Art of the Classic Maya Relief

Grant Schar

Among the finest extant examples of Maya monumental art are two that are notable not only for their beauty and extraordinary technical achievement, but because they were created from the most intractable materials the Maya could have chosen for carving on a monumental scale. With a view toward estimating the amount of labor that would have gone into carving such obdurate media, I have performed the practical experiments detailed herein.

The first relief to be discussed, Palenque's Palace Tablet (Figure 1), is a large buff-colored construction of three slabs of stone fitted together precisely on a vertical axis (Van Stone 2005:81) and carved from the highest quality limestone available on the Peten-Yucatan peninsula (Coe and Kerr 1998:131). The stone has an exceptionally fine, dense crystalline texture with occasional small gas bubble pits scattered throughout the matrix. Initially the stone was roughly cut to shape at the quarry with robust hafted chisels (Eaton 1991:221). The limestone slabs were pried loose from a stratified bed of stone with a thin cross-section. Their top surfaces were perfectly smooth and required no additional dressing to prepare for carving (Robertson 2010:12; Miller and Martin 2004:128).

The other relief to be discussed is the magnificent Lintel 3 from Temple 4 at Tikal, currently housed in the Cultural Museum in Basel (Figure 2). The lintel was carved on several adjoining planks of heavy, iron-hard sapodilla wood. In spite of the difficulties encountered with sculpting this very tough material, the exquisitely wrought figurative elements and glyphs represent perhaps the finest surviving examples of the Maya woodcarver's skill (Coe and Kerr 1998:137).

Both of these commemorative reliefs were created on a large scale: The Palace Tablet measures roughly 246 by 240 centimeters with a carved surface area of 54,000 square centimeters discounting the vacant area at the base, while Lintel 3 is 205 centimeters wide by 176 centimeters high with a total area of 36,080 centimeters.

For both of these reliefs the initial stages of material preparation and surface dressing had to proceed at a fairly rapid pace. Freshly quarried limestone can be worked with relative ease while still saturated with water, but it begins to dry out and harden quickly once it is exposed to the air (Milliman 1974:282). This is especially true for limestone slabs with a broad carving area and thin cross-section. It has been suggested that it is easier to cut dense limestone while it is still fresh from the quarry. This is true for the initial stages of dressing and shaping of the slab, but not for the actual carving. My experience has shown that any attempt at detailed carving or contour shaping in wet limestone will result in creating a significantly harder stone surface. I have attempted to carve dense, wet limestone with copper and bronze chisels and discovered a curious characteristic of calcareous sedimentary rock. When carving and scraping dry limestone, the excised particles of calcium carbonate are easily brushed away from the carved surface, but in the presence of water, the microcrystalline powder that occurs from the grinding and breaking up of calcium carbonate crystals results in a microcrystalline paste that fills in the intragranular voids in the limestone surface. This paste re-crystallizes into a hard, cement-like rind that resists tooling even with modern steel chisels.

For Lintel 3, freshly felled sapodilla logs were split into planks and roughly dressed with adzes and hafted chisels while the wood was still green and somewhat softer. The wood had to be dried and seasoned before commencing with the relief carving for the same reason that a cabinetmaker does not make furniture out of raw lumber. Sapodilla wood, like other dense hardwoods, is subject to warping and checking as it dries. The Maya artisans would have taken this into account when dressing and fitting the planks together for the lintel. After curing, the planks had to be re-fitted, their edges shaved to achieve a tight alignment between them. Any cracked or checked board ends had to be removed, and the surface of

Figure 1. The Palace Tablet: photograph by Jorge Pérez de Lara and drawing by the author of the sixth glyph from the top in the leftmost column (reading **mi-K'IN**, for *mih k'in* "zero days"), selected for the experiment in carving.

Figure 2. Lintel 3 of Tikal Temple 4: photograph by Justin Kerr (Coe and Kerr 1998:Fig. 92) and inked drawing of a **BAAH-hi-ja** compound from the upper right quadrant of the lintel, on sapodilla with the wood grain oriented vertically.

the boards were re-tooled to bring them to an even plane.

