

# How to Map with Ink: Cartographic Materials from Colonial Oaxaca

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**Abstract.** Material technology played a key role in the making of indigenous maps. This article analyzes the use of ink to explore the chemical and botanical practices used by native painters and Spanish officials to make and authenticate maps. This underexamined aspect of indigenous cartography enhances our understanding of a painter's technical skills, allowing us to gain insight into the complex process of selecting and preparing a variety of organic and inorganic ingredients to illustrate them. Spanish scribes and regional judges used their own formulas to make ink, applying the liquid substance to review and annotate maps to fit legal protocols. Combining a sample of maps from Oaxaca with botanical histories, chronicles, and orthographic treatises, this article traces the use of ingredients such as rocks, plants, liquids, roots, and soil as they made their way from the physical world to the hands of an Indian painter or a Spanish official who skillfully transformed them into ink. The interaction between different substances contributed to the distinct style and function of indigenous mapmaking.

Francisco Hernández, the royal physician and naturalist who in the late sixteenth century spent seven years in New Spain cataloging native plants and their uses, identified two types of ink made by painters in the Mixteca. “*Tetilli* or black stone,” he said, “is a soil extracted primarily from the region of this New Spain known as the Mixtecas [*sic*]; it is sometimes used by painters to produce said color.”<sup>1</sup> Hernández noted that a carbon-based mix made from an aromatic pine known as *ócotl* also circulated in the region.<sup>2</sup> “[Painters] also prepare among them,” observed the physician, “another blend of black ink with the smoke of woodchips from any pine tree known as *ocotilli* (*ócotl* in the vernacular and from where the ink gets its name).”<sup>3</sup> When burned, the wood produced thick black smoke captured

by painters in clay jars until it condensed. Afterward, they would scrape the soot from the inside of the jars, forming small round balls that, according to Hernández, could be purchased at local markets for individual use.<sup>4</sup> In the late sixteenth century, painters made and used ink to facilitate the portrayal of geographic landscapes based on formulas developed over time that combined organic and inorganic elements designed to give luster and to allow the substance to adhere to a surface.

A painter from Cuquila, a *cabecera* (head town) in the Mixteca Alta in northwestern Oaxaca, applied one of these formulas in 1599 to prepare a blend of black ink, *nduta tnoo*, to draw a map of the region (fig. 1) for the Spanish scribe Alonso Morán.<sup>5</sup> The painter included two structures, a temple and a church, from where a network of roads marked by footprints spread to other parts of the region. The arteries connected Cuquila to Tlaxiaco, the region's center of power to the northeast, to Ocoatepec in the south, and to Chicaguastla in the southwest and on to the Pacific Coast. An ocelot enclosed in an inverted bell-shaped hill appears in the bottom section of the map, representing Cuquila's place-name, the town of the ocelot. The church, temple, and hill include a black-and-white decorative frieze running along the bottom of each structure, consistent with pre-Columbian and early colonial pictorial writing.<sup>6</sup> Likewise, the painter detailed a band of small cylinders below the church's bell to convey political and religious authority, an element drawn from Mixtec architectural design.<sup>7</sup> Two rivers that flow diagonally across the page, in parallel lines, encase all three elements. A combination of technical savvy and fluency in pictorial writing allowed the painter to execute his commission for the scrutiny of the scribe's watchful eye.

When the painter from Cuquila presented the map to local authorities, the scribe used his own blend of ink to authenticate it. Written commentary on the front and back of the map identifying roads and rivers, describing local climate, measuring distances between places, and counting the number of tributaries suggests the presence of another hand involved in the inspection.<sup>8</sup> The practice of authentication, an exercise between painters, scribes, and regional judges to identify and annotate the contents of a map, gave authorities the opportunity to review the map and to ask a painter questions in order to validate it according to legal protocols. The patch of paper (fig. 2) on the map's bottom left-hand corner, for instance, covered the original illustration used by the painter, a dual church-temple motif, for a settlement of houses known as a *casería*. During the inspection or sometime shortly after, the scribe placed the patch over the original illustration, preferring to visualize the *casería* with small houses spread out evenly and conforming to royal directives for the settlement of villages and towns. Spaniards commonly used a solution known as iron-gall ink, a mixture



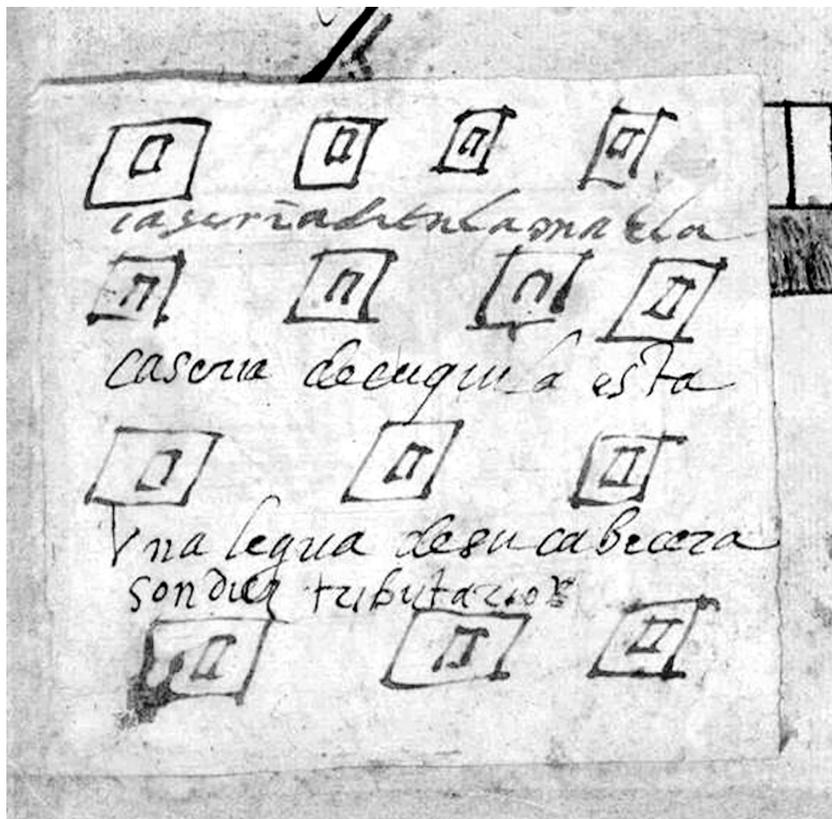


Figure 2. Paper patch, Map of Cuquila, 1599

of tannins, sulfates, and gum from the Old World, to write the alphabetic glosses that accompanied a map's pictorial elements. Iron-gall ink played a crucial role in the making of maps, allowing scribes and officials to codify and make them legible for others and in preparation for their transition into one of various archives where maps and documents rested for future reference. Scribes visually transformed maps with the ink they used, a substance that supported the task of authentication but which also contributed to a map's unique material condition.

