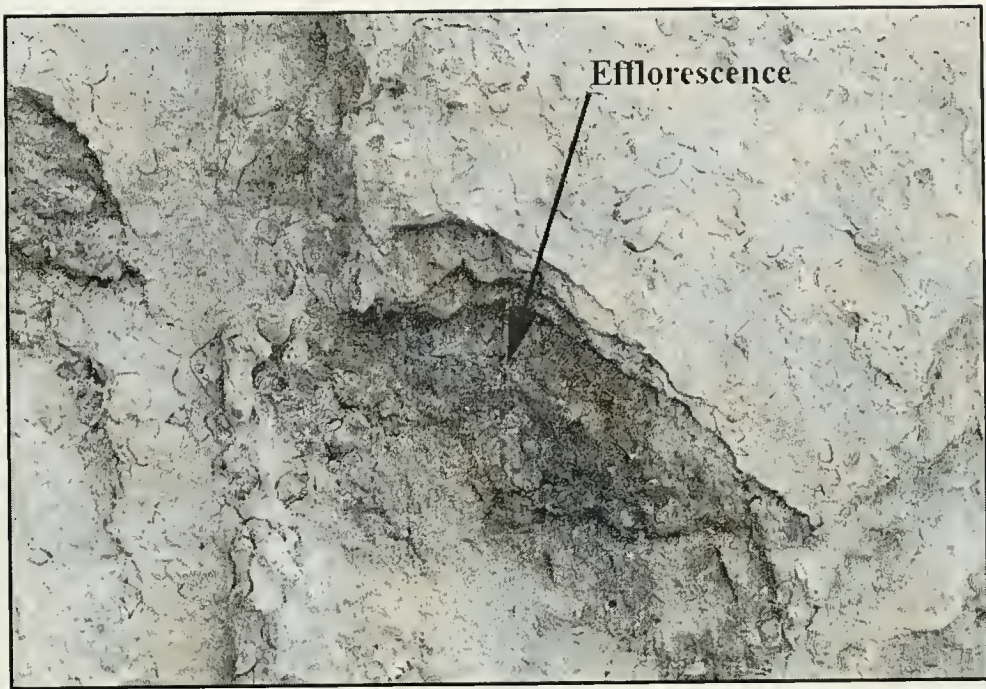


Figure 49. Detail of left pilaster in June 1997. This area can be compared with the photograph illustrating “Cracking” in the Condition Survey Glossary, which was a photograph taken in January 1997.

The general condition of the base of the Sacristy window is worse than was observed in January 1997 at the time of the Condition Survey. The left pilaster has increased surface areas which display a chalky white efflorescence. Increased flaking is also occurring in areas adjacent to the losses previously mentioned. The increased damage and the degree of change can be directly related to the abundant rainfall in San Antonio in the spring of 1997. As the author began making observations and photographing during an extended drought in South Texas, the changes over the summer, fall and winter of 1996 were minimal. However, the precipitation figures for the first six months of 1997, indicate that San Antonio has received 22.06 inches, while 15.57 inches

is the normal accumulation through June.²⁰⁰ The increase in the amount of water and the increase in the number of salt crystallization cycles has visibly affected the stone.



January 1997



June 1997

Figure 50. Left pilaster in January 1997 compared with pilaster in June 1997. Note the loss of material and increase in efflorescence.

In conclusion, both an expedient and effective course of action is needed. It is hoped that the characterization and condition assessment of the stone in the Sacristy window will lead those responsible for the care of this resource to take a serious look at providing an active approach to the conservation and maintenance of the carved stonework at San José.

