Infrared imaging of Precolumbian murals at Bonampak, Chiapas, Mexico

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The Classic Maya ruins of Bonampak, Chiapas, Mexico, contain what may be the most thematically complex paintings in Precolumbian America. In 1995–96, we recorded these murals by employing equipment that, to our knowledge, had never before been used in remote settings. The results suggest that polychrome paintings, including those in isolated places, benefit from documentation beyond the range of human vision.

Bonampak Structure 1 has three rooms, each covered from floor to capstone with murals. Room 1 displays feather dances and tribute offerings. Infrared images reveal cacao beans and Spondylus shells; glyphs itemize five units of 8,000 chocolate beans (Miller 1997). Two 'holy lords' appear in bloody conflict and the torture of vanquished warriors in Room 2. Room 3 exhibits sun dances, penile bloodletting and human sacrifice.

Who painted the murals? Room 1 presents hieroglyphic evidence that the overlord of Bonampak was a ruler of nearby Yaxchilan; at least one Yaxchilan artisan sculpted the stone lintels. The small site of Bonampak probably could not have supported the painterly skill evinced by the calligraphic fluidity and varying style of the murals. Multiple master painters from Yaxchilan were presumably at work. The related La Pasadita, Guatemala, murals may also have been executed by painters from *ateliers* at Yaxchilan (Kamal *et al.* 1999).

The Bonampak murals were likely painted after the dedication of Structure 1 on 11 November AD 791 (Julian), just prior to the so-called Maya collapse. Because of their supposedly unfinished character, one of us previously proposed that the paintings recorded an 'artistic and inscriptional record' of the Classic Maya 'demise' (Miller 1986: 151). However, excepting a few hieroglyphic captions, the paintings show an almost microscopic scale and exceptional degree of completion.

It is evident that the Bonampak murals were to be observed from multiple viewing points, some only centimetres from the wall. The paintings are not rough, unfinished works of art: only a few hieroglyphic captions are missing. This points to one of two explanations: (1) a deliberate omission of names, or (2) the name glyph pigments were more fragile than others. No pigments were observed in the infrared within the captions, and the omissions remain as mysterious as ever.

Many Maya pigments become transparent at near-infrared wavelengths, thus allowing penetration to carbon-based under-drawing. Some pigments are transparent at the wavelengths of infrared film; others require the longer wavelengths provided by the infrared vidicon. Located in Room 3 is a profile image of the Maya hunting god Zip (FIGURE 1). Though visible, the detail of the carbon-based under-drawing is difficult to discern. An infrared vidicon image (FIGURE 2) discloses the carbon under-drawing. Also, virtually none of the glyph detail of Room 1 caption 33 is visible (FIGURE 3) while the infrared vidicon image (FIGURE 4) reveals crisp outlines of the glyph block.

Exceptionally fine detail was found in Room 3, including previously unseen microglyphs (FIG-URE 5) and small, dynamic figures (not shown), both extremely difficult to see at visible wavelengths. Small details were observed in the other two rooms as well. Some calligraphic lines are so thin as to appear to have been made with quills or brushes of only a few hairs. This depth of detail indicates that the murals were more finished than previously thought.

We conclude that the most viable approach to imaging ancient paintings is multi-spectral, including infrared. No amount of squinting or guesswork will detect details beyond human vision, though such images may need complementary photographic formats. The success at remote Bonampak recommends application of this technology to other sites and traditions of painting.

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FIGURE 1 (left). The Maya hunting god Zip, south wall, Room 3 (© Bonampak Documentation Project).

FIGURE 2 (below). Infrared vidicon image of the Maya hunting god Zip, south wall, Room 3 (© Bonampak Documentation Project).



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FIGURE 3. Caption 33, north wall, Room 1 (© Bonampak Documentation Project).



FIGURE 4. Infrared vidicon image of caption 33, north wall, Room 1 (© Bonampak Documentation Project).



south wall, Room 3; glyphs c. 3 cm across (© Bonampak Documentation Project).

