Chromatic reintegration: Color Matching Challenges in Polychrome Wooden Ceilings

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ABSTRACT

This paper presents a comprehensive study on the materials, manufacturing techniques, and conservation strategies used in the polychrome wooden ceilings and walls of the Church of Santa María de Cuevas in Chihuahua, Mexico, whose origin dates back to Spanish colonial times. It focuses on the chromatic reintegration process and the significant findings discovered during the restoration project. The renowned Italian technique of sottotono (lower color tone) was employed to establish color reintegration criteria, allowing for a clear distinction between restored and original paint in the ceilings situated 12 meters above the floor. The varying intensities of the original paint posed challenges, particularly in beam ceilings where achieving smooth variations was not feasible. Floral decorative motifs exhibited a consistent red-orange hue, while yellow displayed variations, especially in areas affected by water damage. The blue color, prominent throughout, exhibited notable variations in hue, with two different saturations observed. The restoration process revealed unique insights into the design techniques used and variations in motifs and spacing. These findings deepen understanding of materials, techniques, and conservation strategies employed in Spanish colonial churches in the region, providing valuable knowledge for future preservation efforts.

KEYWORDS Color restoration, chromatic restoration, blue indigo, Santa Maria de Cuevas, Chihuahua, Mexico, Jesuits, Spanish colonial missions.

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1. Introduction

For the past 25 years, collaborative efforts involving government and private sectors have focused on researching, conserving, and promoting Chihuahua, Mexico's cultural heritage, particularly buildings from the Spanish Colonial period and the 19th century. A key project is the conservation of the 17th-century mission church of La Asunción de Santa María de Las Cuevas, supported by national and international entities. In 2021, Misiones Coloniales de Chihuahua A.C. led the conservation of the church's polychrome wooden ceiling with support from the Eka Nawerame fiscal stimulus program and local community involvement. This project establishes standards for future preservation work, aiming to preserve the entire decorative scheme of the church.

1.1. *Geographic and natural context*

Chihuahua, the largest state in Mexico, spans an area equivalent to half of Spain, resulting in diverse climates and vegetation. Santa Maria de Cuevas, located in the state's central region, has a semi-dry climate with desert vegetation and underground water that feeds a stream flowing to the San Pedro River year-round. Summer temperatures can reach 35°C, while winter temperatures can drop below 3°C (CNA, 2024).

The region features large rock formations, canyons, and caves with pre-Hispanic rock paintings. Natural resources include lime, gypsum, limestone, quartz, barite, and magnesium. Vegetation mainly consists of cacti, mesquite (*Prosopis glandulosa*), and tascate (*Juniperus deppeana* and *Juniperus durangensis*), with nearby pine-oak forests also present (Economía, 2011).

1.2. *Historical context*

Historical records indicate that a mission visit was established in Cuevas by 1663, though there is no mention of a church at that time. The first record of a church appears in 1678 (Roca, 1979), when its construction is reported. Recent research, however, suggests that the current building was constructed between 1696 and 1700 by Jesuit missionary Luis Mancuso, who incorporated existing walls and initiated an architectural and artistic project. Mancuso commissioned painter Domingo Guerra to create a wooden ceiling and murals in the nave and presbytery, depicting the Assumption of the Virgin Mary. Guerra's signature, dated 1700, appears on the upper frieze of the presbytery. In 1753, the region's mission administration was transferred to the Archdiocese of Durango, and in 1758, Bishop Tamarón y Romeral moved the parish seat to San Lorenzo, leaving Santa María without a resident priest (Márquez, 2004). These historical insights clarify the timeline and significance of the church and its decorative artwork.

Fig. 1. Aerial view of the Spanish Colonial mission church of La Asunción de Santa María de Cuevas. (Photo: Misiones Coloniales de Chihuahua A.C., 2021).

1.3. *Social context*

The region where Santa Maria is located has a predominantly mestizo population, which refers to individuals of mixed European and Indigenous descent. However, there are also a few Rarámuri families living in the community. The economic activities in the area revolve around agriculture and cattle raising, with the availability of water playing a significant role in sustaining these activities. It is important to note that many families in Santa Maria have at least one member, or sometimes the entire family, living in the United States. These family members provide an important source of economic resources through remittances, which contribute to the community's livelihood and well-being.