The relationship between mapping and materials is not always transparent. Before painters committed symbols to the surface of a map, they prepared the substances they would use to illustrate it. Indigenous painters, shrewd multilingual individuals often dressed in European clothing and accustomed to dealing with scribes and officials, made pigments by select-

ing elements found in nature, converting them into working ingredients, and mixing them to produce colorants, inks, and binders. This important but overlooked aspect of mapping highlights skills in botany, healing, and chemistry to transform plants and minerals into cartographic materials. The knowledge applied reflects a deep engagement with organic and inorganic substances acquired through generations of learning. Knowledge, as James Secord has posited, sits at the center of a dialogue between those who produce objects and their dissemination among various groups of people at the local, regional, and global levels.<sup>9</sup> Since maps reflect a similar pattern of production and circulation, the study of materials such as ink informs a broader dialogue about ethnicity, cross-cultural encounters, and imperial expansion that shaped spatial relationships. While painters controlled geographic and pictorial knowledge as well as the tools needed to make maps, scribes and officials helped define their content to fit Spanish legal principles. With ink, authorities facilitated the viewing of a map by providing a written description of towns, roads, rivers, boundaries, and distance in accordance with legal and notarial protocol.

### A Sample of Materials

“It is a painter’s craft to know how to use colors, and draw and give meaning to images with carbon, and to properly combine colors, and know how to grind and mix them,” commented Franciscan friar Bernardino de Sahagún about an Indian painter’s range of skills. In his *Historia general de las cosas de Nueva España*, a history of Mesoamerican culture compiled with the assistance of native informants during the second half of the sixteenth century, Sahagún highlighted their “good hand” and their ability to paint gracefully, to embellish, and to carefully consider the subject matter.<sup>10</sup> This attention to materials and craftsmanship observed by the Franciscan reflects an appreciation of the tools and methods that native painters—described by Spanish authorities typically as *pintores* but known among Zapotecs as *huazèè*, among Mixtecs as *ñahuisi tacu*, and among Nahuas as *tlacuilo*—used to hone their craft.<sup>11</sup> Painters during the second half of the sixteenth century responded to spatial realignments, surveying, and record-keeping practices that ordered and classified individuals and their actions. These efforts contributed to the commission and production of native maps, an activity that combined pictorial skills and geographic knowledge along with a measure of cultural awareness.

A pictorial analysis of three dozen maps made from 1580 to 1617 yields important clues about painters’ choice of materials. Most used three to five different colors in each map, a practice that continued after the early seventeenth century, when sources in the archives become scarcer.<sup>12</sup> They

achieved this diverse chromatic range through the mixture of plants, minerals, roots, insects, fluids, and fruit that constituted the adhesives, ink, and colorants used to make maps. Pintores favored the colors green, brown, red, blue, and black but applied others including yellow, steel gray, teal, and magenta. While color in pictorial manuscripts of the pre-Columbian period had a close association with ritual and politics, the practice of assigning meaning to specific tones suffered after the second half of the sixteenth century when painters tailored maps to appeal to scribes and royal officials more interested in establishing locations and boundaries.<sup>13</sup> Some painters such as the artist from Cuquila used a single color to illustrate their maps. The Dominican Francisco de Alvarado in his *Vocabulario en lengua mixteca*, a dictionary of the Mixtec language intended for evangelization published in 1593, identified monochromatic pictorials among Mixtec as “dzo eeni nuu tacu,” or “painting of one color.”<sup>14</sup> The use of this convention existed in central Mexico as well. Twenty years earlier, Alonso de Molina noted in his *Vocabulario en lengua castellana y mexicana* (1571) that monochromatic paintings were known as “çancecni ycac tlacuilolli” and “çancecni tlachia tlacuilolli” (painting of a single color).<sup>15</sup> Although the precise context of monochromatic images remains obscure, terms such as these convey the significance that materials and color played in the art of painting to carry messages.

The study of materials and technology informs a rich and evolving historiography associated with indigenous mapmaking in colonial Mexico. Major studies of native cartography have carved important paths to understand shifting modes of pictorial representation during the sixteenth century as well as the historical context and political conditions under which maps were made.<sup>16</sup> These works have enriched our understanding of native painters and their role as mediators between authorities, towns, and individuals in the early colonial world, but they have stopped short of mentioning the presence of the mineral and natural materials used to make maps. In most respects, the responsibility of investigating Mesoamerican material technology used in pre-Columbian and early colonial pictorial documents has fallen under the purview of conservators and textile experts, who have established useful parameters to measure the types of elements used in native pictorial activities including mapmaking.<sup>17</sup> Two recent edited works feature contributions that showcase indigenous material technology originating in central Mexico during the sixteenth century.<sup>18</sup> The work of art historian Diana Magaloni Kerpel, a unifying thread in both volumes, draws effectively from the use of conservation practices, historical analysis, and visual interpretation to examine the relationship between materials, colors, and usage.<sup>19</sup>

The growing interest in early modern materials, commodities, and technology among historians of science and art has exposed the intimate relationship between learned inquiry and practical experience.<sup>20</sup> Gabriela Siracusano's *El poder de los colores*, an analysis of materiality in Andean colonial art, provides a particularly useful model for considering questions about the application of knowledge to produce pigments and other elements used in mapping. Siracusano proposes that the diversity of materials of European and New World origin available to artists in the Andes promoted experimentation with ingredients and techniques, contributing to the paintings' unique character. Her use of chemical analysis and early modern treatises on alchemy, art, metallurgy, botany, and medicine to inform the circulation of knowledge and pigments among social networks opens unique possibilities to contextualize intellectual exchanges and the technical practices associated with visual culture. For Oaxaca, questions about materiality suggest new paths to examine indigenous learning in the natural sciences that contributed to the fabrication of materials used to paint a map as well as the transformative influence of European ideas, tools, and ingredients on pictorial records.

### Mesoamerican Inks

The painter from Cuquila preferred ink for his maps. He prepared a mixture of ink in 1595 to paint a map (fig. 3) on behalf of Pascuala de Rojas, an indigenous noblewoman who petitioned a livestock ranch (*estancia*) from Spanish authorities.<sup>21</sup> The painter placed Chicaguastla in the upper left-hand corner, Mistepec in the upper right, and Cuquila at the bottom, serving as the map's main reference point; the large oval in the center of the page identified the site. Although the spatial configuration of the 1595 map differs from that of the map made in 1599 (fig. 1), several elements tie both maps to the same author. The shape of the churches used to designate towns share the painter's distinctive double-line contour and the same design for doors, windows, and bells. Roads designated with a single line on both maps share identical feet that indicate travel, while the mountains, highly stylized renderings, all include similar nubs to indicate broken and uneven terrain. Most important, the painter's signature black ink facilitated the description of regional landscapes. That the painter chose the same substance to draw the 1595 and 1599 maps is testimony of the skills required to consistently mix materials, dexterity in this activity resulting from observation, practice, and "artisanal innovation."<sup>22</sup>

