Figure 1. Reconstruction of the Sun Stone. Drawing: Fernando Carrizosa. Courtesy of Proyecto Templo Mayor.

Color in monumental Mexica sculpture

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Polychrome sculpture and color reconstruction

Since the remote Egyptian past, sculptors have assiduously employed color as a powerful visual resource. Colors applied on reliefs and three-dimensional sculptures—whether wood, stone, ceramic, or metal—have served to confer them with great legibility and to transmit all sorts of sensations, values, and meanings to the beholder (Brinkmann 2008:24; Panzanelli 2008). Moreover, only with the addition of color have artists achieved the lifelike effects they desire. Their main goal has been to captivate viewers with a semblance of reality or *mimesis*. This intention was heightened, for example, in the Spanish baroque school, which sought to deeply move the feelings of the increasingly skeptical masses during the Counter-Reformation, and in pop art, which battled abstract expressionism by means of the mass representation of the real, the everyday, and the popular.

Despite the enormous importance of color throughout the history of world art, specialists have tended to theorize as if color were absent from ancient sculpture. To a large extent, this is a product of the influence exerted by neoclassical authors such as Georg Wilhelm Friedrich Hegel, Johann Joachim Winckelmann, Johann Gottfried Herder, and Joshua Reynolds, who aesthetically defined Greco-Roman sculpture by the whiteness of the Parian, Pentelic, and Carrara marbles used (Østergaard 2008:40; Panzanelli 2008:8–10; Potts 2008:84–85). They overlooked the fact that, over the diaphanous and pure surfaces of the marble, the artists of antiquity applied chromatic layers that completely transformed the viewers' sensations. This taste for the purity of the stone dared many eighteenth- and nineteenth-century collectors to remove all vestiges of pigment from the masterpieces they treasured in their cabinets.

In studies of Mexica art, something similar has occurred.[1] As a general rule, there is a tendency to imagine the sculptures of Tenochtitlan as devoid of polychromy. This is due to the fact that the works held in museums throughout the world show us their crude surfaces dominated by gray, pink, red, or violet tones characteristic of the basalt, andesite, or volcanic scoria itself (see López Luján and Fauvet-Berthelot 2009:88–89).

The reality, however, is quite different in Greco-Roman sculpture as well as Mexica monoliths. Careful examination of the pores of the stone in search of a glint of color quickly yields results. All one needs is a little patience, adequate cleaning tools, magnifying glasses, special lights, and infrared photography to produce revealing chromatic reconstructions. Outstanding in this respect is the recent research conducted by Vinzenz Brinkmann (2008) and Jan Stubbe Østergaard (2008). For example, Brinkmann's team not only returned the renowned Peplos Kore, which appeared on the Acropolis in 1886, to its original splendor; but also, after discovering its original polychrome design they proved that the sculpture is actually an image of Athena or Artemis, rather than a young girl dedicated to the city's temple as previously thought (Brinkmann 2008:128–130). Likewise, the restoration of rich tones and shadows to the bust of the young Caligula at the Carlsberg Glyptotek in Copenhagen has elevated the work to the most vivid of imperial Roman portraits (Brinkmann 2008:114–115; Østergaard 2008:41, 110–113).

In the case of Mexica sculpture, the first chromatic reconstruction dates back to 1916, as H. B. Nicholson (1985:156) has pointed out.[2] In that year, Dionisio and Francisco Abadiano published a drawing in which they returned to the Sun Stone (ca. A.D. 1502–1520) the color it had lost from centuries of burial in the Zócalo

1. An early account of this research was presented under the title "Unveiled Brightness: Color in Monumental Mexica Sculpture," in the "Mirrors and Footsteps: Reflections on the Work of Alfredo López Austin" conference, convened by Davíd Carrasco at Harvard University on April 15, 2011. We would like to express our deepest gratitude to María Barajas, Davíd Carrasco, Alfredo López Austin, Debra Nagao, and Scott Sessions.

2. Before this time, several large-format sculptures retaining some of their original polychromy had been discovered in Mexico City. For example, an offering vessel in the form of a jaguar (*ocelocuauhxicalli*) was found in 1901 during renovations to the foundation of the neoclassical Palace of the Marqués del Apartado, located on a street north of the Metropolitan Cathedral. According to Thomas H. Dawley (1902), the animal's skin was painted ochre with black spots, while the claws and the offering container were painted red. In 1913, Manuel Gamio discovered a neo-Toltec style bench on the southwest corner of the Great Temple. This bench, analyzed in 1917 by Hermann Beyer (1955; see Nicholson 1985:151–153), is composed of fifty-two stone panels with more than fifty warriors carved in polychrome bas-relief. Beyer (1955:fig. E, lower left) produced a drawing of six of these warriors and an undulating serpent, in which he recorded with simple hatching the distribution of red, ochre, blue-green, white, and black pigments.