How and with what did the Maya manage to carve hard limestone and sapodilla wood? They had no metal tools nor did they employ percussive assistance to drive their stone blades; the Maya could not have used mallets to expedite the carving because stone tools will not tolerate percussion against a hard surface. What, then, did the Maya use for sculpting tools? The answer would come after spending a few hours carving a test glyph on a 100 by 100 by 35 millimeter block of seasoned sapodilla wood with a high carbon-steel whittling knife. The thin blade of the knife is 30 millimeters long, 7 millimeters wide at the base, and tapers in a slight curve to a sharp point. Working without the use of a mallet, I developed a systematic approach to carving that would serve as a model for all subsequent sculpting with stone tools. At first the extreme hardness of the wood presented a somewhat daunting challenge. The edge of my whittling knife would simply skate across the wood without biting into the surface. Carving techniques that would have worked on softer woods had to be abandoned in favor of a very old method of carving that I first described two decades ago—tracking and planing (Schar 1995:73). Although my earlier discussion of tracking and planing pertained to cutting limestone in ancient Egypt with mallet-driven bronze chisels, the basic technique, as I was to discover, also applied to cutting dense hardwood with stone tools. The methods of carving were very different for both the Old and New World artisans, but the end result was essentially the same. For the Maya sculptors tracking and planing with stone tools involved making a series of closely spaced, parallel cuts on the wood with a short slicing motion. By repeating the slicing motion several times, the cuts were gradually deepened. The resulting pattern created a field of narrow ridges between the carved tracks. By turning the whittling knife on its opposing axis, the blade served as a plane for cutting through the ridges. The ridges provided a place of purchase for the knife. With repeated tracking and planing, the wood was removed a fraction of a millimeter at a time. Of course, the knife dulled rapidly against the iron-hard wood and required frequent re-sharpening—about once every ten minutes. It soon became apparent that my impending carving experiments on sapodilla wood and hard limestone would be a prolonged venture.

One thing became very clear after my preliminary wood-carving exercise with the small, thin-bladed steel whittling knife: the Maya would not have used bifacial stone blades for intricate carving. Bifacial implements are unsuitable for refined sculpting for three reasons. Firstly, a bifacial blade is too thick in cross-section to allow for delicate work. Bifacial blades are simply too unwieldy for relief carving. Secondly, the cutting edge of a bifacial blade is too irregular for carving and especially for planing. Lastly, the knapping and binding of a bifacial blade to a haft requires too much time to accomplish on a tool with a useful working life far shorter than the time taken for its manufacture—why would one spend an hour or more making a tool that can only be used for 20 to 40 minutes? Stone tools are very hard, but they are also very brittle. There seemed to be only one other possibility left for identifying the tools the Maya used for relief carving. I turned my attention to a review of plates displaying chert and obsidian debitage flakes recovered from the Cenote of Sacrifice at Chichen Itza (Sheets 1991:179-180, 182). Ranging in size from one to five centimeters in length and one to three centimeters in width, these unifacial blades were just the right size and thinness to make excellent carving tools. However, I was not sure how well these small, fine-edged chips of stone would bear the stress put on them during the carving process.

For my relief-carving experiments, I fashioned both flint and obsidian blades in order to test their respective cutting properties. Using light strokes with a hammerstone, I core-flaked enough material for my projects within an hour. The blades were not so much purpose-built as found objects in the debitage. I culled more than 300 unifacial blades from the shards. The flakes were grouped into two basic types with an overlap in their respective functions. Gravers were used for carving design outlines, picking out fine carving details, and for scoring tracks in preparation for background reduction (Figure 3). Planers served to remove scored material and to shape and round off design

Figure 3. Using a graver to sharpen the outline.

Figure 4. Reducing the background with a planer.

elements (Figure 4). Hafting these small blades presented another problem. What the Maya used to fix these unifacial blades to a haft is apparently unknown. I suspect it may have been a mixture of tree resin, wood ash, and perhaps bee's wax. This could have made a malleable, adhesive fixing agent of sufficient strength to hold the blade fast to the haft and resist displacement during carving. As a suitable substitute, I found that epoxy plumber's putty worked perfectly as a binding agent. It can be shaped like modeling clay and cures for usage within an hour. Poplar doweling, cut into 10 centimeter lengths, was used to make hafts for the gravers and planers. Anticipating heavy wear on the implements, I fashioned several dozen tools to begin the sculpting process (Figure 5).

I had previously purchased two thick planks of sapodilla wood from an exotic wood dealer in Florida but finding the right limestone required an extensive search through the backlots of several local ornamental stone vendors. Eventually I found a slab of white French limestone that had the right texture and density to simulate the Palenque stone for my carving. Except for their colors, both limestones have a smooth, even crystalline

Figure 5. Typical hafted blades.

structure that accepts fine carving details. The white limestone I chose is quite hard, and judging from how the artisans struggled to carve some of the design elements in the glyphs, the same is true of the Palace Tablet stone (see Robertson 1985:Pls. 266-267). In fact, the quality of the carving in the Palace Tablet reveals a few lapses in refinement here and there among the glyphs. Carving limestone over sustained periods with stone tools without the benefit of mechanical assistance is an exhausting enterprise. Sculpting large reliefs out of hard materials is best approached methodically to achieve a good result. Generally in bas-relief carving, particularly where there are large vacant areas around the design elements, considerably more time is spent cutting away the background than is invested in carving the glyphs and figurative elements. This is due to two things: the volume of material to be removed is usually far greater and the need to keep the excavated background on an even plane demands close attention to detail. Both Lintel 3 and the Palace Tablet are exceptions to this rule because of the close juxtaposition of design elements. In both reliefs the positive and negative spaces are just about equal.