²⁰⁰ KMOL News 4, Weathernet

APPENDIX I

HISTORICAL PHOTOGRAPHS OF SACRISTY WINDOW OF SAN JOSE

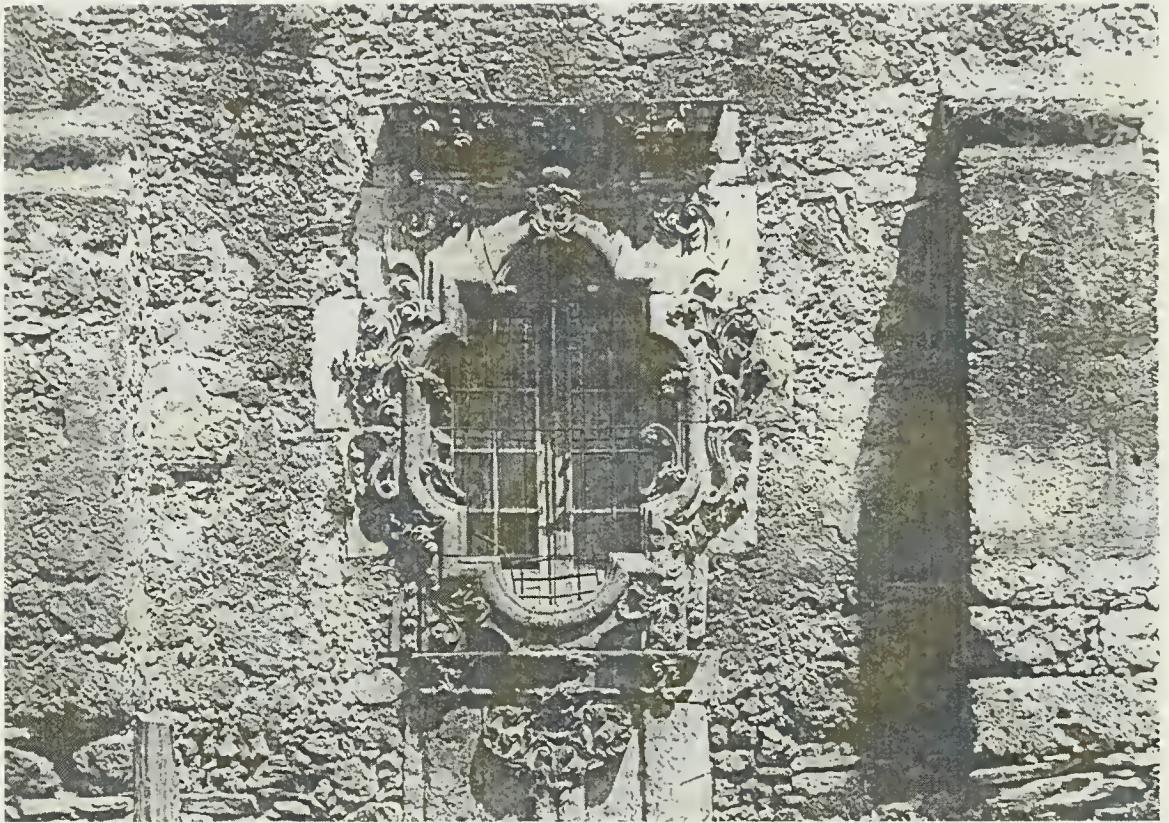


Figure 51. Early photograph of Sacrsity Window. The photograph is labeled 1920, however, the left side of the window shows scrolls which are absent from photographs in the 1890s. Ernst Schuchard Collection - Mission Scrapbook. Daughters of the Republic of Texas Library.

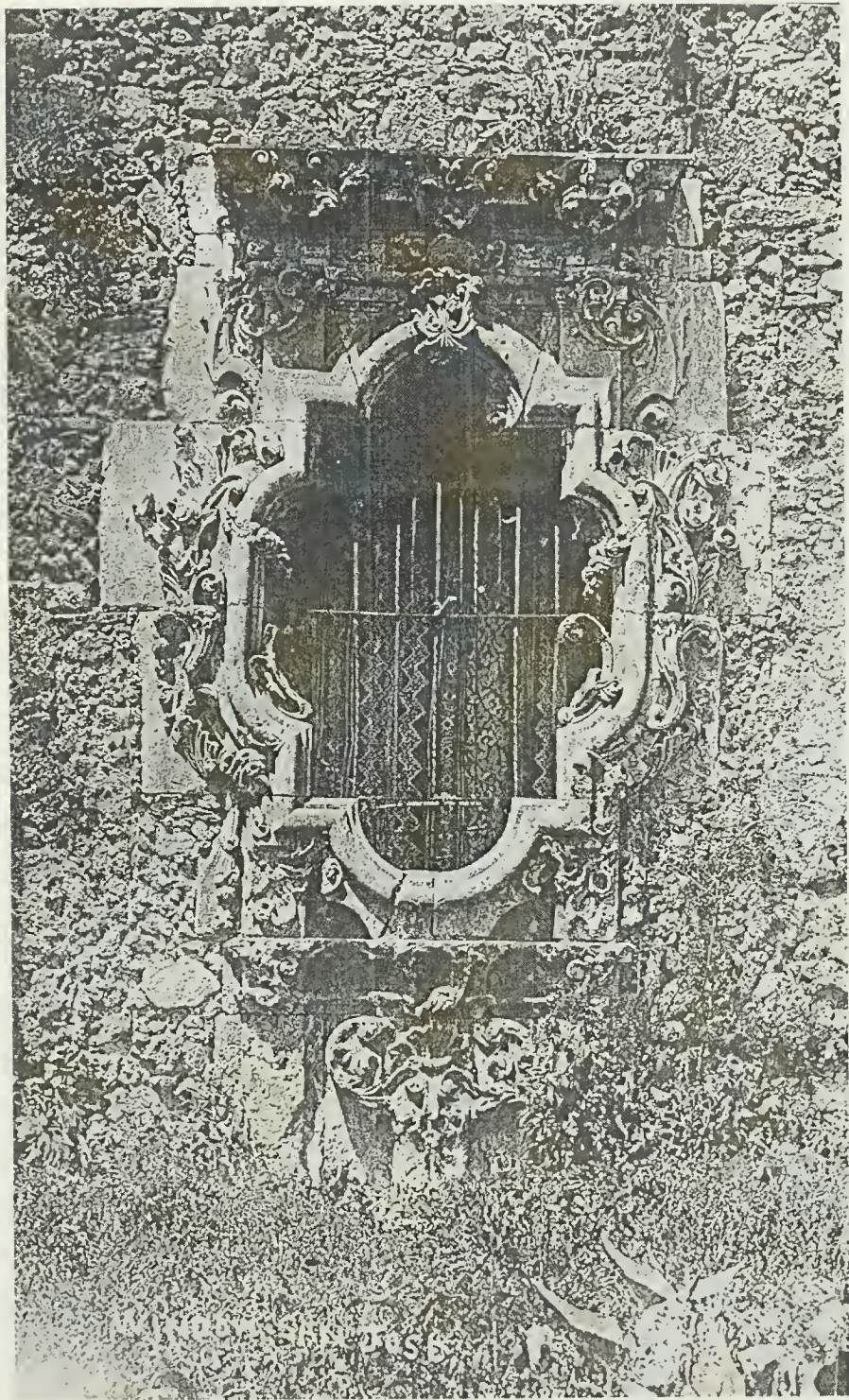


Figure 52. Sacristy Window, ca. 1890-1895. (Picture File, Mission San José Rose Window. Daughters of the Republic of Texas Library.)