as well as nearly a century of exposure to the elements on the west tower of the Metropolitan Cathedral.[3] To some extent, the Abadiano brothers based their drawing on direct observations made while creating casts of the monument. Many years later, Hermann Beyer (1921:16, fig. 36) presented his own chromatic reconstruction of the central face of the Sun Stone, before Roberto Sieck Flandes (1942) published a more ambitious rendering of the entire disc and lateral surface of the sculpture. Neither Beyer nor Sieck Flandes, however, based their illustrations on direct observation of the monolith; rather they inferred the colors from similar motifs in the codices. The resulting excessively colored reconstructions they made are now reproduced by the thousands on book covers, ashtrays, and all sorts of tourist memorabilia. In 2000, a team coordinated by art conservator María del Carmen Castro (see Solís Olguín 2000) undertook the cleaning of the Sun Stone, which revealed the use of a much more limited palette than those imagined by the Abadiano brothers, Beyer, and Sieck Flandes. In fact, they found only vestiges of red and ochre, and detected areas without traces of polychromy that may have been covered with blue, black, and white pigments (fig. 1).

Another interesting example is the Coyolxauhqui Stone (ca. A.D. 1440–1469), a monument representing the moon goddess. Unfortunately this monolith lost its color, not from exposure to the elements, but because it was hastily cleaned on several occasions so that archaeologists and then president José López Portillo could admire it immediately after its discovery in February 1978 (García Cook and Arana 1978:16–21). As a consequence of these careless actions, archaeologists were only able to record a few traces of red and ochre pigments (ibid.:fig. 58). In lieu of these lost archaeological data, Carmen Aguilera (1985) produced a reconstructed drawing based on Central Mexican codices, using nine different pigments, including green, gray, orange, and brown. In 2008, in conjunction with the thirtieth anniversary of the Great Temple Project, Lourdes Cué, Fernando Carrizosa, and Norma Valentín undertook research that reversed Aguilera's approach. For several months, they analyzed the pores of the stone to identify every minute trace of pigment and then consulted the codices to corroborate formal conventions of representation of the different iconographic motifs. This research resulted in a drawing published in the magazine *Arqueología Mexicana* (Cué et al. 2010), which revealed that the sculpture's true colors were limited to five pigments (fig. 2). Subsequently, a life-size fiberglass replica was installed in the archaeological zone of the Great Temple, which in our opinion has overly bright, saturated colors. Far more accurate is the computer projection, since that time, of extremely faint beams of ochre, blue, black, white, and red light directly on the monolith in the Great Temple Museum.[4]

The Mexica sculptural palette

One of the basic conclusions to emerge from our own research is that the painters of Tenochtitlan's sacred precinct utilized a very limited color palette. In fact, after thirty-five years of archaeological excavations in the historic center of Mexico City, we have only detected the presence of red, ochre, blue, white, and black pigments, nearly all of them made from minerals (Vázquez del Mercado 1998; Grimaldi 2001; Ortega et al. 2001; Ortega 2003; López Luján 2005a:105–107; López Luján et al. 2005; López Luján 2010:54–71). In contrast, western Mesoamerican pre-Hispanic and early colonial codices painted in native styles possess a much wider set of dyes and pigments, mainly of organic origin (e.g., Durand-Forest 1974; Miliani et al. 2012). We can think of many possible explanations for this, such as: (a) The extant Basin of Mexico codices all date from the colonial period, and pre-Hispanic ones from this region would have been painted with a more limited palette; (b) the Mexica did not create green, orange, or gray paintings that were adequate for stone, stucco, or earthen media; (c) if the Mexica did produce such paintings, the cost of applying them on large surfaces was prohibitively high; (d) such paintings (possibly organic colorants) were vulnerable to the elements and thus did not survive; or (e) the presence of only certain colors on the monuments obeyed a strict symbolic purpose.

In our view, the presence of only these five pigments on Mexica sculptural monuments suggests a cosmological purpose: an allusion to the center of the universe and the four cardinal directions. In this sense, Danièle Dehouve (2003:68–72) has demonstrated that, among Nahuas, Tlapanecs, and Mixtecs today, symbols and metaphors alluding to color are limited to five groups: blue-green, red, white, black/navy blue,

3. This drawing appeared on the cover of the first issue of the magazine *Acción Mundial,* January 29, 1916.

4. For important studies of polychrome architecture and sculpture in other Mesoamerican civilizations, see Boone (1985), Houston et al. (2009), and Fash (2011).

Figure 2. Color reconstruction of the moon goddess on the Coyolxauhqui Stone. Drawing: Luz María Muñoz. Courtesy of Proyecto Templo Mayor.

and yellow. These groups, she tells us, correspond to the color of the leaves of the corn plant and to the four different colors of the mature corncob.