I selected two glyphs for replication to the same scale as the original designs. From Lintel 3, depicting king Yik'in Chan K'awiil's celebration of a military victory in 743, a **BAAH-hi-ja** compound in the upper right quadrant was chosen as the subject. The glyph selected for reproduction in limestone is considerably larger. From the long text on the Palace Tablet recording the accession of K'an Joy Chitam in 702, I opted for the Initial Series glyph for zero days portraying the full-figure form of the number zero and the monkey-man personification of the day who, appropriately in this instance, is also the patron of artisans (Robertson 1985:56). Each of the glyphs was carved to completion in turn. The time required to draw and ink the designs on wood and stone and the hours spent fabricating the gravers and planers were not included in the overall time needed to complete the projects. Both glyphs were accomplished within 160 hours at an average of 6 hours of sculpting per day.

The carving commenced with isolating the respective glyphs from their backgrounds. Using short, slicing strokes with a graver, I carefully scribed a line around the perimeter of the glyphs. By repeating this step dozens of times, the incised line was gradually widened and deepened until it provided a one-millimeter deep mortise or ledge to work against with a planer. On the original reliefs this procedure was repeated around all of the glyphs and figurative elements in the design until islands of wood and stone were separated from the background. By tracking and planing,

working from the edge of one mortise to another, a valley was slowly created between the isolated designs. The valley was painstakingly deepened and widened until it met the outer ledges of the designs at right angles.

One quickly develops a feel for the cutting properties of flint and obsidian blades. Due to the pronounced hardness of the sapodilla wood and the Palace Tablet limestone, the sculpting techniques for both materials were essentially the same. When cutting sapodilla wood it is best to allow the keen edge of the stone blade to do the work. Too much pressure on the blade will easily fracture the cutting edge. The carving stroke must be light and yet firm, with the carving pressure focused through one's fingertips and thumb. A lighter touch is especially relevant when carving with obsidian blades. Obsidian tools are notably softer than those made of flint. Although extremely sharp, obsidian blades wear out far more rapidly than those made of chert, and they are particularly prone to crumbling when cutting across the grain of the wood. However, tool breakage did not always render flint or obsidian blades useless. A fracture would often simply expose a fresh cutting edge. Moreover, many of the gravers had multiple points for carving that extended the tool's life. Planers, with their cutting edges worn and rounded smooth, were recycled as burnishers for polishing the completed sapodilla wood glyph.

As mentioned above, the sculpting techniques for sapodilla wood and hard limestone are about the same except for the amount of pressure placed upon the tool. The orientation of the wood was an especially limiting factor when carving sapodilla wood around a curve in the design against the grain. Most of the tool wear occurred at these junctions. However, with the homogeneous crystalline structure of the limestone one does not have to contend with the grain of the carving surface. The resistance to tooling was equal throughout the carving area. Additionally, tools that were dulled to the point of uselessness for carving sapodilla wood still had enough of a cutting edge for working limestone. By increasing the pressure on a dulled tool, limestone particles could be broken away from the brittle limestone surface, as well as carved. This method was particularly favorable for removing stone from the background with planers.

The completed sapodilla wood carving, including the background, measures 8.5 by 10 centimeters with a surface area of 85 square centimeters (Figure 6). The background was cut back by three millimeters in 20 hours and another 20 hours were required to complete the glyph. In all, 103 blades were expended on the wood carving. With a total area of 36,080 square centimeters, Lintel 3 would have required an astounding 16,978 hours to carve at an expenditure of 43,733 stone blades. The limestone glyph-carving experiment, including the background, was cut back by 5 millimeters in 59 hours (Figure 7). Sixty-one more hours were spent sculpting the intricate details of the two figures. The limestone carving expended 184 tools at an average rate of one blade for every 2.9 centimeters. With a total surface area of 54,000 square centimeters, the Palace Tablet would have required 12,000 hours to complete at an expenditure of 18,400 blades. As a rule of thumb, I suggest that the fastest rate at which dense limestones were carved with stone chisels falls between 4.5 to 6 square centimeters per hour.

Figure 6. Completed wood carving.