In colonial Oaxaca, ink circulated in various compositions, allowing scribes and painters to record alphabetic and pictorial elements onto a flat



surface including paper, vellum, and cloth. Besides the materials described at the beginning of this essay, Hernández identified other ingredients to make ink. He pointed to the use of two varieties of *tlaliyac*, a mineral extracted from the earth either as clods with bits of silver and gold particles or as black stones. He described them as “hot, dry, and astringent [in] nature and acrid in taste. The natives make ink out of them.”<sup>23</sup> The physician also mentioned *nacazcōlotl*, a fruit shaped like deformed ears (“orejas torcidas”), noting: “Its nature is very astringent and somewhat dry. You prepare with it very good ink.”<sup>24</sup> During his travels in New Spain, Hernández responded to a mandate to investigate the devastating *cocoliztli* epidemic that swept central Mexico in 1576. That same year, Sahagún and his native informants worked on the final stages of the *Historia general* in spite of the rising death toll.<sup>25</sup> It was during this period that the informants shared with Sahagún the properties of various plants and minerals including *nacazcōlotl*. “There is in this land,” he remarked, “a fruit of a tree which thrives in hot lands [and] that is not edible. This fruit is called *nacazcōlotl*. If you add copperas [ferrous sulfate] and other materials, you make very good ink to write.”<sup>26</sup> But it was another blend called *tlilliocotl* that the Franciscan praised above others. Sahagún called it “tinta del humo de las teas” (wood-smoked ink), noting: “The natives make ink from the smoke of wood and it is very fine ink; they call it *tlilliocotl*. They make it in some jars called *tlicomalli* in order to distill it. It is worth the cost of many inks.”<sup>27</sup> Its fabrication mirrored the ocotilli blend described by Hernández for the Mixteca.

For generations, ocotilli ink and its variants had been an essential component of Mesoamerican ritual practices. Testimonials from the decades following the subjugation of Oaxaca in the first half of the sixteenth century suggest that the fabrication of ink continued to inform celebrations that invoked the old deities. An Indian slave identified simply as “Juan” declared in 1545 before an Inquisitorial tribunal that don Francisco, a native lord from the important head town of Yanhuitlán in the Mixteca Alta, worshiped with others in secret:

Since it wouldn’t rain, don Francisco sent the priests to the woods to make charcoal. When they brought it, they ground it and made ink. Don Francisco undressed and blackened himself saying, “I am no longer a Christian, I have returned to what I used to be.” He then bled his ears while the others perfumed him with copal. He sent for many quails and sacrificed them, calling the devil, and he asked his friends and relatives to do the same.<sup>28</sup>

The slave’s account exposes another dimension of the manufacture and use of ink. While his motivations to reveal such an intimate moment remain

obscure, the testimony vividly captures the ideological conflicts faced by those forced to negotiate disasters, disease, and punishment. The pressure of a drought pushed don Francisco to revert to ancient ritual practices through an elaborate cleansing ritual, where black ink played a central role in his transformation. The cacique and his cohorts selected the proper wood, and they burned it to make charcoal, returned it to the house, and ground it before applying it on their bodies. It should come as little surprise to find priests and caciques making ink since these groups held considerable sway over pictorial writing before the sixteenth century, when it facilitated the dissemination of Mesoamerican beliefs and practices.<sup>29</sup>

In other parts of Mesoamerica, painters also made ink using the bark of the *huitzquahuitl*, a large tree of reddish wood native to Michoacán. According to Sahagún, they would split the bark into pieces, grind it, and place it in water until it turned deep crimson. From this mixture, painters could obtain a bright red dye by combining organic materials and a stone known as *tlaxócotl*, or they could obtain ink by mixing *tlalíyac* soil and other unspecified elements.<sup>30</sup> *Tlaxócotl*, described in Spanish as *piedra alumbre* (alum stone), existed in great quantities and was an important ingredient in the mixture of colorants.<sup>31</sup> A variant of *huitzquahuitl* ink known as *huitztecóláyotl* incorporated brazilwood, a species of tree native to South America but also found in Oaxaca and Morelos. Painters boiled the red dye from the brazilwood with *tlalíyac* until the substance thickened and cooled.<sup>32</sup> Dominican Francisco Ximénez commented in his *Historia natural del reino de Guatemala* (1722) about a rich black soil used in the Maya region to make black ink. “God has even blessed these parts with black inks,” he said, “both to dye and also to write. . . . In that mountain range of Zacapulas, next to the town of Cuzal, there is a mineral in the form of black soil that just by crumbling it in water produces the blackest ink to write. It is, however, necessary to add gum, [for] without it, [anything you write] will vanish because it is soil.”<sup>33</sup>

Painters added a binding agent to their concoctions to ensure that ink and colorants adhered to their intended surface. Various organic materials served this purpose including the pseudobulbs of the *tzacutli* orchid, storage organs that grow between the stem and two lymph nodes typical among orchids. The glue made from *tzacutli* functioned both as a binding agent when mixed with other natural elements to make colors and as an adhesive.<sup>34</sup> Hernández noted that *tzacutli* was highly valued for its “white, fibrous roots,” which possessed strong adhesive qualities.<sup>35</sup> “The root is cold, humid, and viscose,” he observed; “you prepare with it excellent, tenacious glue that Indians, especially pintores, use so that the colors adhere firmly [to paper] and the figures won’t fade easily.”<sup>36</sup> Hernández described how the parts were cut into small pieces and then dried in the sun,

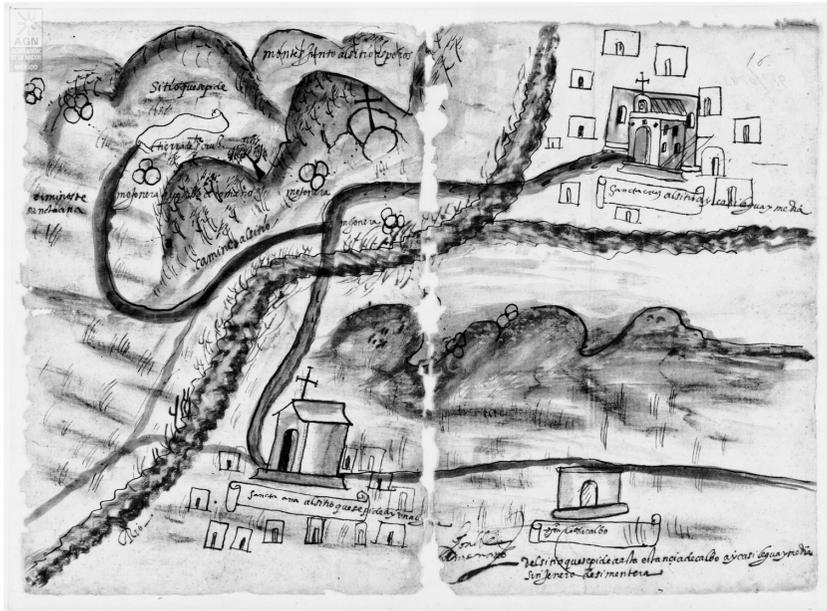


Figure 4. Map of Santa Ana and Santa Cruz, 1591. Archivo General de la Nación, no. 0581, Tierras, vol. 56, exp. 5, fol. 16

ground into powder, and mixed with cold water. Tzacutli also possessed medicinal qualities used to treat patients with dysentery and other maladies associated with laxity. In Oaxaca and other parts of New Spain, painters applied sophisticated botanical knowledge that allowed them to identify plants and other minerals to transform them into materials for their trade.