As for the chemical composition of the pigments used in Mexica monumental sculpture, the first analysis of this type dates back to the work of Alejandro Huerta Carrillo (1979). During the 1970s, he studied the Temple of the Sun, a building buried beneath the Metropolitan Sacristy. The façades of this pyramid are decorated with large bas-reliefs in the form of *chalchihuitl* or jade beads. They were painted with red, blue, white, and black pigments, which were partially identified with the aid of an optical microscope.

Many years later, we undertook an in-depth study of the reliefs that decorate the benches of the House of Eagles (ca. A.D. 1469–1486), which involved specialists from the Dipartimento di Scienze della Terra of Turin, the Mexican National Institute of Nuclear Research, and the National Institute of Anthropology and History (Chiari 1999, 2000; Ortega et al. 2001; Ortega 2003; López Luján 2005a:102–116). We applied eight different techniques that allowed us to measure color, trace the general morphology of the surface and strata of the pictorial layer, determine the nature of pigments, as well as identify and quantify the chemical and mineral elements (fig. 3). We began by conducting a spectrophotometric study, which makes it possible to quantify the colors and their state of conservation, thus leaving a detailed record for posterity. To this end we determined the chromaticity coordinates, dominant wavelengths, and purity percentages. We also used a scanning electron microscope to discover the elemental composition of the pigments and found the following predominant elements: iron in the red and ochre, silicon and magnesium in the blue, and carbon in the black. Infrared absorption spectroscopy and X-ray diffraction further confirmed that the red pigment was hematite, the ochre was goethite, the black was soot, and the blue was palygorskite in some cases and sepiolite in others.

More recently an in-depth study of polychromy was conducted on a gigantic monolith (ca. A.D. 1486–1502) depicting the Tlaltecuhtli earth goddess (fig. 4). This monumental sculpture was discovered in October 2006 (Matos Moctezuma and López Luján 2007; López Luján and Chávez Balderas 2010), and since that time we have pursued a comprehensive program of conservation

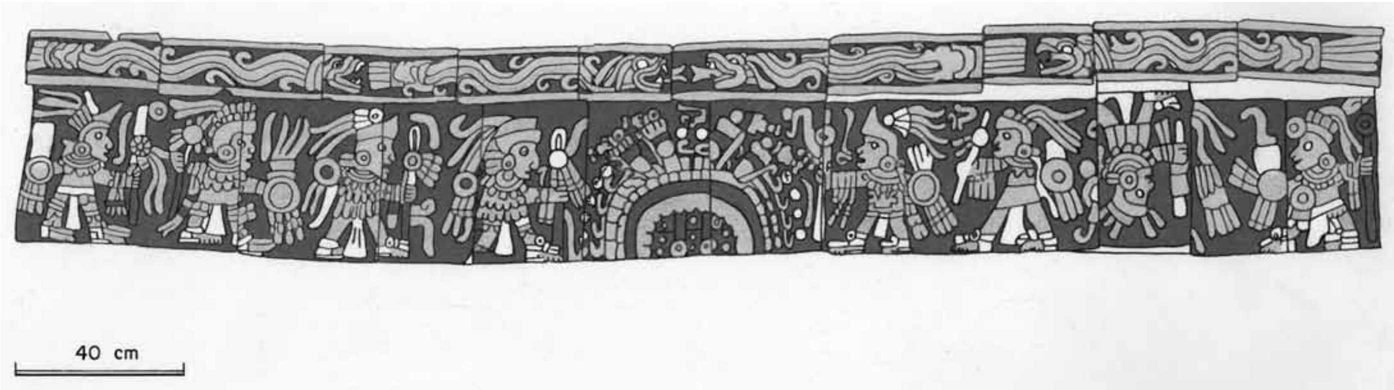

Figure 3. Color reconstruction of a bench from the House of Eagles. Drawing: Fernando Carrizosa. Courtesy of Proyecto Templo Mayor.

and analysis. Before extracting the sculpture from the area of excavation, we performed a terrestrial laser scan with colleagues from the University of Ferrara in Italy to record the correlative position of the four fragments into which the monolith had broken (López Luján 2010:34–37). Subsequent petrographic analysis and scanning electron microscopy of the fragments allowed us to identify the stone as a lamprobolite andesite (Torres Trejo 2008; López Luján 2010:37–50). The Mexica mined this type of stone from deposits in the Chiquihuite Formation,

Figure 4. Color reconstruction of the earth goddess on the Tlatecuhtli Stone. Drawing: Luz María Muñoz. Courtesy of Proyecto Templo Mayor.

about eight miles north of the island of Tenochtitlan (López Luján et al. 2003:145–147). Another fundamental task was the preparation of a three-dimensional scan of the monolith with the assistance of Saburo Sugiyama and his team from the Aichi Prefectural University (López Luján 2010:50–54). With high-precision Minolta equipment, we produced a monochrome topographic model that recorded every detail down to the tiniest pore on the sculpture. Then we added polychrome image data that had been generated after the initial cleaning of this impressive representation of the earth goddess. The result was a surprisingly realistic reconstruction that digitally joined the four fragments of the monolith together. Our project artist used this reconstructive model to produce the line drawing we later employed to record our interventions and samplings.