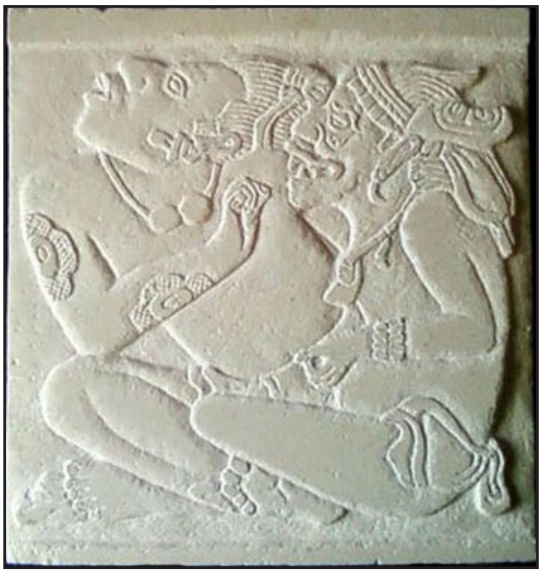

Figure 7. Completed stone carving.

Figure 8. The Temple XXI monument unearthed in 2002. Sheltered from erosion, the panel has been well preserved. Photo: Jorge Pérez de Lara.

Both of these sculpting exercises left me with the distinct impression that neither of them could have been designed and carved by one and the same person. The sheer volume of design elements and the monumental size of these reliefs would have overwhelmed one or even two artisans. If these reliefs were to be carved in a timely manner it must have been a collective enterprise. Evidence exists to support this supposition. Stela 31 at El Peru is signed by no less than eight sculptors (Coe and Kerr 1998:133). In his comprehensive comparative analysis of the carved design elements, Mark Van Stone has identified at least 20 different hands that participated in the sculpting of the Palace Tablet (Van Stone 2005:368).[1] I have discerned at least two different hands at work on the Palace Tablet (see Robertson 1985:Pls. 266, 268). Artists usually leave evidence of their manner of carving in the way they render figurative elements, such as the treatment of eyes, ears, and even fingernails. Most likely, both of these reliefs were designed and painted by a master calligrapher who may have participated in the carving, but the completion of these reliefs was most certainly a team effort.

It was mentioned earlier that a systematic approach to bas-relief carving will achieve the best results. This is particularly true for carving reliefs with life-sized figures set against large vacant areas of background. It was precisely these empty spaces that presented such a challenge for the Maya relief sculptors. Maintaining an even, reasonably flat surface while reducing the background in bas-relief carving is difficult to achieve with hand-held stone tools without the percussive assistance of a mallet.

In 2002 an exquisitely carved limestone panel was excavated from the rubble of Temple XXI at Palenque (Figure 8). Sculpted for dedication in AD 736 in finely-grained tan limestone, the relief depicts the seated figure of Pakal the Great flanked by the images of his grandson Ahkal Mo' Nahb III and his great grandson Upakal K'inich. Measuring 60 by 228 centimeters and with a carved surface area of 13,680 square centimeters, the time required to carve the panel fell between 2200 and 3000 hours. A project of that magnitude would require three artisans a year to complete.

Buried for more than 1000 years, the panel shows only moderate surface erosion. Fortunately the relief has preserved not only the finely wrought images, but the sculptors' tool marks as well. The figure of Upakal K'inich, the second figure from the right, reveals a wealth of information on ancient Maya stone-carving techniques. The sculptor focused a great deal of time fleshing out the anatomical details of Upakal K'inich's head while the rest of his body received only a summary treatment. Although deftly carved, the shapes are hardly more than deeply etched lines in the stone with their edges beveled to suggest three-dimensional form. At first glance the flat appearance of the shapes might suggest they were hurriedly done, yet nothing could be further from the truth. The carved shapes were achieved only at considerable expenditure of time and flint blades. Cutting limestone by hand with stone tools is more closely akin to grinding the stone away rather than carving it in the strictest sense of the word.

In the space immediately to the right of Upakal K'inich's face there is distinct evidence of the painstaking process involved in reducing the background of a limestone relief (Figure 9). Just to the right of his eye there are a series of closely-spaced tracks created with a graver. From the tip

[1] Van Stone estimates that just over twenty sculptors could have carved the Palace Tablet in 19 hours. My carving exercise indicates that 12,000 hours of carving is closer to the mark.

Figure 9. Detail of the Temple XXI panel showing the head and shoulder area of Upakal K'inich revealing numerous tool marks. Photo: Jorge Pérez de Lara.

of his nose down to the edge of his shoulder, faint traces of graver tracks are visible, intersected by planer strokes. Dense limestone is an obdurate material that can be cut away only a fraction of a millimeter at a time with stone blades, and one can sense the tedium involved in reducing the background. Either the sculptor's enthusiasm for carving flagged after several hundred hours of sculpting or perhaps time constraints interrupted the completion of the relief.

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