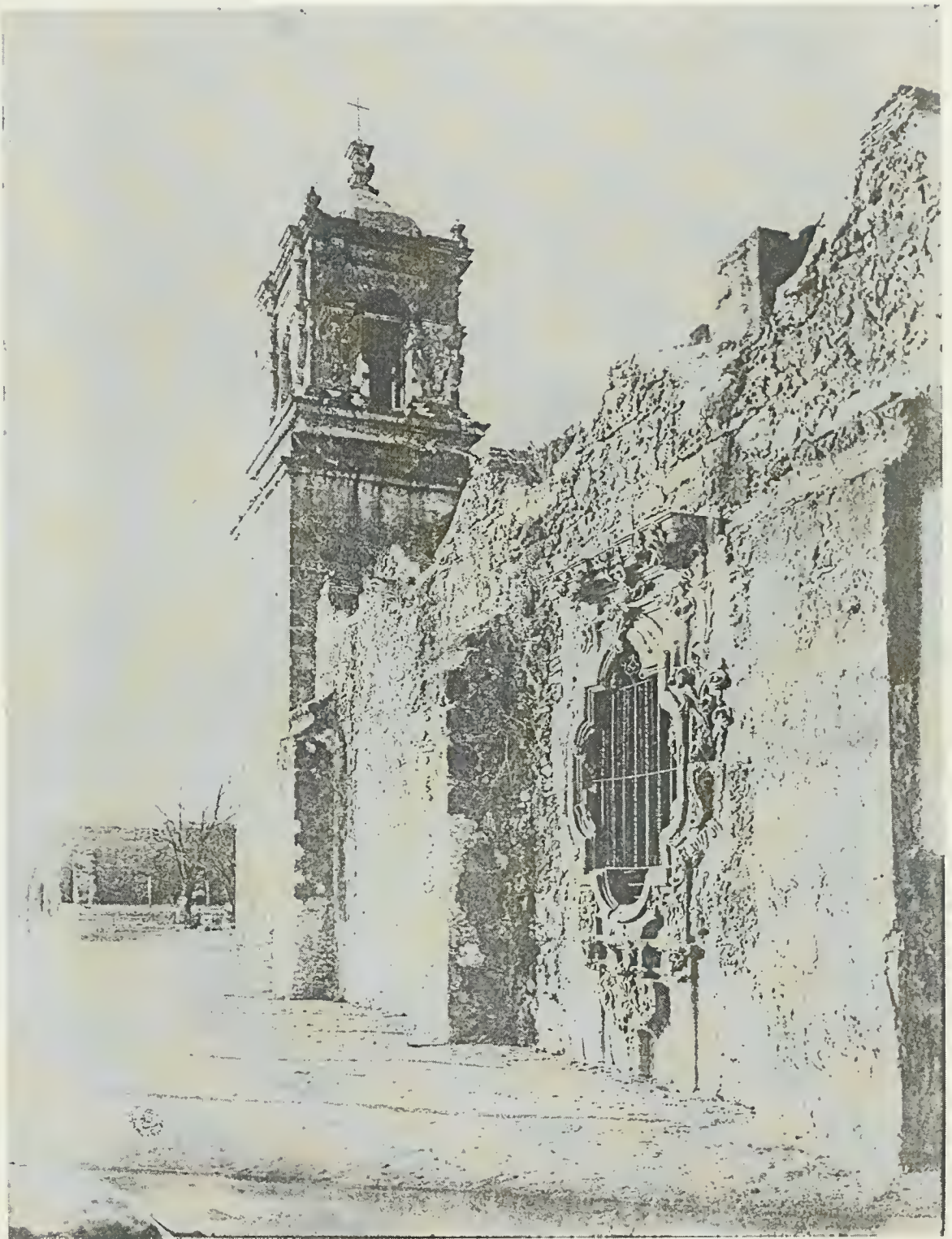
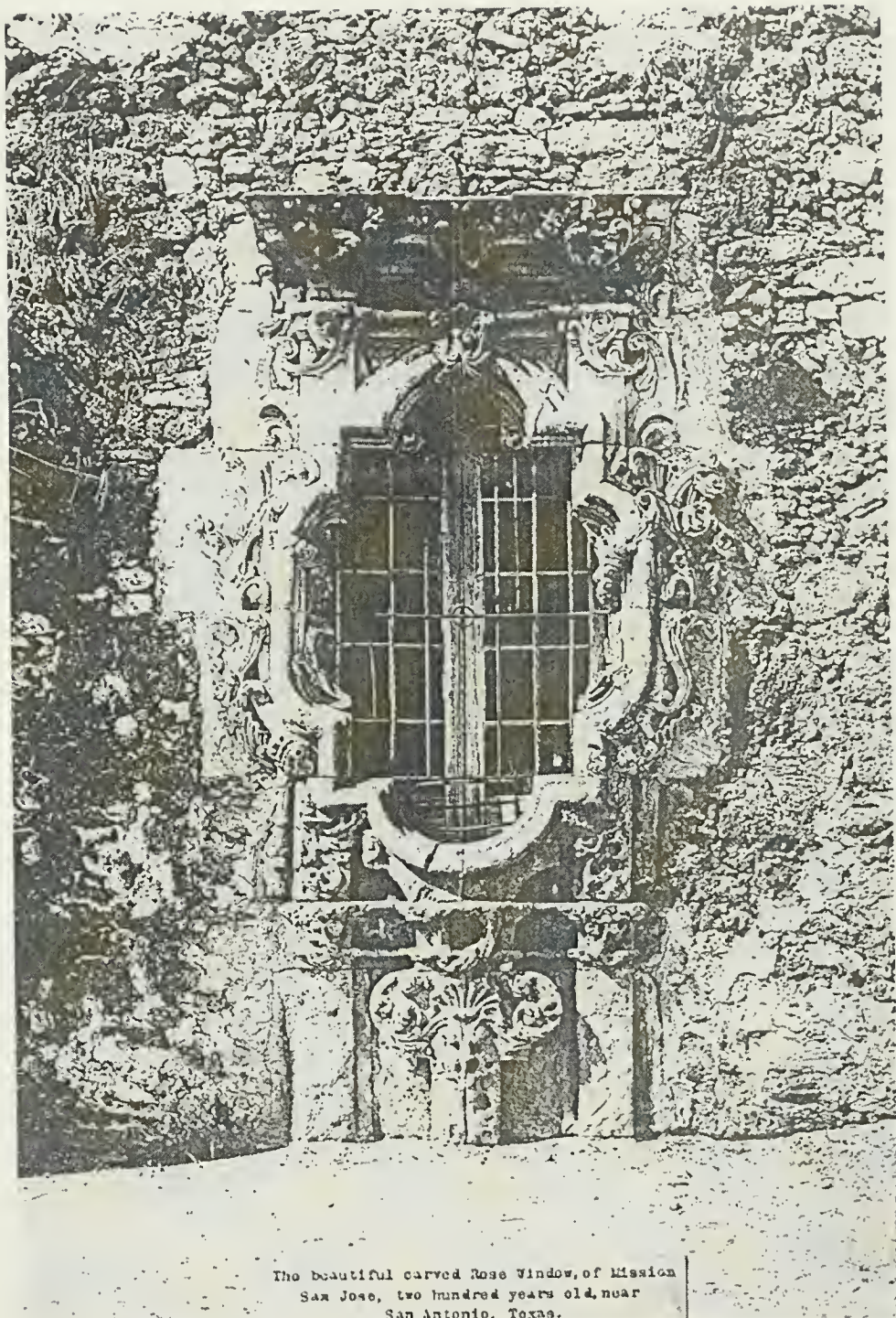