The fact that the Tlaltecuhtli monolith has retained its original colors is due in large measure to the efforts of Virginia Pimentel and her team of conservators, who prevented the sculpted surface from suddenly detaching from the layer of clay and mortar that had covered it for nearly five centuries. They also managed to dry the piece gradually over the course of nearly a year. Once the four large pieces of the monolith had been moved to the field laboratory, a team led by restorer María Barajas (Barajas et al. 2010; Barajas 2011) began the painstaking and meticulous task of cleaning the monument. The process lasted more than two years because the layer of color no longer adhered to the stone substratum. In fact, almost any physical contact or air movement caused flakes of the pigment to come off the sculpture. Finally, after numerous studies conducted at Mexico's National University, a German silica-based product named KSE 300 © was selected to fix the pigment to the stone. The fruits of these efforts can be seen at first glance, offering a visual sensation not experienced with the Sun Stone or Coyolxauhqui monolith.

The Tlaltecuhtli's temporary stay in the field laboratory also allowed us to perform a series of observations and studies about the nature of the pigments and their agglutinant (Chiari 2008; Mazurek 2008; López Luján 2010:54–71). Of fundamental importance was determining the composition of the chromatic palette, which is limited to red, dark red, ochre, blue, white, and black, and thus similar to the sculptures and mural paintings previously discovered in the Great Temple archaeological zone (López Luján et al. 2005; see Anderson 1963). With the exception of black, these colors were applied directly onto the rough texture of the stone, without an undercoat, to form well-delineated monochromatic surfaces that were saturated, opaque, uniform, and devoid of any shadows or variations of tone. X-ray diffraction analysis undertaken at the Getty Conservation Institute further revealed that most of the sculpture's pigments are of mineral origin and fully identifiable, as follows.

The red pigment, which was used to depict the blood, gums, ears, leather, bands, and background of the composition, was made from hematite. Hematite is a common iron oxide generally found in the form of sediment and in volcanic rocks. In the case of the Tlaltecuhtli, the diffractogram indicated that the pigment was not red ochre but a well-crystallized and finely ground hematite similar to *synopsis,* as described by Pliny the Elder (Bearat 1996). It is difficult to ascertain exactly where this hematite came from, though there were several deposits near Tenochtitlan, including Sierra Patlachique in the Teotihuacan Valley. There is also the possibility that the Mexica painters simply obtained their supplies of hematite and other pigments in the Tlatelolco market (Cortés 1994:63; Bernardino de Sahagún 2000:906–907).

Various sixteenth-century documentary sources contain descriptions of reddish mineral pigments, but it is difficult to say whether they correspond to the red we identified on the Tlaltecuhtli monolith. The informants of the Franciscan friar Bernardino de Sahagún (1963:257) described one of them in this concise manner: "*Tlachichilli* is chili-red earth, spongy, dark, dark-surfaced. I make something chili-red." According to Sahagún (2000:1141) himself, it is a dark red material, similar to red ochre, used in the production of bowls, plates, pitchers, and sauce vessels. His informants described another pigment, *tlahuitl,* in the following terms: "Its name comes from nowhere. It is a rock; it is *tepetate*; it is like *tepetate*. It is ruddy. It is mined. It is necessary, required, useful. It is a medium for beautifying, for reddening" (Sahagún 1963:243). Sahagún (2000:1132), in his Spanish explanation of the Nahuatl text, compares *tlahuitl* to vermilion.[5] The protophysician Francisco Hernández (1959–1984:3:409) specified that it was a kind of yellow earth that had to be exposed to fire to acquire reddish tones, and that the native inhabitants painted walls and floors with it. This may correspond to yellow ochre turning into hematite.

The red hair of the Tlaltecuhtli monolith, however, is a different matter. It was painted with an extremely dark red, almost burgundy pigment. The X-ray diffraction

5. We must say, however, that mercury sulfide was not found on the Tlaltecuhtli monolith.

analysis showed it to be composed of a more or less crystalline hematite, though the ground-up crystals were not necessarily pure. Interestingly, the analysis also revealed the presence of a small percentage of titanomagnetite, a black mineral with a metallic sheen, whose magnetic properties were observed in a fraction of the powdered pigment sample when a magnet was placed nearby. The dark hue of the red can thus be explained by mixing hematite and magnetite.