The variety of inks is often clearly discernible when examining indigenous maps. The thin black lines used to define the visual elements in the 1591 map of Santa Ana and Santa Cruz in southeast Oaxaca (fig. 4) reflect a luster not visible in the more opaque and matted finish achieved by the ink of the painter from Cuquila.<sup>37</sup> Originally prepared to petition a site of land, marked by a banner bearing no inscription in the upper left-hand corner, the map shows the painter's application of a range of colors that contrasts sharply with the stylized renderings of the artist from Cuquila. The road that connected Santa Cruz, Santa Ana, and the new site was painted deep red, while a river detailed in green, gray, and yellow that flows across the page runs next to the town of Santa Cruz in the upper right-hand corner. The painter made these colors by drawing from the same botanical knowledge that guided the fabrication of ink. The black outline from the painter's



Figure 5. Detail, Map of Santa Ana and Santa Cruz

ink contrasts sharply with the iron-gall ink used by the scribe to inspect the map. The scribe's intervention appears near the church of Santa Ana, where he added additional houses to the perimeter of the town (fig. 5). The scribe used a banner that included the name of the town—an element influenced by European mapping techniques—as a space to incorporate a comment about distance, noting that the site was located a league away. The contrast of the two inks enhances our understanding of the painter's pictorial intentions and the scribe's expectations, its presence a visual reminder of negotiations over land.

### Recipes from the Old World

Spaniards in the New World had their own traditions for making ink that tapped into centuries of experimentation and practical learning. In early modern Spain, carbon-based and other unknown mixtures circulated with the popular iron-gall inks, a combination of tannins, vitriol, and gum. Antonio Mut Calafell's compendium and analysis of late medieval and early modern Spanish formulas for ink suggest that the majority of users mixed the iron-gall variety.<sup>38</sup> Knowledge of ink circulated in manuscript form mostly through the writings of notaries and scribes, who scribbled mixtures in loose notes or annotated recipes on the margins of a page. In print format, ink recipes appeared primarily in treatises on calligraphy and orthography such as *Doctrina cristiana del ermitaño y el niño* (1546) by Andrés

Flórez, who published a variation of a common recipe used throughout the Hispanic world: “Good ink is made from white wine and the common type from water; it is better if it is puddle water. Add an ounce of mashed nutgalls to a pint of water and boil until a third is dissolved. Strain, mix an ounce of coppers or better yet vitriol, and add a quarter ounce of Arabic gum, stir well and move in strained lukewarm water. Repeat as necessary.”<sup>39</sup> The acidic quality of tannins, usually obtained from tree galls, produced a dark substance when mixed with iron salts and diluted in water or wine; gum acted as a binding agent for the mixture. Individuals obtained various lusters and shades of ink depending on the ingredients, which also included onions, pomegranates, sugar, and liquor.

Variations of Flórez’s formula circulated widely in the Hispanic world. Diego Bueno added sugar and six ounces of brandy to his mixture of galls, vitriol, and gum.<sup>40</sup> Others took advantage of the Atlantic trade to incorporate new ingredients into their recipes. Nicolás Monardes in his *Historia medicinal de las cosas que traen de nuestras Indias*, a compendium of curative plants from America published in Seville in 1574, wrote about a rich soil from the New World used to make ink. “Of the black [soil],” he declared, “I can say someone sent me a small sample from which to make ink. When diluted in water or wine, you can make fine ink to write well, and it has a blue hue which makes it more pleasant to the eye.”<sup>41</sup> Regional differences characterized the production of ink, which, according to Adrian Johns, “enjoyed no common chemical or cultural composition.”<sup>42</sup> But the differences depended less on the ingredients used to make the composition than on the method of preparation. Juan de Iciar in his *Arte sutilisima*, printed in 1553, instructed readers to place a solution of three ounces of crushed galls and half a pitcher of rainwater under the sun for a period of two days, after which they should add two ounces of vitriol and set it to rest for another two days.<sup>43</sup> Ignacio Pérez used the same ingredients but mixed galls, vitriol, and gum each in separate vessels with water and wine, letting them rest for a period of six days and stirring four to five times a day. “You will then place a large cauldron over a good flame,” he said, “and you will deposit the jar with the galls and let it boil for an hour,” a process that he instructed should be repeated for the contents of the other two containers.<sup>44</sup>

Despite these differences, the formulas suggest that individuals valued certain properties of ink including tone and durability, which made the substance stand out. To add luster, Iciar recommended boiling his solution moderately and adding pomegranate peels.<sup>45</sup> For writing on paper, José de Casanova in his *Primera parte del arte de escribir* (1650) recommended using water, because “it is looser, [and] it has less body and strength,” but for parchment he suggested wine. “It is imperative it be wine,” he declared, “for the black is better, it settles and endures more.” After describing the mix-

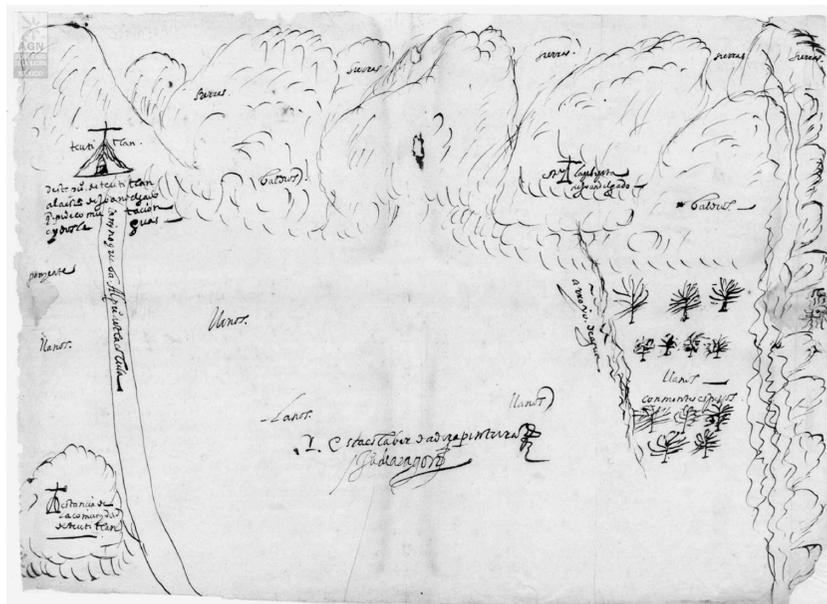


Figure 6. Map of Teotitlán, 1583. Archivo General de la Nación, no. 0560, *Tierras*, vol. 35, exp. 7, fol. 11

ture of ink prepared over a two-week period without the use of fire, Casanova remarked, “I have acquired experience with many recipes that circulate in written form and I have found none that produce better results than this one.”<sup>46</sup> In some instances, individuals even valued ink for its medicinal properties that helped alleviate certain ailments of the skin. Sixteenth-century Spanish physician and pharmacologist Andrés Laguna provided a recipe for making the liquid substance, noting, “Writing ink heals pus-filled sores and burn wounds over which you must apply thick coats with water until the sores granulate.”<sup>47</sup>