The church holds a central role within the community's social and cultural fabric, promoting different activities that contribute to community strengthening. The annual Fiestas Patronales, celebrated on August 15th, in honor of the Assumption of the Virgin Mary, are particularly significant. During these festivities, a series of gatherings and dances are organized, including a Mass celebration and the traditional jaripeo or rodeo.

To ensure the maintenance and proper functioning of the church, a dedicated church committee is responsible for overseeing its upkeep and organizing activities for its benefit. These activities include various celebrations such as baptisms, first communions, and funerals. The members of the committee are chosen and assigned by the community, with new members being approved and appointed every three years. This community-led approach highlights the involvement and collective responsibility in preserving and cherishing the church as an integral part of their cultural heritage.

2. The polychrome wooden ceiling

The polychrome wooden ceiling of the Church of Santa María de Cuevas is a remarkable feature that sets it apart from other churches in the country. It is considered the oldest example of a mostly intact polychrome wooden ceiling in Mexico. The decorative surfaces in the nave and presbytery of the church are adorned with intricate figures and elements, each carrying its own iconographic meaning (Munoz-Alcocer *et al.*, 2016; Muñoz Alcocer *et al.*, 2017).

In the case of the baptistery, which is located to the far right of the east facade near the main entrance, it serves as a chapel that houses a recent sculpture of the Sacred Heart of Jesus. The fixed baptismal font is likely movable, indicating its flexibility for different ceremonies and needs.

The ceiling of the baptistery is composed of ten north-south beams of varying sizes, which are adorned with geometric vegetal motifs painted in yellow and blue, along with black lines. The sides of the beams feature flower and leaf patterns, adding an additional layer of decorative detail. The wooden panels between the beams are decorated with red four-petaled flowers and blue leaves. The spaces between these elements display red and green flowers framed by blue circles. This intricate and colorful design creates a visually striking and ornate ceiling. Similar to the rest of the church, the baptistery's ceiling is completed with a marbled-paint wooden cornice, providing a finishing touch that enhances the overall aesthetic appeal and cohesion of the interior.

The attention to detail, the use of vibrant colors, and the incorporation of organic and geometric motifs showcase the skilled craftsmanship and artistic expression that went into creating the polychrome wooden ceiling of the baptistery in Santa María de Cuevas Church.

2.1. *Materials & Techniques*

The materials and manufacture technique of the decorative surphaces of Santa Maria de Cuevas church have been studied in deep and in major context with other Spanish colonial churches in Chihuahua (Muñoz Alcocer, 2018). Multi-technical analysis of non-invasive and invasive techniques (Muñoz-Alcocer *et al.*, 2020) have determined the pigments and dyes used on the decoration of Santa Maria’s polychrome wooden ceilings and walls. In addition, for the purpose of the conservation project, new samples were taken and analyzed by the Laboratorio de Patrimonio Histórico to confirm the previews results (Table 1).

2.1.1. *Colorimetric study*

The portable Spectro 1 by Variable was used as spectrophotometer. It features an 8mm diameter measurement size, within a spectral interval of 10 nm, covering a range of 400 to 700 nm, using full-spectrum LEDs. The device measures in just 1.5 seconds and has a short-term repeatability of 0.05 ∆E00. Its inter-instrument agreement, tested on 32 ceramic tiles, is an average of 0.2 ∆E00, with a maximum of 0.5 ∆E00. The optical geometry is diffused, and it supports illumination types A, F2, D50, and D65, with 2-degree and 10-degree observers.

A avarage of 4 mesurments were taken by beam and panel base on the blue color hue of ceiling section. In addition comaparison masures were taken between the orginal polychrome and the restoration areas, before and after the color correction.