Figure 53. Sacristy Window, ca. 1912. (Picture File, Mission San José, C.O. Lee, photographer. Gift of Allen Richards. Daughters of the Republic of Texas Library.)



The beautiful carved Rose Window, of Mission
San José, two hundred years old, near
San Antonio, Texas.

*Figure 54. Sacristy Window, ca. 1930. (Picture File, Mission San José,
N.H. Rose Collection. Daughters of the Republic of Texas Library.)*

APPENDIX II

HISTORICAL PHOTOGRAPHS OF MISSION SAN JOSE FACADE

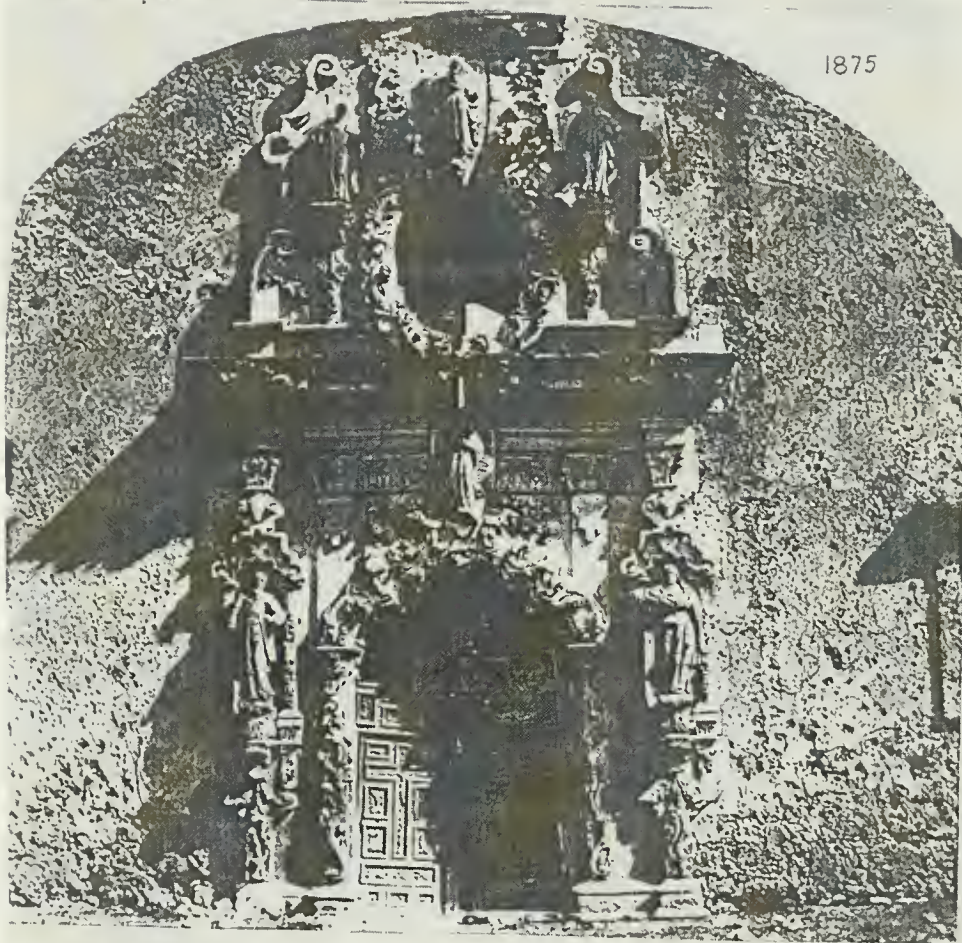
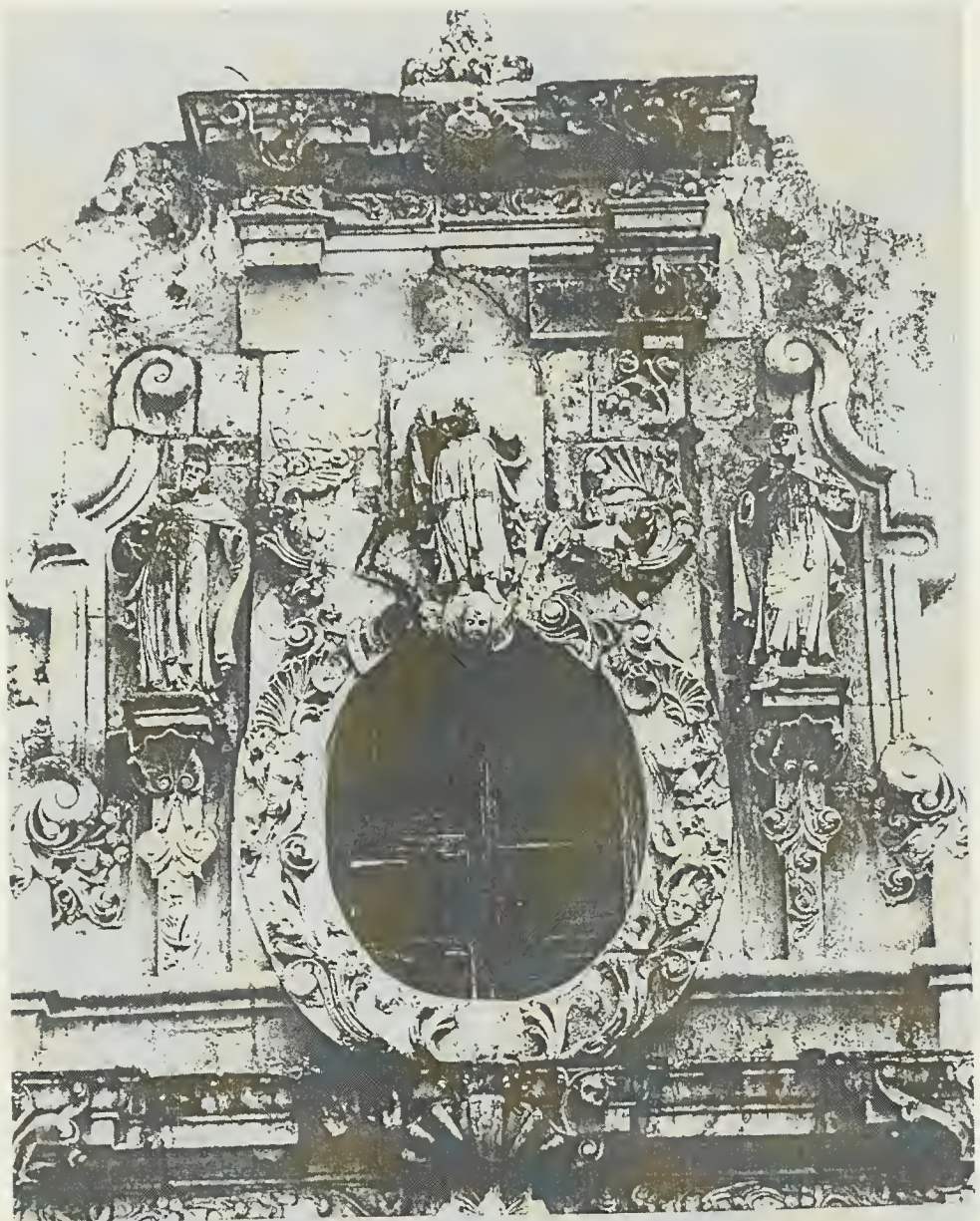