Scribes in Oaxaca used variants of these mixtures to write documents and, on occasion, to make their own maps.<sup>48</sup> In 1583 the Spanish scribe Juan de Aragón sketched a map of Teotitlán in the southwestern region of the Valley of Oaxaca (fig. 6) for a survey to allocate land.<sup>49</sup> Aragón mapped a largely isolated part of the region surrounded by mountain ridges in the north and plains and heavily forested mountains in the east. The scribe viewed the region from a southwestern point near Teotitlán’s estancia (in the bottom left corner), fanning the region’s natural features across the page

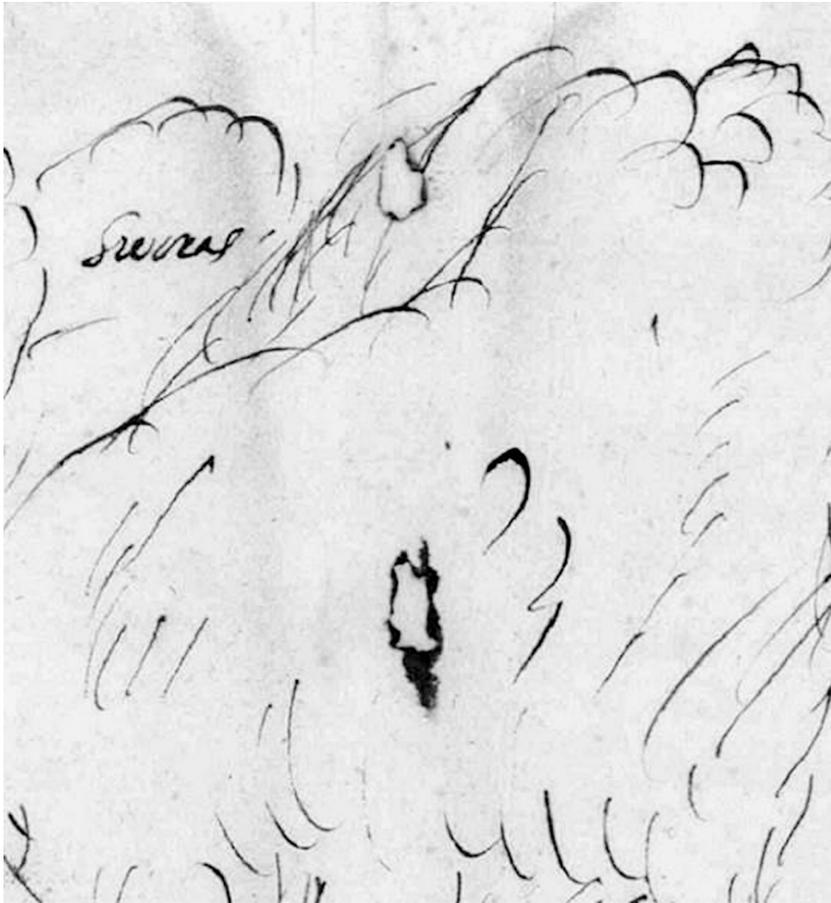


Figure 7. Detail, Map of Teotitlán

and creating a useful blank space in the center on which to later inscribe the map. “This is the true painting,” certified Aragón with a flourish of his pen. Signatures by royal officials legitimized maps, investing them with juridical authority. Signing implied several acts such as the viewing, reading, writing, categorizing, and dialogue involved in the inspection of a map. The scribe used iron-gall ink to draw the map’s components including the road to Tlacolula that ends at an estancia held by Teotitlán (on the left edge), as well as to annotate unused territory described as *baldíos*. His choice can be gleaned in the two holes along the map’s central axis (fig. 7) where blots of

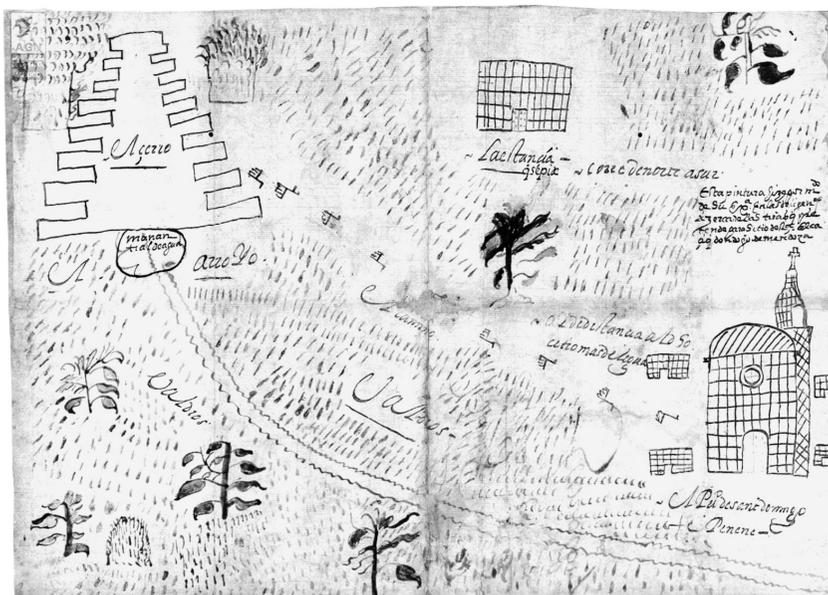


Figure 8. Map of Santo Domingo Tepehene, 1617. Archivo General de la Nación, no. 2225, Tierras, vol. 2812, exp. 11, fol. 312

ink concentrated, burning through the paper over time, a product of iron-gall's corrosive effect.

Indigenous pintores incorporated the European ink into their own surplus of materials. In 1617 don Domingo de Mendoza, a native cacique from Tepehene in the Mixteca Alta, drew a map (fig. 8) to petition Spanish authorities for an estancia a little over a league away from the main town.<sup>50</sup> Mendoza used a palette of three different colorants to define a triad of trees with vibrant red blossoms and another trio with yellow flowers. The two most inconspicuous elements on the map, the mountain in the shape of an ancient temple in the upper left-hand corner connected by a trail of feet to the church in the bottom right, do not incorporate color but instead appear to be drawn with iron-gall ink. When the map is turned over (fig. 9), one can see where the lines of the pyramid-shaped mountain, visible on the map's upper right-hand side, have seeped through the page, leaving noticeable traces comparable to the scribe's certification on the left-hand edge. The map's material condition suggests that indigenous painters sometimes used a combination of Old and New World substances to represent spatial relationships and the natural environment in much the same way they incorporated a mixture of Western iconology and Mesoamerican cosmology.