ANALYTHICAL STUDY	WOOD	GROUND	COLORS				
			(yellow)	(red)	(blue)	(green)	(black)
FORS XRF Optical Microscopy ATR-FTIR Spectrosco	Pine wood	Gypsum ($CaSO_4.2H_2O$) Hemihydrate $CaSO_4.1/2$ H_2O)	Yellow ochre Iron Oxide	Red ochre Iron Oxide	Indigo	Malaquite $CuCO_3 \cdot Cu_3(OH)_2$	Iron Oxide?/carbo n black

Tab. 1. Technical analysis & materials results

2.2. *State of conservation*

The north section of the baptistery partially collapsed due to heavy rains in the 1980s, requiring the replacement of some wooden planks. While most beams were in good condition, the wood of the cornice in both corners of the north wall deteriorated significantly. Large losses of the ground layer and polychrome were visible near the damaged areas, whereas the south wall appeared intact.

Diagnostics revealed the ground layer was made of calcium sulfate (dihydrate, hemihydrate). Originally, gypsum stucco filled the unions between panels and beams to create a continuous decorative subphase, but this stucco was lost on the north side of the ceiling up to its center. In areas not damaged by water, some panels still retained stucco on the borders, though with poor cohesion and adhesion (Figure 2).

Paint loss corresponded to ground layer deterioration. Colors remained stable in unaffected areas, maintaining consistent tone and intensity except for blue. This is explained by the organic nature of the component that provides this blue coloring, as we will see later: indigo, from different species of Indogofera that were cultivated in America in colonial times, with special emphasis on *Indigofera suffruticosa Mill*.

To prepare this blue, known as Mayan blue, the indigo dye was precipitated in inert substrates of capillary clay called palygorskite (magnesium aluminosilicate), and after this, the aforementioned combination was baked at temperatures between 250ºC and 300ºC, giving rise to a pigment -hybrid lacquer, much more stable than the initial indigoid dye. (Doménech and Doménech-Carbó, 2006; Doménech *et al.*, 2007, 2009; Vázquez de Agredos Pascual, Doménech Carbó and Doménech Carbó, 2011)

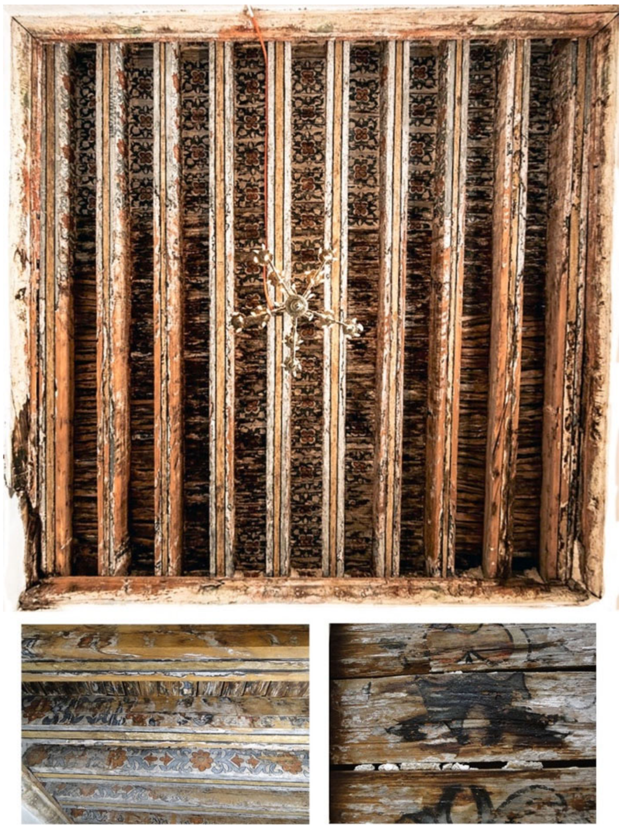

Fig. 2. General view and details of the polychrome wooden ceiling of the baptistery before interventions. (Photo: Montes-Trevizo F., Muñoz-Alcocer,K.,2024).

Alternatively, other substrates inert to palygorskite were used: from other clay silicates of capillary nature to calcareous matrices, among others. In the case of Santa Maria studies indicate the use of gypsum as mortar to produced the blue pigment. The central beam lost most paint intensity, while blue on the borders and panels retained its vibrancy. This discoloration, initially thought to be due to window light, was also found on the interior-facing side of the same beam, suggesting other factors may contribute to the fading (Figure 3).