Figure 55. Facade, ca. 1875. (Ernst Schuchard Collection - Mission Scrapbook. Daughters of the Republic of Texas Library.)



1876

Figure 56. Detail of Facade, ca. 1876. (Ernst Schuchard Collection - Mission Scrapbook. Daughters of the Republic of Texas Library.)

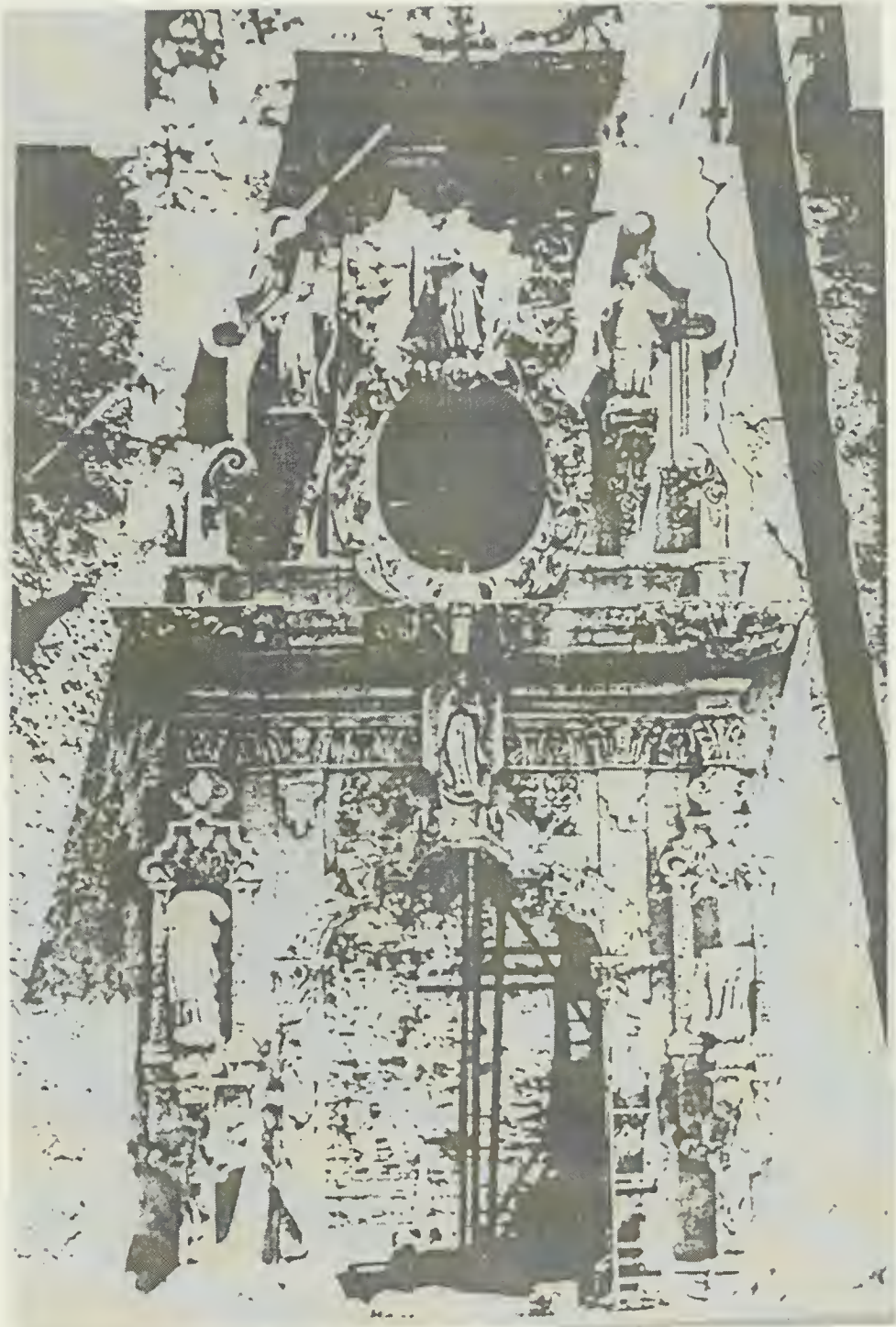


Figure 57. Facade ca. 1917. The shoring within the church represents the restoration project by Fr. Hume in 1917. (San Antonio Express-News Collection at the Institute of Texan Cultures, #69-8663).