The ochre pigment, which was used to realistically render the goddess's skin, is composed of poorly crystallized goethite and hematite known as "yellow ochre." Goethite is the product of the decomposition of sulfates, carbonates, and iron silicates that tend to be deposited along coastal areas. Perhaps this is *tecozahuitl* or *tecoxtli,* both of which are mentioned in the sixteenth-century texts. With respect to the first, the informants of Sahagún (1963:242) tell us: "Its name comes from *tetl* [stone] and *coçauhqui* [yellow]; that is, it is a yellow stone; yellow in the form of a stone. It is ground up. It is a dyeing medium, a painting medium, a means of making things especially brilliant." This brief description can be complemented with a passage from Hernández (1959–1984:3:410) which mentioned some basic uses of *tecozahuitl,* saying that it is "a kind of ochre or yellow earth with which the painters render this color" and that "some women adorn their faces with it, whereas men used to paint their entire body with it when they prepared to go to war or before attacking the enemy, for they believed it thus instilled terror." The *Codex Mendoza* (1992:40r; see Besso-Oberto 1986) indicates that the province of Tlacozauhtitlan in the modern-day state of Guerrero periodically paid *tecozahuitl* as tribute to Tenochtitlan. Sahagún (2000:1133) also commented that "in order to make a tawny color they take a stone they bring from Tlalhuic (state of Morelos), which is called *tecoxtli,* and they grind it, and mix it with *tzacutli* [orchid mucilage]. It becomes tawny in color. They call this color *cuappachtli*." Hernández (1959–1984:3:409), in turn, simply noted that *tecoxtli* is "a good ochre for painting roofs and vaults and that it is abundantly found in some places of this region."

The white pigment, used to depict the cotton, paper, bone, teeth, claws, stars, and shells on the monolith, is calcite.[6] In Nahuatl, this mineral was known as *tizatl, tetizatl,* and *chimaltizatl,* about which the informants of Sahagún (1963:243–244) had the following to say: "*Tiçatl*. With it women spin. It is white, cylindrical, round. This is mud; this is a watered chalk. Then it is fired in an oven to refine. It becomes chalk." "*Tetiçatl*. Its name comes from *tetl* [rock] and *tiçatl* [chalk], because it is a rock. It is ground, fired, pulverized. With it things are painted." "*Chimaltiçatl*. It comes from Uaxtepec. It is broken off like a cliff rock. And when it is to be painted on, it is fired; it becomes very soft. Then it is ground up; it is mixed with glue. With it things are painted; they are varnished white." Sahagún (2000:1132) added in his Spanish commentary that the first of these minerals was sold in the market, the second was obtained in Tula in the modern-day state of Hidalgo, and the third was similar to the plaster of Castile and came from Uaxtepec in the present-day state of Morelos. The *Codex Mendoza* (1992:28r, 42r) complements this information by telling us that this kind of material was paid periodically in tribute to Tenochtitlan by the neighboring provinces of Tepeacac and Atotonilco de Pedraza, respectively in the modern-day states of Puebla and Mexico-Hidalgo.

The black pigment, which was used to outline the reliefs that represent cotton textiles, bones, and stars on the monolith, is a non-crystalline material. It most likely is *tlilli ocotl,* a widely disseminated soot prepared from the combustion of conifer resin. The informants of Sahagún (1963:242) described it as follows: "It is the smoke of pine pitchwood, the lampblack of pine pitchwood. It is a medium for blackening, for dyeing, for tracing lines, for blending with black. It is powdery, finely powdered, pulverized. It is that which admits water, which blots, which stains." According to Sahagún (2000:1132), this pigment was made from the smoke of torches. Hernández (1959–1984:3:409) pointed out that it was frequently sold in the market.

Finally we come to the blue pigment, which our analysis identified as Maya Blue, an artificial pigment made from the vegetal indigo colorant obtained from *añil* (*Indigofera suffruticosa*) leaves and a clay that can be paligorskite or more rarely sepiolite (Reyes-Valerio 1993; Chiari et al. 2008). This pigment was used to paint the ear and facial ornaments of Tlaltecuhtli, the Venus glyphs, and the eyebrows of the skulls and telluric faces. The palygorskite, named *sacalum* or "white earth" in Mayan, was imported from Yucatán, while *añil* or *tlacehuilli* was obtained in the tropical regions of Mexico. The informants of Sahagún (1963:242) tell us that *tlacehuilli* "is an herb. Its growing place is in the hot lands. It is pounded with a stone. The juice is squeezed out. It is wrung dry. [The juice] is placed in a bowl. There it becomes thick; there the *tlaceuilli* gathers. This color is

6. The problem remains as to whether this is finely pulverized calcite applied with the help of an organic binder or, more likely, a whitewash done with lime and then carbonated, which would adhere by itself.

dark blue, gleaming, greenish. It is a dyeing medium, a medium for painting black, for painting in colors" (see also Sahagún 2000:1131; Hernández 1959–1984: 3:112–113).