Fig. 3. View of the beams facing window light. It is possible to observed the color blue hue diffrences between the beams (Photo: Muñoz-Alcocer,K.,2024).

3. The Conservation project

The comprehensive restoration of the church of Santa María de Cuevas and the close relationship between specialists and community members will not only safeguard the building but also create an inclusive environment for social participation. This will contribute to job creation, a sense of belonging, and the strengthening of social fabric, thereby empowering the community to explore collective processes for the common good, enhancing their cultural assets and considering them as a factor for social and economic development. This community and inclusive approach also allows us to generate, through the conservation and dissemination of Cultural Heritage, spaces 'of human occupation with meaning and meaning', favorable for individual and community well-being, following paradigms linked to areas of Health Sciences and Integration Social, as is the case of Occupational Therapy (AOTA, 2008).

3.1. *Conservation treatment & Criteria*

The proposed intervention process for the restoration is based on international guidelines and the criteria established by INAH (National Institute of Anthropology and History). The approach follows principles of minimal intervention, respect for originality, and the use of materials similar to the originals.

The restoration of the polychrome narthex ceiling, which serves as a model for the overall project, aimed to achieve a comprehensive understanding of its narrative and decorative interpretation in relation to the church's decorative painting. Each segment of the ceiling is seen as part of a cohesive whole. The methodology for the restoration consists of five stages: 1. Preliminaries; 2. Stabilization of the structure; 3. Stabilization and consolidation of the polychrome; 4. Chemical and mechanical cleaning; 5. Chromatic reintegration of the polychrome (Table 2).

STAGE	MATERIALS	PROCESS
Preliminaries		• Photographic & Digitalization • Deterioration mapping • Dirt cleaning
Consolidation	• Fish glue	• Injection around the paint flake
Cleaning	• Deionized water • Neutral soap	• Mostened swabs • Mechanical cleaning with scalpel
Ground reintegration	• Calcium suphate • Animal glue	• Brush application covering the ground layer lossess and new panels
Color reintegration	• Watercolors according to original pigments and dyes	• Brush application covering the paint lossess under the *Sottotono* chromatic criteria (lower tone under the original)

Tab. 2. Conservation treatment process

It's important to note that this paper specifically presents the results of the conservation process conducted to recover the polychrome of the ceiling, with a particular focus on the chromatic reintegration of the blue. It does not address interventions related to the roof structure of the church.

3.2. *Digitalization*

The ceiling was photographed by photogrammetry technique in order to optain a 3D model of the polychrome ceiling before and after the conservation treatment.

A Nikon D850 camera, with a 14-24mm f/2.8 lens, used at a focal length of 18mm, f/2.8, ISO 100, and variable shutter speeds ranging from 1 second to 1/60 second.

A total of 252 images were taken to cover 6.94m^2 area obtaining 268,568 points.

The digital images provided a perspective view of the ceiling and, through software, a flat view of the ceiling, a mapping of the structure and state of preservation of the pictorial layers and, for the purposes of this paper, the color degradation (Figure 5).

*Fig. 4. Conservation treatment application, training & community outreach (Photo: Muñoz-Alcocer, K. & Jaquez Sotelo J., 2024***.**

Fig. 5. Photogrametry image of the ceiling before the intervention. It Is possible to observe the three face-sides of the beams. Note the blue color tone variations between the beams, including at beam-face that is not exposed to light. (Photogrametry & imaging: Misiones Coloniales de Chihuahua A.C., Montes Treviso F.,2024).

3.3. *Training program & Community outreach*

The community's involvement in the conservation project is crucial for raising awareness about the importance of the ceiling artwork and the challenges of preserving polychrome ceilings. The project includes a technical training program for six local women and one woman with art studies, equipping them with the necessary skills to contribute to the preservation efforts. Workshops and presentations are also organized to educate the community and visitors about the unique decorative surfaces of the church. These activities aim to emphasize the historical and artistic value of the artwork and encourage community members to take pride in and advocate for the conservation of their cultural heritage. The interactive workshops and presentations facilitate learning about the techniques and materials used in creating the artwork and foster discussions about its significance and conservation challenges. Overall, the project seeks to deepen the community's appreciation and understanding of the church's decorative surfaces.