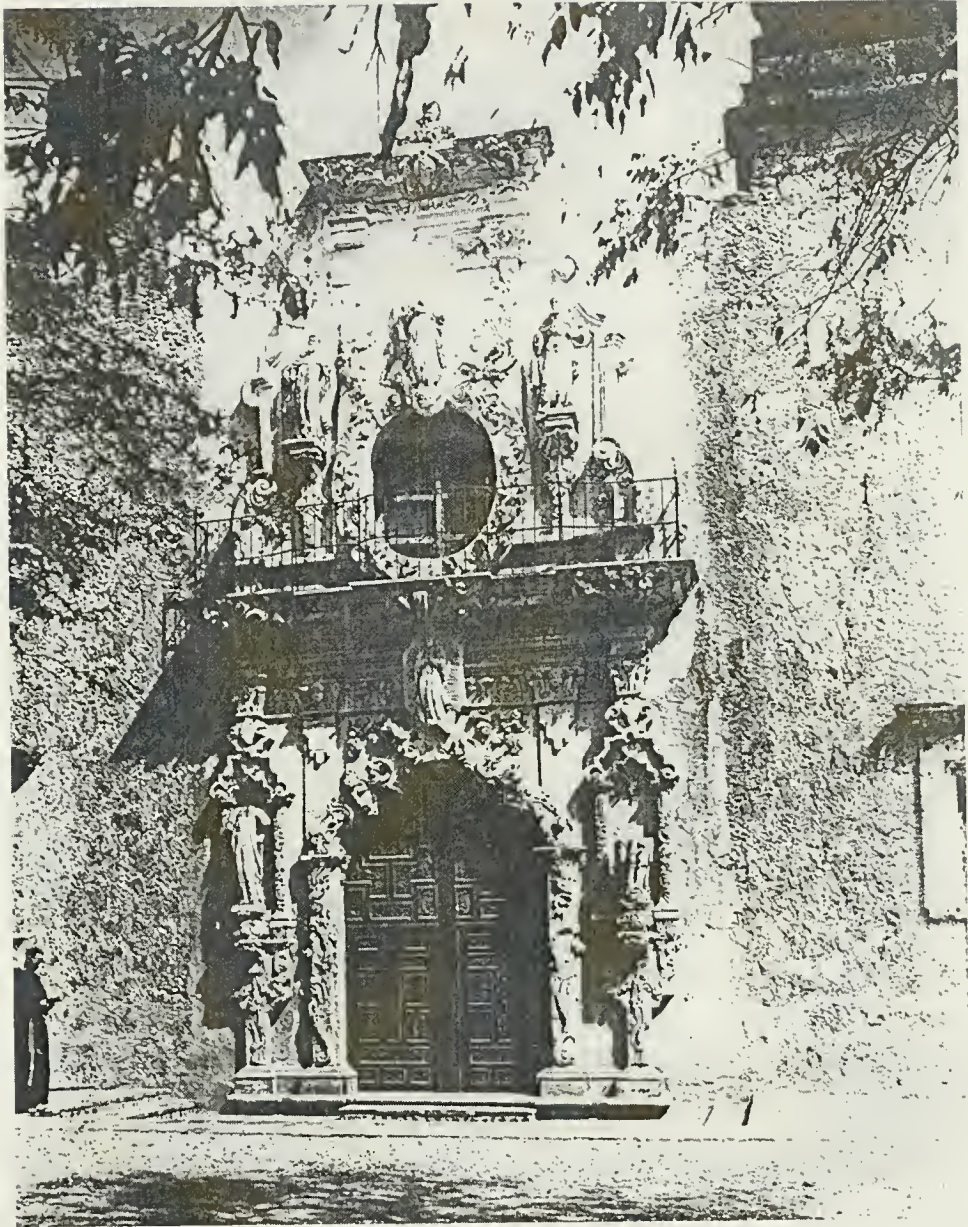


Figure 58. Facade in 1947, before Lenarduzzi restoration. (Ernst Schuchard Collection - Mission Scrapbook. Daughters of the Republic of Texas Library.)