Figure 9. Verso, Map of Santo Domingo Tepehene

## Conclusion

We tend to take ink for granted. Our twenty-first-century sensibilities have conditioned us to see beyond this material; it exists for us to use at will and is available almost everywhere we turn. We write, scribble, draw, and print with ink without really considering its unique value in our efforts to communicate. In colonial Oaxaca, indigenous painters used ink to paint maps that described spatial relationships in order to negotiate land. Hidden beneath the fibers of the writing surfaces it touched, the history of ink shares an intimate relationship with plants and minerals, elements used to create colors to embellish and give meaning to maps. Painters such as the artist from Cuquila applied ink to great effect, drawing from traditional Mesoamerican pictorial techniques while incorporating materials introduced by Spaniards in the New World. The diversity of methods and formulas used to make ink in Spain and New Spain reveals the way knowledge circulated and how it informed the activities of individuals in towns and regions across the Atlantic. In central and southern Mexico, painters shared their learning of botany with men like Sahagún and Hernández who left detailed records of their accounts. Together with dozens of extant maps that illustrate landholdings, political boundaries, and petitions for unused

property, these sources provide valuable insight into the range of skills used to make maps in colonial Oaxaca.

## Notes

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- 1 "El *tetlilli* o piedra negra es una tierra que se extrae principalmente en la región llamada de las Mixtecas, de esta Nueva España, y que usan a veces los pintores para dar dicho color." Francisco Hernández, *Historia natural de Nueva España* (hereafter *HNNE*), vol. 2, in *Obras completas*, vol. 3 (Mexico City, 1959), 409.
- 2 The use of Nahuatl as the primary unit to classify plants and minerals from New Spain reflects Hernández's preference for this widely spoken language, his careful research having been informed by Nahua interpreters, painters, and healers. See José M. López Piñero and José Pardo Tomás, "The Contribution of Hernández to European Botany and Materia Medica," in *Searching for the Secrets of Nature: The Life and Works of Dr. Francisco Hernández*, ed. Simon Varey, Rafael Chabrán, and Dora B. Weiner (Stanford, CA, 2000), 124; and Francisco Hernández, *The Mexican Treasury: The Writings of Dr. Francisco Hernández*, ed. Simon Varey and trans. Rafael Chabrán, Cynthia L. Chamberlin, and Simon Varey (Stanford, CA, 2000), 78.
- 3 "Se prepara también entre ellos otra clase de tinta negra llamada *ocotlilli* con humo de astillas de cualquier pino (*ócotl* en lengua vernácula y de donde la tinta toma el nombre)." *HNNE*, vol. 2, 409.
- 4 *Ibid.*
- 5 Map of Cuquila, 1599, Archivo General de la Nación, Mexico City (hereafter AGN), no. 2463, Tierras, vol. 3556, exp. 6, fol. 175. Cuquila was a small head town in the Tlaxiaco region of the Mixteca Alta with a rich pictorial tradition. Other native maps from the Cuquila region include the Map of Tlaxiaco and Cuquila, 1588, AGN, no. 1692.9, Tierras, vol. 2692, exp. 17, fol. 8; the Map of Tlaxiaco, Cuquila, and Mistepéc, 1595, AGN, no. 1614, Tierras, vol. 2682, exp. 17, fol. 18; and the Map of Mistepéc, Chicaguastla, and Cuquila, 1595, AGN, no. 0867, Tierras, vol. 876, exp. 1, fol. 122.
- 6 The Codices Bodley, Nutall, Selden, Colombino, and Yanhuítlán, the Lienzo de Zacatepec, and the Map of Teozacoalco (1580) all share this pattern in asso-

- ciation with imperial buildings, temples, and place-names. Detailed studies on each of these manuscripts can be found in Zelia Nuttall, ed., *The Codex Nuttall: A Picture Manuscript from Ancient Mexico* (New York, 1975); Alfonso Caso, ed., *Interpretación del Códice Bodley 2858* (Mexico City, 1960); Caso, ed., *Interpretación del Códice Selden 3135 (A.2)* (Mexico City, 1964); Caso, "El mapa de Teozacoalco," *Cuadernos americanos* 47, no. 5 (1949): 145–81; Alfonso Caso and Mary Elizabeth Smith, *Códice Colombino: Interpretación del Códice Colombino por Alfonso Caso; Las glosas del Códice Colombino por Mary Elizabeth Smith* (Mexico City, 1966); and Wigberto Jiménez Moreno and Salvador Mateos Higuera, eds., *Códice Yanbuilán* (Mexico City, 1940). For the Lienzo de Zacatepec, see Mary Elizabeth Smith, *Picture Writing from Ancient Southern Mexico: Mixtec Place Signs and Maps* (Norman, OK, 1973), 89–121, 264, 266–90.
- 7 James Kiracofe, "Architectural Fusion and Indigenous Ideology in Early Colonial Teposcolula: The Casa de la Cacica: A Building at the Edge of Oblivion," *Anales del Instituto de Investigaciones Estéticas* 17, no. 66 (1995): 45–84; Kevin Terraciano, *The Mixtecs of Colonial Oaxaca: Nudzahui History, Sixteenth through Eighteenth Centuries* (Stanford, CA, 2001), 160.
  - 8 The handwriting on the front of the map is different from the writing on the back. One possible explanation is that one individual, a *corregidor* (regional judge) perhaps, inspected the map's symbols and descriptions, leaving the task of signing the map to Morán, the scribe. Another possibility is that the painter may have annotated his own map, but this practice was a rare occurrence.
  - 9 James Secord, "Knowledge in Transit," *Isis* 95, no. 4 (2004): 654–72. I thank Josep Simon for pointing me to this source.
  - 10 "El pintor, en su oficio, sabe usar de colores, y dibujar o señalar las imágenes con carbón, y hacer muy buena mezcla de colores, y sábelos moler muy bien y mezclar. El buen pintor tiene buena mano y gracia en el pintar, y considera muy bien lo que ha de pintar." Bernardino de Sahagún, *Historia general de las cosas de Nueva España* (hereafter *HGNE*), vol. 3, ed. Ángel María Garibay (Mexico City, 1977), 115.
  - 11 Juan de Córdova, *Vocabulario en lengua çapoteca* (Mexico City, 1987 [1578]), 315v; Francisco de Alvarado, *Vocabulario en lengua mixteca* (Mexico City, 1962 [1593]), 168; Alonso de Molina, *Vocabulario en lengua castellana y mexicana* (Madrid, 1944 [1571]), 120.
  - 12 This period coincided with a shift in Spanish and Indian populations that adjusted spatial boundaries as a result of demographic decline and resettlement campaigns in the sixteenth century. See William Taylor, *Landlord and Peasant in Colonial Oaxaca* (Stanford, CA, 1972); 21, 26–27, 37; Peter Gerhard, *A Guide to the Historical Geography of New Spain*, rev. ed. (Norman, OK, 1993), 51–52, 90–91, 159; Terraciano, *Mixtecs of Colonial Oaxaca*, 119–21; Charles Gibson, *The Aztecs under Spanish Rule: A History of the Indians of the Valley of Mexico, 1519–1810* (Stanford, CA, 1964), 28, 54, 282–85; and James Lockhart, *The Nahuas after the Conquest: A Social and Cultural History of the Indians of Central Mexico, Sixteenth through Eighteenth Centuries* (Stanford, CA, 1992), 44–46. A second upward trend in Indian map production starting in the 1680s responded to changing land tenure legislation and growing competition for land. See Taylor, *Landlord and Peasant*, 68–70; Gibson, *Aztecs under Spanish Rule*, 285–88; Lisa Sousa and Kevin Terraciano, "The 'Original Conquest' of Oaxaca: Nahuatl and Mixtec Accounts of the Spanish Conquest," *Ethnohistory* 50, no. 2 (2003):