4. Results

The conservation project of the polychrome ceiling of the baptistery yielded significant results, not only in terms of recovering the structure and aesthetic appearance of the ceiling but also at the socio-cultural dimension level, as explained below. Although the complete process of the intervention will be mentioned, the chromatic reintegration of the blue indigo will be discussed in more detail due to its relevance and the nature of this paper.

4.1. *Treatment*

4.1.1. *Wood structure*

The intervention on the wood structure permitted the recovery of the stability and appearance of the wood panels that were lost during the collapse of both angles. The panels were made of cedar wood, matching the variety and dimensions of the originals to create a similar appearance between the new beams and the originals. Additionally, new wood inserts were added at both corners of the wood cornice to maintain a continuous visual appearance around the ceiling. Cedar wood was chosen because it is more stable than pine, and it also allows for a clear distinction between the original wood and the wood used in the restoration.

4.1.2. *Cleaning*

The dark water stains that covered a large part of the panels on the north side of the ceiling were cleaned with deionized water. During the cleaning process, it was possible to identify a layer of walnut-colored, water-based stain applied directly to the wood and over the original paint. This created significant difficulty in cleaning the polychrome, necessitating the use of neutral soap in some areas to achieve a higher level of cleanliness. Although it was decided not to insist on cleaning in areas where the color came off during the process, it was possible to recover the overall readability of the decorative motifs.

4.1.3. *Ground layer reintegration*

The stucco applied to cover the ground layer losses was made of calcium sulfate dihydrate with animal glue. This process permitted the identification and highlighting of original paint particles and sections that were previously not visible to the naked eye. In the south area of the ceiling, where the polychrome is well-preserved, the ground layer presents a gray tone instead of white, as found in the narthex ceiling or visible in other parts of the church. To prevent a strong contrast between the original background and the conserved sections, a layer of colored-gray stucco was applied once the chromatic reintegration was concluded, except for the black underline.

4.1.4. *Chrormatic reintegration*

The criteria for the color reintegration of the decorative motifs on the ceiling followed the well-known Italian technique *sottotono*. This method of chromatic reintegration involves applying a lower tone in the newly restored areas compared to the original paint. The same approach was used in the restoration of the polychrome wooden ceiling of the narthex, as previously described. This technique was chosen because it allows for clear and appropriate differentiation in the color reintegration of the ceilings in the nave and presbytery, which are located 12 meters above the floor.

The variation in hue intensity of the original paint posed a challenge for the *sottotono* method, especially on beam ceilings where creating a softer variation is not as feasible as on flat surfaces. The red-orange color of the floral decorative motifs generally maintained a consistent hue intensity. However, the yellow exhibited more variations, particularly in the north section where water damage had significantly deteriorated the color, turning it almost brown in some areas instead of the original yellow ochre. The blue, being the predominant color used on the ceiling, showed significant variations, as mentioned earlier in Figure 3. It was evident that two different blue saturations were applied, as seen in the inscription (lines without meaning) made by the artist with a darker blue than the lighter blue used on the lower side of the beam (Figure 6). The panels were painted in a darker blue hue, while the sides of the beams, especially the bottom, were painted with a lighter or less saturated blue. This differentiation was likely intended to create depth and visual contrast in the ceiling's appearance.

Fig. 6. View of the bottom side of the beam with the inscription or lines in dark blue over the light blue of the beam (Photo: Muñoz-Alcocer, K.,2023).

The chromatic reintegration was executed using watercolors, prepared based on the original materials identified through technical analysis. Iron oxide pigments were used to produce the red and yellow colors, malachite for the green, indigo for the blue, and carbon black for the borders of the decorative motifs.