These six powdered pigments were adhered to the sculpture by means of a binder. Thanks to a gas chromatography–mass spectrometry study we know that the material was not made with animal proteins, oils, waxes, or resins, but rather with sugars. Glucose and mannose specifically were identified, which suggests that the substance was orchid mucilage. The Mexica obtained this viscous substance from the pseudobulbs of several orchids endemic to the Basin of Mexico and the Morelos Valley, including *amatzauhtli* (*Encyclia pastoris*), *tzacuxochitl* (*Bletia campanulata*), and *chichiltictepetzacuxochitl* (*Laelia autumnalis*). With its excellent cohesive and adhesive properties, the mucilage had many uses, including that of binder for powdered pigments. The informants of Sahagún (1963:197) said the following about *tzacuhtli*: "The branches are slender. It has stems. Its root is sticky; this is named tzacutli. It is an adhesive." According to Hernández (1959–1984:2:118), the "root" (actually a pseudobulb) of *tzacuhtli* "is cold, wet, and glutinous; an excellent and very binding gluten is prepared with it that the Indians use, and mainly the painters, to adhere colors more firmly so that the figures do not easily come off." In order for the mucilage to be transparent and colorless—and thus ideal as an agglutinant in pigment—it had to be extracted from fresh bulbs which had been cut into pieces and then dissolved in hot water (González Tirado 1996:23–26, 94).

Taken altogether, the three-dimensional scans, the line drawing, and the chemical data enabled us to create a digital chromatic reconstruction of the monolith. The colors were applied following the rules of the Mixteca-Puebla style defined by Donald Robertson (1994:14–21), including the use of bright, well-saturated, uniform colors without any shadows.

Color and symbolism at the Great Temple

In recent years, color reconstructions have been very useful in resolving problems of iconographic identification. A good example of this involves the ancient *chacmool* from Stage II of the Great Temple (ca. A.D. 1375–1427). Unlike the *chacmool* from the imperial period (A.D. 1469–1521) with attributes of the rain god Tlaloc sculpted on its body, this early representation lacks such reliefs (Franco Brizuela 1987; López Austin and López Luján 2001a, 2001b). This led some authors to reject the possibility of identifying it, even though painted (rather than sculpted) attributes were clearly present. After producing a line drawing of the early monument with the help of Fernando Carrizosa and cleaning the polychrome surfaces with great care, we determined the spatial distribution of the surviving pigments with the aid of stereoscopic magnifying glasses and ultraviolet light (fig. 5). Upon this fact base we were

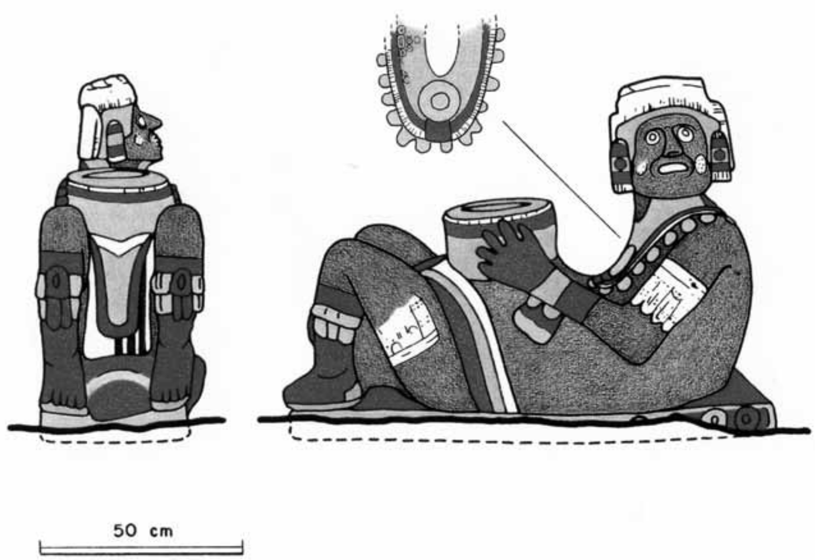

Figure 5. Color reconstruction of the *chacmool* discovered on Stage II of the Great Temple. Drawing: Fernando Carrizosa. Courtesy of Proyecto Templo Mayor.

able to build a faithful color reconstruction which we then compared with pictographic representations of Tlaloc. From painted attributes such as the *chia* circles on the cheeks, the circular gold pectoral medallion, and the color combination of the petticoat, as well as the black skin, the red hands and feet, and the white headdress and bangles, we realized that this sculpture also represented the rain deity. All of this confirms that there is symbolic continuity between the early and late Mexica chacmool, and that both are differentiated from the Tarascan variety, which depicts an old man with an erect penis, and the Maya and Toltec version, which is a young butterfly warrior.