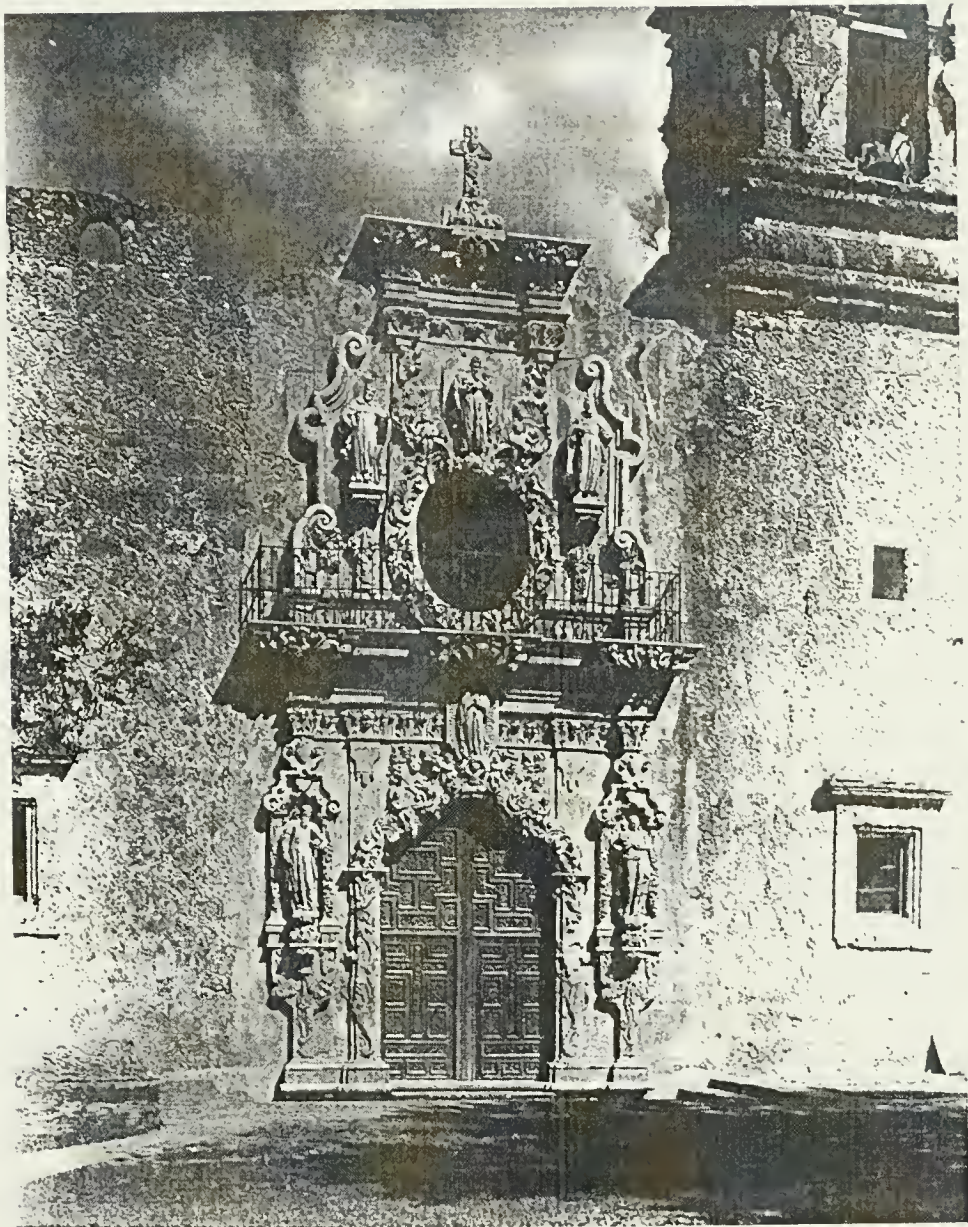


Figure 59 . Facade in 1949, after Lenarduzzi restoration. (Ernst Schuchard Collection - Mission Scrapbook. Daughters of the Republic of Texas Library.)

APPENDIX III
TRANSCRIPTIONS OF LENDARDUZZI CONTRACTS

CONTRACT FOR WORK ON FACADE AT MISSION SAN JOSE

I, E. Lenarduzzi, will do the following work according to the enclosed specifications and for the sum mentioned herein on the Mission San Jose, San Antonio, Texas:

- 1) I will begin this work as soon as the scaffolding in front of the Mission facade shall have been erected, and I will remain on this job, working six days a week, weather permitting, until it is completed. I will not obligate myself to work for anyone else until this work on the Mission shall be satisfactorily completed.
- 2) I will not remove or destroy any of the stone or sculptured work on the Mission facade, except for the inserted concrete slab described below in section 7.
- 3) I will make a new statue of the Virgin and Child [St. Anne] to stand on the right of the front door, except that portion of the original statue which is still intact. The new portion of this statue will be made to conform with the original as it appears from the old prints still available.
- 4) I will replace the arms and head of the figure that stands to the left of the front door.
- 5) In the Guadalupe group:
 - a) I will touch up the face of the statue of the Virgin;
 - b) I will sculpture seven new figures of the cherubs that surround the Virgin, saving extant portions of the originals;
 - c) I will re-work the festoon-carving surrounding this group insofar as this is possible without removing or damaging any of the original work.
- 6) As for the figures in the upper portion of the facade; I will carve a new head for the center figure and arms and hands where needed for the side figures. I will clean all three of the figures. I will replace the destroyed portions of the angel and shell at the side of this group.
- 7) At the top of the facade I will replace the missing cap and will re-work the five-foot frieze. Below the left cap, I will remove the inserted concrete slab and replace this with a new stone carved to conform with the intact portion. Below this stone, I will sculpture and replace the angel and shell.
- 8) Atop the top of the facade I will replace the angel and shell and re-work the four-foot square carving above the angel.
- 9) I will fix the molding in all the corners. I will rebuild the finiment on top of the facade, using brass 3/4" thick for pins and anchors.
- 10) Throughout this work I shall use only select Austin Stone, as approved by the Archbishop, Father Rihn and Mr. Rufus Walker.
- 11) Upon completion of the carving and touching-up, I will water-proof the entire facade, using Hydrozo water-proofing materials. This water-proofing will be applied by hand with a brush.
- 12) I guarantee first-class work, all complete, for the sum of \$2,750.00 This sum includes all materials, scaffolding, tools and labor.
- 13) Should I find in the course of this work that I will need any helpers, such helpers, should they work on Archdiocesan property, will be insured under Workmen's Compensation through the Chancery Office. I, as Contractor, will pay the premium for such insurance.

14) On the first day of each month, the contractor, after having submitted paid invoices and paid pay-roll, may collect 50% of that amount due to him up to that date. Upon completion of the job to the satisfaction of the owner, the balance due on this contract shall be paid.

Witness our signatures of this 2 day of March 1948.

E. Lenarduzzi
Contractor

Robert E. Lucey
Archbishop of San Antonio

CONTRACT FOR WORK ON ROSE WINDOW AND SACRISTY DOOR

AT MISSION SAN JOSE

I, E. Lenarduzzi, will do the following work according to the following specifications and for the sum mentioned herein at Mission San Jose, San Antonio, Texas:

1) I will begin work immediately after the signing of this contract and will remain on this job, working six days a week, weather permitting, until it is completed. I will not obligate myself to work for anyone else until the work herein specified shall be satisfactorily [sic] completed.