The lower tone (*sottotono*) was determined to establish differentiation between the original paint and the restored areas. This was relatively straightforward for the red, green, and yellow colors. However, determining the lower tone for the blue areas was more complex. The center beams, which were largely exposed to light from the windows, exhibited an almost transparent blue hue against a white-gray background. In these areas, no pigment runoff from water damage was detected, unlike the bottom sides of the beams, where the colorant material concentrated due to water infiltration. It is important to note that the degradation of the blue color on the central beams was not solely due to light exposure. Beams on the interior side (without direct light exposure) also showed tone degradation, similar to beams facing the window. This is likely due to the organic nature of the indigoid blue pigment used, which resembles Mayan blue, as discussed in previous publications (Muñoz Alcocer, 2018; Muñoz-Alcocer *et al.*, 2020), This suggests a continuity of its production after the Pre-Columbian period.

The chromatic reintegration followed the original paint hue of each specific beam or ceiling area, as it was not feasible to use a single hue for all areas based on the darker sections of the ceiling. Doing so could have created misleading visual results when viewed from the floor and might have intensified the color beyond the original. By matching the hue of the chromatic reintegration to the nearby original paint, a more distinct differentiation between the original and restored areas was achieved. However, while the reintegration appeared adequate at scaffold level, it did not have the desired effect when viewed from the floor. Since the scaffold covered the entire surface of the ceiling, it was possible to assess the results of the chromatic reintegration only after its removal and the completion of photogrammetry imaging. Intensifying the blue in areas where the original paint had almost faded was necessary to achieve an integral view of the decorative design from floor level (Figure 7).

The color correction was achieved through the use of a spectrophotometer. The dark blue of the panels served as a base color to determine the correct hue, which was then applied as a neutral tone, even in the lighter or more transparent blue sections. Although the selected hue was stronger than the original light blue or gray-white areas, adjusting the saturation allowed for a uniform appearance from any viewpoint on the ceiling (Figures 7 & 8) .