Color reconstructions have also helped us gain a better understanding of the architectural project and iconographic program of the Great Temple, a dual pyramid that artificially reproduced Coatepec, the "Mountain of Serpents." In fact, the serpent sculptures adorning the base of the pyramid from Phase IVb (ca. A.D. 1469–1481) are precisely where we discovered the most revealing chromatic patterns (López Austin and López Luján 2009:271–293). Beginning with the three impressive basalt serpents that frame the platform of the pyramid on the west side, two of them have long, undulating bodies carved in stone and covered with stucco. The serpent to the north is blue, a color considered to have a cold nature, related to rain deities and the wet season. In contrast, the serpent to the south is ochre, a color thought to have a hot nature, linked to the sun, fire, and golden vegetation in the dry season. As one would expect, the serpent on the central axis of the building is half blue and half ochre. The two stairways of the main façade are also flanked by large serpent heads carved in basalt. The two sculptures on the north side have a pair of jade beads on their back, whereas the two on the south side are feathered and bear the mat symbol over their eyes. In terms of color, the serpents on the north side are distinguished by a clear predominance of the color blue,[7] while those on the south side are likewise blue, but also have important ochre elements (figs. 6–7).

The chromatic dichotomy is more conclusive on the serpent heads located on the side and back façades of the pyramid. All of them share reliefs that depict geometric scales on the serpent's nose. The two heads on the north side, however, have jade beads on the back and are blue. In contrast, the two heads on the south side lack the jade beads and for the most part are ochre. This chromatic pattern reappears on the large stone braziers flanking each of the four serpent heads with geometric scales. The four braziers on the north side are decorated with rain god busts and abundant blue pigment, while the four braziers on the south side are adorned with the sun god Huitzilopochtli's red bow and ochre-colored surfaces. We can add to this list two altars that are located at the entrance to the platform. The one on the Tlaloc side is ornamented with beautiful frogs, while the one on the Huitzilopochtli side bears cloud serpent bas-reliefs. As one would expect, the frogs are painted blue, whereas the serpents are partially ochre.

In sum, blue was the color chosen for the serpents, braziers, and altars on the side of the temple dedicated to the rain god, while ochre was used to paint those on the side consecrated to the sun god. In this respect, many authors have discussed the importance of duality at the Great Temple (see López Luján 2005b:70–75). The suggestion that this pyramid symbolically summarized the basic oppositions of the universe, such as winter solstice/summer solstice, earth/sky, night/day, wet season/dry season, is also well known. With regard to the latter opposition, Aguilera (1982) has proposed that the northern half of the pyramid marked the *xopan,* which can be translated as "blue-green time." This was the season from May to October, when the rains dominated. The southern half, according to Aguilera, signaled the *tonalco* or "time of the sun." This period, from November to April, corresponded to the dry season.

As we have seen, the dual iconographic program of the Great Temple also made use of a blue-ochre chromatic opposition. In this regard, Danièle Dehouve (2003:64–67) and Elodie Dupey (2003:83–86; see also 2010) have noted that the Nahuatl words *xoxoctic* and *xouia,* used for blue-green, belong to the semantic field of death, rawness, and vegetation in its fresh and tender stage. Xoxouhqui was also one of the names for Tlaloc. In contrast, the words *cozauhqui* and *coztic,* used for yellow, pertain to the semantic field of life, dryness, and the ripening of grains. Yellow, along with red, was the color of the sun and of the fire god, who was called Ixcozauhqui or "He Who Has the Yellow Face."

In this respect, we should also remember that the city of Tenochtitlan was founded on a spot that would become "the root, the navel, and the heart of all world order" (Durán 1994:337). According to Hernando Alvarado Tezozómoc (1949:63), this place was identified by the presence of two springs. The first of them was known as *tleatl, atlatlayan*—that is, "fiery water, watery

7. We must note that one of these two serpents flanking the northern stairway has palygorskite blue on the left eye and palygorskite blue covered with sepiolite blue on the right eye. It is likely an example of ancient restoration or repainting.