2) In re: Rose Window

The work of the Rose Window will be confined to those improvements that were approved by the Right Reverend Robert E. Lucey, Mr. Harvey Smith and Mr. Rufus Walker on the occasion of their inspection of the window on June 16, 1948, viz: the removal of the unsightly cement mortar around the borders of the window to be followed by the insertion of a mortar that will blend with the walls; the removal of the plaster slab under the cornice and the insertion of a solid block of limestone; the filling of cracks and crevices in the joints caused by the elements; the placement of a block of limestone at the base of the window. None of the carving on the window is to be touched. In this work I will be under the supervision of Mr. Harvey Smith and Mr. Rufus Walker.

3) In re: Sacristy Door

All of the decomposed blue shale is to be removed, preserving the original cornice immediately above the door. In its place a completely new doorway, molded and carved to conform to with the original will be erected out of the approved Austin limestone. Upon completion of this doorway, I will water-proof the entire surface, using water-proofing materials as approved by Mr. Rufus Walker and Mr. Harvey Smith. This water-proofing will be applied by hand with a brush.

4) I guarantee first-class work, all complete, for the sum of \$1,800. This sum includes all materials, scaffolding, tools and labor. This sum is to be paid upon satisfactory completion of the entire job.

5) Should I find in the course of this work that I will need any helpers, such helpers, should they work on Archdiocesan property, will be insured under Workmen's Compensation through the Chancery Office. I, as Contractor, will pay the premium for such insurance.

Witness our signatures of this 30 day of June 1948.

E. Lenarduzzi
Contractor

Robert E. Lucey
Archbishop of San Antonio

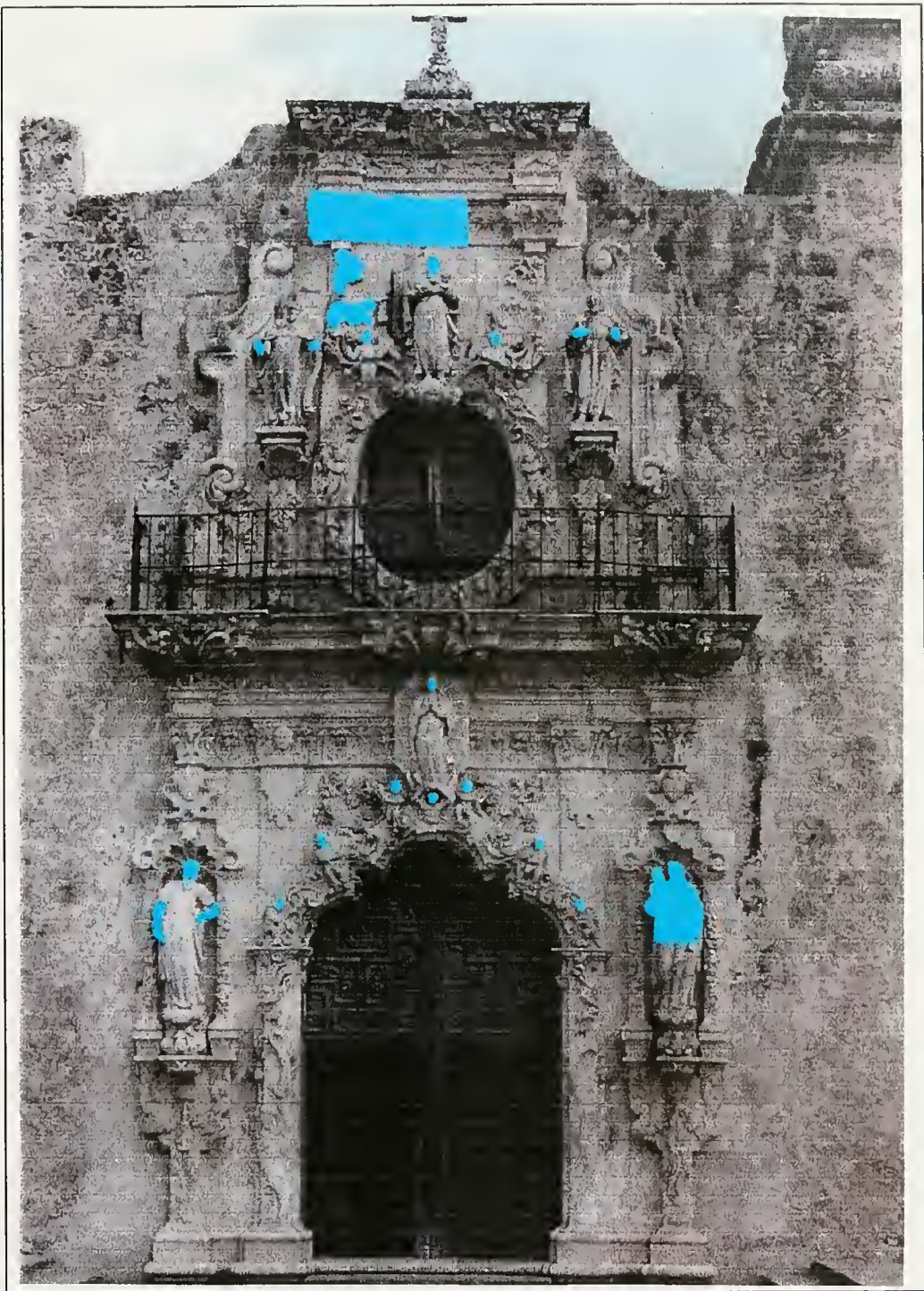


Figure 60. Facade of Mission San José showing areas restored by Lenarduzzi in 1948 using Austin Stone.

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ABBREVIATIONS USED IN DOCUMENTATION

ASA - Archdiocese of San Antonio Archives

DRTL - Daughters of the Republic of Texas Library

FPC - Ford Powell & Carson

NPS - National Park Service

OSMHL - Old Spanish Missions Historical Library

SACS - San Antonio Conservation Society Library

SAMNHP - San Antonio Mission National Historical Park

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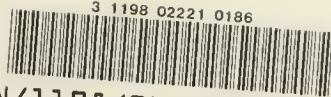


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