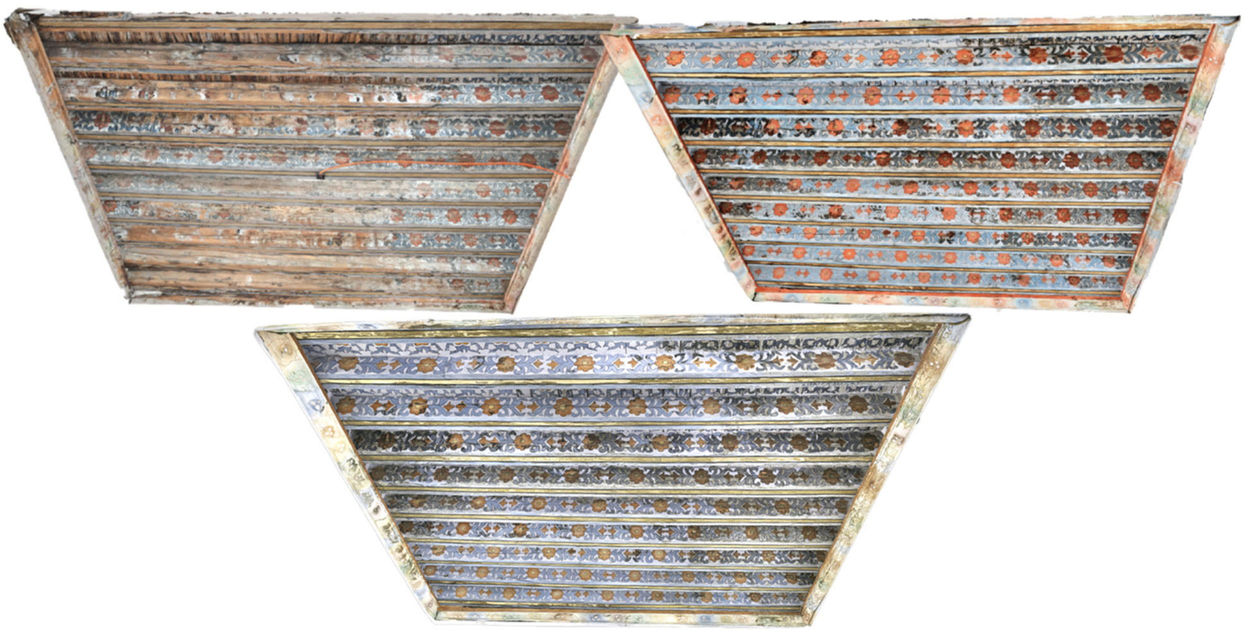

Fig. 7. The photogrammetry images presented showcase the polychrome wooden ceiling of the baptistery before (left) and after the first stage (right) and second stage (bottom) of the restoration intervention. These images highlight the differences in the blue hue between the original paint and the chromatic reintegration. The use of a neutral chromatic blue color, guided by a spectrophotometer, made it possible to obtain a harmonious view of the ceiling while simultaneously establishing a clear distinction between the original paint and the restoration areas. This discrepancy in color is an important aspect to consider, as it demonstrates the challenges faced in achieving a perfect match during the restoration process (Images: Misiones Coloniales de Chihuahua A.C., Montes Treviso F., 2024).

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Fig. 8 View of the beams after the color correction. Note that the same blue hue was used for the chromatic reintegration, despite the difference in the hue of the original paint (Photo: Muñoz-Alcocer,K.,2024).

The readings from the spectrophotometer were analyzed in the CIEL*a*b* color space for the 10° Supplementary Standard Observer and D65 Standard Illuminant. As reported in the *L*a*b** diagram (figure 9), the colorimetric data allowed us to confirm that the blue hue of the panels (T) has lower luminosity (L). The beam sides facing natural light (a) and those facing the interior of the room (c) presented interesting results. Although the chromatic values (a* and b*) were almost identical, it was the luminosity (L*) that differentiated these groups. The 'a' sides, closer to the window, exhibited higher L* values, while the 'c' sides had lower values. However, beams 2.c, 5.c, and 6.c showed the same L* values as the beam sides exposed to natural light (3.a, 5.a, 7.a, 8.a). This suggests that light is not the only factor influencing the hue degradation of the blue color; it may also be related to the method of application and the skill of the painter.

Finally, the use of the spectrophotometer also enabled the establishment of a homogeneous chromatic reintegration. The slight variations in hue were consistent with the original polychrome hues of the beams or panels.

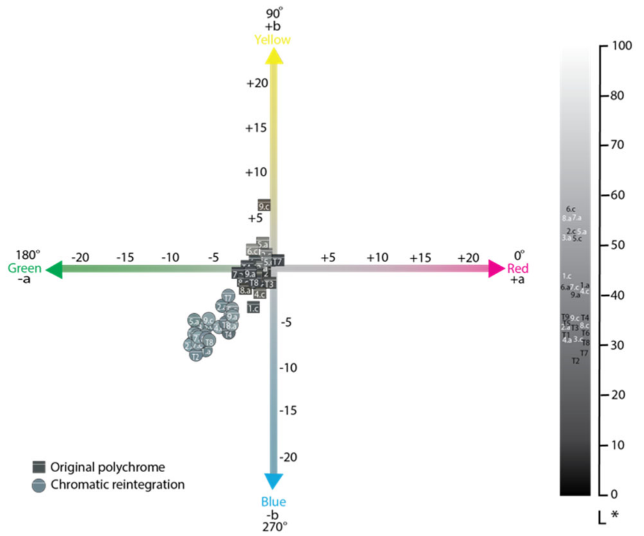

Fig. 9. Diagram of CIELAB color chart with the L a* b* resulted form the orginal paint and the chormatic reintegration (Muñoz-Alcocer,K.,2024).*

4.2. *Particular findings*

The restoration process allowed for a detailed examination of the polychrome materials and design of the ceiling, revealing the involvement of multiple artisans. While the overall design was applied using a stencil technique, the botanical elements, such as flowers and leaves, were hand-painted and outlined. Variations in the design were observed, including differences in starting points and omissions, with some areas missing black outlines, suggesting that the work may have been left unfinished (Figure 10).