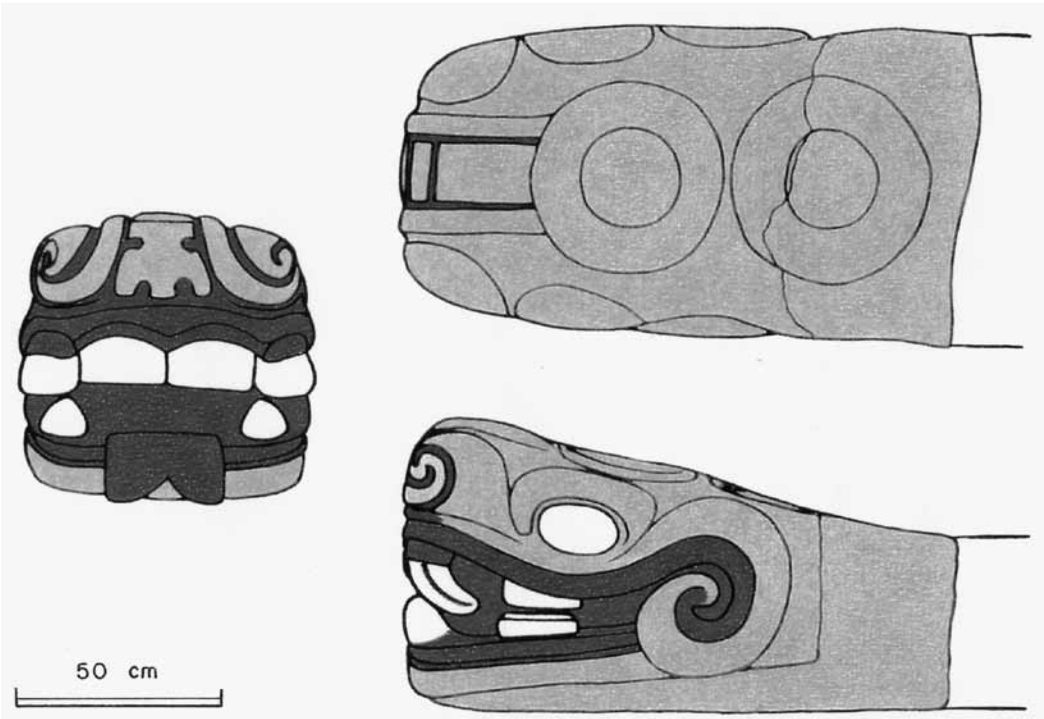

Figure 6. Color reconstruction of the jade serpent found on Stage IVb of the Great Temple. Drawing: Fernando Carrizosa. Courtesy of Proyecto Templo Mayor.

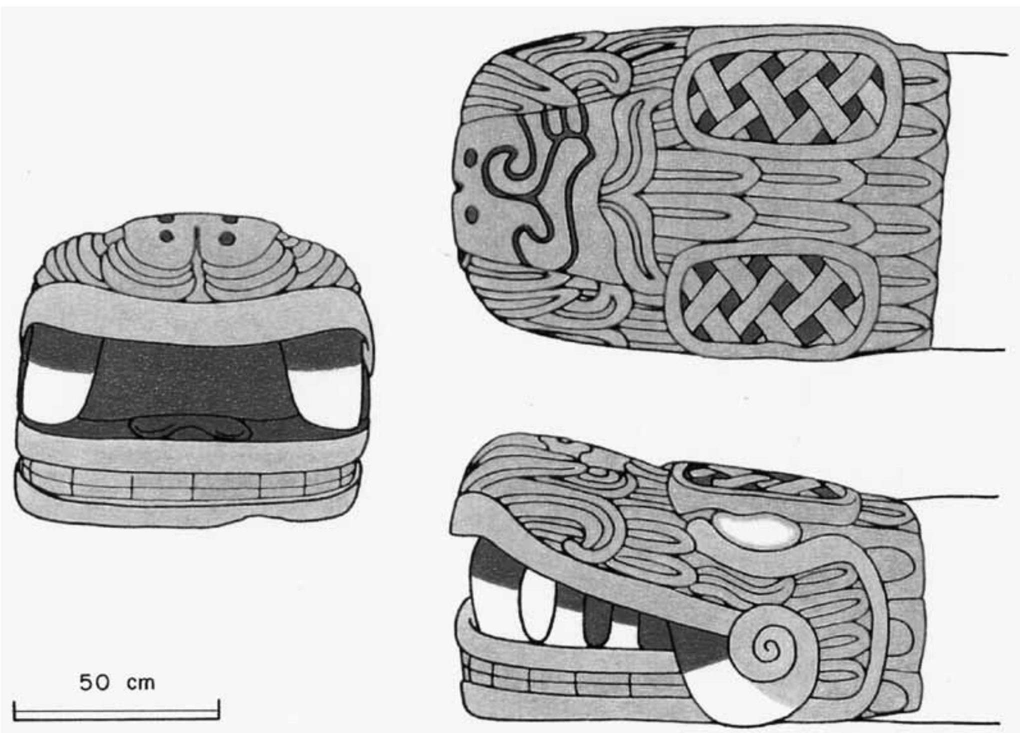

Figure 7. Color reconstruction of the feathered serpent discovered on Stage IVb of the Great Temple. Drawing: Fernando Carrizosa. Courtesy of Proyecto Templo Mayor.

bonfire." The second was called *matlalatl, toxpalatl,* which means "blue water, yellow water." It is significant that Sahagún's informants tell us that this blue and yellow place called *matlalatl toxpalatl* was precisely the "navel of the earth" and there dwelled the "father and mother of the gods," that is, the fire god Xiuhtecuhtli himself (Sahagún 1969:18–19, 41, 88–89).

As a concluding remark, it is clear to us that color analysis is not only quite helpful for revealing the use of certain raw materials in the pre-Columbian past and reconstructing long-lost technological practices, but also for understanding the functions and meanings of ancient polychrome sculpture. After all, these Mexica masterpieces were created for deep religious reasons—not to please our aesthetic desire.

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