- 349–400; Yanna Yannakakis, “Witnesses, Spatial Practices, and a Land Dispute in Colonial Oaxaca,” *The Americas* 65, no. 2 (2008): 161–92; and Alexander Hidalgo, “A True and Faithful Copy: Reproducing Indian Maps in the Seventeenth-Century Valley of Oaxaca,” in “Imperial Geographies and Spatial Memories in Spanish America,” ed. Alexander Hidalgo and John F. López, special issue, *Journal of Latin American Geography* 11 (2012): 117–44.
- 13 Serge Gruzinski, “Colonial Indian Maps in Sixteenth-Century Mexico: An Essay in Mixed Cartography,” *Res: Journal of Anthropology and Aesthetics*, no. 13 (1987): 51–52.
- 14 Alvarado, *Vocabulario en lengua mixteca*, 168.
- 15 Molina, *Vocabulario en lengua castellana y mexicana*, 96.
- 16 Gruzinski, “Colonial Indian Maps”; Dana Leibsohn, “Primers for Memory: Cartographic Histories and Nahua Identity,” in *Writing without Words: Alternative Literacies in Mesoamerica and the Andes*, ed. Elizabeth Hill Boone and Walter D. Mignolo (Durham, NC, 1994), 161–87; Leibsohn, “Colony and Cartography: Shifting Signs on Indigenous Maps of New Spain,” in *Reframing the Renaissance: Visual Culture in Europe and Latin America, 1450–1650*, ed. Claire Farago (New Haven, CT, 1995), 265–81; Barbara E. Mundy, *The Mapping of New Spain: Indigenous Cartography and the Maps of the Relaciones Geográficas* (Chicago, 1996); Mundy, “Mesoamerican Cartography,” in *The History of Cartography*, vol. 2, bk. 3, *Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies*, ed. David Woodward and G. Malcolm Lewis (Chicago, 1998), 183–256; Alessandra Russo, *El realismo circular: Tierras, espacios y paisajes de la cartografía indígena novohispana, siglos XVI y XVII* (Mexico City, 2005).
- 17 See Mary Elizabeth Haude, “Identification of Colorants on Maps from the Early Colonial Period of New Spain (Mexico),” *Journal of the American Institute for Conservation* 37, no. 3 (1998): 240–70; Sylvia Rodgers Albro and Thomas Albro, “The Examination and Conservation Treatment of the Library of Congress Harkness 1531 Huejotzingo Codex,” *Journal of the American Institute for Conservation* 29, no. 2 (1990): 97–115; Leticia Arroyo Ortiz, *Tintes naturales mexicanos: Su aplicación en algodón, benequén y lana* (Mexico City, 2008); Teresa Castelló Yturbide, *Colorantes naturales de México* (Mexico City, 1988); and Hans G. Wiedemann and Andreas Boller, “Thermal Analysis of Codex Huamantla and Other Mexican Papers,” *Journal of Thermal Analysis* 46, nos. 3–4 (1996): 1033–45. Compare Arthur Anderson, “Materiales colorantes prehispánicos,” *Estudios de cultura náhuatl*, no. 4 (1963): 73–83; and Carmen Arellano Hoffmann, “El escriba mesoamericano y sus utensilios de trabajo: La posición social del escriba antes y después de la conquista española,” in *Libros y escritura de tradición indígena: Ensayos sobre los códices prehispánicos y coloniales de México*, ed. Carmen Arellano Hoffmann, Peer Schmidt, and Xavier Noguez (Toluca, Mexico, and Eichstätt, Germany, 2002), 217–56.
- 18 Important aspects of the study of pigments associated with Sahagún’s work including the redaction of botanical treatises, painters and techniques, and the circulation of materials across the Atlantic are covered in the collection of essays in Gerhard Wolf, Joseph Connors, and Louis Waldman, eds., *Colors between Two Worlds: The Florentine Codex of Bernardino de Sahagún* (Cambridge, MA, 2012). On the making of the Beinecke Map, a complex pictorial record made on native bark paper held at Yale University, see the essays in Mary Miller and

- Barbara E. Mundy, eds., *Painting a Map of Sixteenth-Century Mexico City: Land, Writing, and Native Rule* (New Haven, CT, 2013).
- 19 See Diana Magaloni Kerpel, "The Traces of the Creative Process: Pictorial Materials and Techniques in the Beinecke Map," in Miller and Mundy, *Painting a Map*, 75–90; and Magaloni Kerpel, "Painters of the New World: The Process of Making the *Florentine Codex*," in Wolf, Connors, and Waldman, *Colors between Two Worlds*, 47–78.
  - 20 See Wolf, Connors, and Waldman, *Colors between Two Worlds*; Ursula Klein and E. C. Spary, eds., *Materials and Expertise in Early Modern Europe: Between Market and Laboratory* (Chicago, 2010); Daniela Bleichmar, Paula De Vos, Kristin Huffine, and Kevin Sheehan, eds., *Science in the Spanish and Portuguese Empires, 1500–1800* (Stanford, CA, 2009); Paula De Vos, "Natural History and the Pursuit of Empire in Eighteenth-Century Spain," *Eighteenth-Century Studies* 40, no. 2 (2007): 209–39; De Vos, "The Science of Spices: Empiricism and Economic Botany in the Early Spanish Empire," *Journal of World History* 17, no. 4 (2006): 399–427; Antonio Barrera-Osorio, *Experiencing Nature: The Spanish American Empire and the Early Scientific Revolution* (Austin, TX, 2006); Gabriela Siracusano, *El poder de los colores: De lo material a lo simbólico en las prácticas culturales andinas, siglos XVI–XVIII* (Buenos Aires, 2005); Pamela H. Smith and Paula Findlen, eds., *Merchants and Marvels: Commerce, Science, and Art in Early Modern Europe* (New York, 2002); and Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore, 2001).
  - 21 Map of Mistepéc, Chicaguastla, and Cuquila, 1595, AGN, no. 0867, Tierras, vol. 876, exp. 1, fol. 122. In Oaxaca, some indigenous women, who "held great wealth in land, houses, livestock, and movable property of all kinds, were entitled to specific services from the population of the communities making up their cacicazgos [entailed estates], and functioned as regional entrepreneurs." Ronald Spores, "Mixteca *Cacicazgos*: Status, Wealth, and the Political Accommodation of Native Elite Women in Early Colonial Oaxaca," in *Indian Women of Early Mexico*, ed. Susan Schroeder, Stephanie Wood, and Robert Haskett (Norman, OK, 1997), 186.
  - 22 Ursula Klein and E. C. Spary, "Introduction: Why Materials?," in Klein and Spary, *Materials and Expertise*, 1.
  - 23 "Ambos son de naturaleza caliente, seca y astringente, y de gusto acre. Los indígenas hacen tinta de ellos." *HNNE*, vol. 2, 407–8.
  - 24 "Su naturaleza es muy astringente y algo cálida. Se prepara con él una tinta muy buena." *Ibid.*, vol. 2, 65–66.
  - 25 Martha Few, "Indian Autopsy and Epidemic Disease in Early Colonial Mexico," in *Invasion and Transformation: Interdisciplinary Perspectives on the Conquest of Mexico*, ed. Rebecca Brienen and Margaret Jackson (Boulder, CO, 2008), 153–65; Magaloni Kerpel, "Painters of the New World," 49–52; *HGNE*, vol. 3, 353, 356–57.
  - 26 "Hay en esta tierra un fruto de un árbol que se cría en tierras calientes, que no es de comer; llámase este fruto *nacazcolotl*, con el cual, y el aceche y otros materiales, se hace muy buena tinta para escribir." *HGNE*, vol. 3, 342.
  - 27 "Hacen estos naturales tinta del humo de las teas, y es tinta bien fina; llámanla *tilliocotl*; tiene para hacerla unos vasos que llaman *tlicomalli*, que son a manera de alquitaras; vale por muchas tintas para escribir." *Ibid.*, vol. 3, 343.