The side beams also show inconsistencies, with decorative modules varying in size and shape. These imperfections, noticeable only through the restoration process, highlight the importance of such interventions for understanding the manufacturing techniques. Photogrammetry aids in observing the artwork's condition, but deep, hands-on observation during restoration provides a clearer understanding of the techniques and design applications. The restoration serves as a dialogue with the artwork, offering valuable insights into its creation.

Fig. 10. Detail of the decorative flowers on the panels. Notice the absence of black lines (Photo: Muñoz-Alcocer, K.,2024).

4.3. *Training & Community outreach*

The project focused on involving community members in the conservation of their cultural heritage, aiming to raise awareness of the Church of Santa Maria de Cuevas' historical and artistic significance. Through this, they could pass on knowledge to others in the community and future generations. In addition to conservation training, three workshops were held for local students, ranging from first grade to high school. One workshop, "How Was My Church Painted?", explored the church's artistic history and its relevance to Northern Mexico's heritage. Students participated in field visits to identify local pigments, dyes, and binders potentially used in the church's decoration, contrasting these with materials imported from central Mexico (Figure 11). They also learned the *spolvero* technique for applying decorative motifs and recreated panels using the same methods used 300 years ago to paint the church.

Community outreach included regular meetings to discuss conservation strategies, along with conferences and site visits for both locals and tourists. These efforts highlighted the church's artistic features and aimed to raise awareness of its conservation needs, fostering new perspectives on cultural tourism in Santa María de Cuevas.

Fig 11. Images of the workshop "How was painted my church? With students of Santa Maria de Cuevas schools (Photo: Munoz-Alcocer, K. Jaquez Sotelo J., & Ruiz E., 2024)

5. Conclusions

The study highlights the challenges encountered in achieving perfect color reintegration, particularly with the blue hues. Despite efforts, significant variations in color were observed, indicating the difficulty of obtaining an exact match. This underscores the inherent challenges in preserving and restoring historical artwork to its original state. Nonetheless, the study offers valuable insights into the materials, manufacturing techniques, and conservation strategies employed in the restoration of the Church of Santa María de Cuevas, contributing to the broader understanding of Spanish colonial churches in the Chihuahua region.

The chromatic reintegration technique, *sottotono*, can be difficult to apply when color hue differences are present in the original paint. In the early stages of the project, the intention was to create distinct contrasts using 'similar hue areas,' but the final result failed to achieve proper visual continuity when viewed from floor level. The use of a spectrophotometer allowed for the achievement of a neutral color by starting with the darker tones. Although the hue of the chromatic reintegration appeared more saturated in areas where the original color had faded, a consistent appearance was ultimately achieved, clarifying that the faded areas were indeed part of the original paintwork.

In addition to the technical aspects of the restoration project, this paper also highlights the importance of community engagement, workshops, and training programs. The involvement of local women in the conservation treatments proved to be a valuable experience, fostering a sense of ownership and connection to the cultural heritage of the Church of Santa María de Cuevas. Through these initiatives, the community gained a better understanding of the significance of preserving their historical artwork, and the local women acquired valuable skills in conservation techniques. This holistic approach to restoration not only contributed to the preservation of the church but also empowered the community to actively participate in the safeguarding of their cultural heritage, contributing to cultural identity processes that lead to the safeguarding of its Historical-Artistic Heritage. To this end, the community-centered approach with a gender and intergenerational perspective was considered throughout the process, which, in turn, is committed to the United Nations 2030 Development Agenda, and specifically to the Sustainable Development Goals. (SDGs), such as SDG 4 (Education), SDG 5 (Gender Equality), SDG 10 (Reducing Inequalities), SDG 11 (Sustainable Cities and Communities, whose goal 11.4 mentions the need to Safeguard Cultural Heritage and Natural), and SDG 17 (Partnerships to achieve the SDGs).

6. Conflict of interest declaration

The authors of this paper declare that there are no conflicts of interest regarding the publication of this article. No financial, personal, or other relationships with people or organizations have influenced, or could be perceived to influence, their work within the past three years. The information presented in this paper is a product of the observation and experience of the authors, and not of the conservation project itself.

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9. Short biography of the author(s)

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