- 28 “Como no llovía, el dicho don Francisco mandó a los papas que fuesen al monte, e hiciesen carbón y traído lo molieron e hicieron tinta, y el dicho don Francisco se desnudó y se pintó de manera de tizne y dijo, ahora ya no soy cristiano, sino como antes solía, y luego se sacrificó las orejas y se hizo sahumar con copal y mandó traer muchas codornices y las sacrificó, y llamó al diablo y lo mismo mandó que hiciesen sus amigos y parientes.” Transcription in María Teresa Sepúlveda y Herrera, *Procesos por idolatría al cacique, gobernadores y sacerdotes de Yanhuitlán, 1544-1546* (Mexico City, 1999), 170; original in AGN, Inquisición, vol. 37, exp. 7, fol. 167.
- 29 Terraciano, *Mixtecs of Colonial Oaxaca*, 17.
- 30 HGNE, vol. 3, 342-43.
- 31 *Ibid.*, vol. 3, 343.
- 32 Maximino Martínez, *Catálogo de nombres vulgares y científicos de plantas mexicanas* (Mexico City, 1937), 354.
- 33 “Hasta de tintas negras, así para teñir, como para escribir, ha dado Dios minerales en aquestas partes. . . . En aquesta sierra de Zacapulas, junto al pueblo de Cuzal, está un mineral de tierra negra, que solo con que se desborote en agua, se hace una tinta muy negra para escribir. Aunque es menester echarle goma, porque sola se borra como es tierra.” Francisco Ximénez, *Historia natural del reino de Guatemala compuesta por el reverendo padre predicador general fray Francisco Ximénez, de la orden de predicadores escrita en el pueblo de Sacapulas en el año de 1722* (Guatemala, 1967 [1722]), 343.
- 34 Fernando Martínez Cortés, *Pegamentos, gomas y resinas en el México prehispánico* (Mexico City, 1974), 15.
- 35 Martínez Cortés notes that even though Hernández refers to roots (*raíces*), the parts of the plants used to make the binder are the pseudobulbs. *Ibid.*, 18.
- 36 “La raíz es fría, húmeda y glutinosa; se prepara con ella un gluten excelente y muy tenaz que usan los indios, y principalmente los pintores, para adherir más firmemente los colores de suerte que no se borren fácilmente las figuras.” HNNE, vol. 1, in Hernández, *Obras completas*, vol. 2, 118.
- 37 Map of Santa Ana and Santa Cruz, 1591, AGN, no. 0581, Tierras, vol. 56, exp. 5, fol. 16.
- 38 Antonio Mut Calafell, “Fórmulas españolas de la tinta caligráfica negra de los siglos XIII a XIX y otras relacionadas con la tinta (reavivar escritos, contra las manchas y goma glasa),” in *El papel y las tintas en la transmisión de la información*, Primeras jornadas archivísticas (Huelva, Spain, 1994), 103-83.
- 39 Andrés Flórez, *Doctrina cristiana del ermitaño y el niño* (Madrid, ca. 1546), quoted in Mut Calafell, “Fórmulas españolas de la tinta caligráfica negra,” 160. Another edition of this work was printed in Valladolid in 1552. See José Antonio González Salgado, “Contribución al estudio de la ortografía en el siglo XVI: La reforma del padre Flórez,” *Dicenda: Cuadernos de filología hispánica*, no. 14 (1996): 149-57.
- 40 Diego Bueno, *Arte nuevo de enseñar a leer, escribir, y contar príncipes y señores* (Zaragoza, Spain, 1690), 26, cited in Mut Calafell, “Fórmulas españolas de la tinta caligráfica negra,” 165.
- 41 The original text reads: “De la [tierra] negra se decir, que me enviaron un poco para que de ella hiciese tinta, la cual echada en agua, o vino se hace de ella muy buena tinta, con que se escribe muy bien, y es algo azul que la hace de mejor gracia.” Nicolás Monardes, *Primera y segunda y tercera parte de la histo-*

*ria medicinal de las cosas que se traen de nuestras Indias occidentales que sirven en medicina* (Seville, 1574), 115v, Library of Congress, Rare Book and Special Collections Division.

- 42 Adrian Johns, "Ink," in Klein and Spary, *Materials and Expertise*, 105.
- 43 Juan de Iciar, "Recepta de tinta para papel," in *Arte sutilisima, por la cual se enseña a escribir perfectamente* (Zaragoza, Spain, 1553), n.p.
- 44 "Luego se pondrá una caldera grande, a buena lumbre, y se echará en ella la vasija donde están las agallas y cocerá una hora." Ignacio Pérez, *Arte de escribir* (Madrid, 1599), quoted in Mut Calafell, "Fórmulas españolas de la tinta caligráfica negra," 161.
- 45 Iciar, "Recepta de tinta para papel."
- 46 "Yo he hecho experiencia con muchas recetas que andan escritas y con ninguna he hallado tan buen efe[c]to como con ésta." José de Casanova, *Primera parte del arte de escribir todas formas de letras* (Madrid, 1650), 10.
- 47 "Sirve la tinta con que escribimos, a las llagas llenas de corrupción, y a las quemaduras del fuego: sobre las cuales debe aplicarse espesa con agua, y dejarse hasta que las dichas llagas se encoren." Andrés Laguna, *Pedacio Dioscorides Anazarbeo, acerca de la materia medicinal, y de los venenos mortíferos* (Antwerp, 1555), 568.
- 48 Many of the printed recipes for ink including those by Casanova, Pérez, and Iciar circulated in New Spain during the colonial period. See José Torre Revello, "Algunos libros de caligrafía usados en México en el siglo XVII," *Historia mexicana* 5, no. 2 (1955): 220–27.
- 49 Map of Teotitlán, 1583, AGN, no. 0560, Tierras, vol. 35, exp. 7, fol. 11.
- 50 Map of Santo Domingo Tepenene, 1617, AGN, no. 2225, Tierras, vol. 2812, exp. 11, fol. 312. An insightful analysis of this map centered on the visual representation of space is Duccio Sacchi, "Imagen y percepción del territorio según los mapas mixtecos (1595–1617)," *Historias*, no. 15 (1986): 19–29.