



HIGH-RESOLUTION DIGITAL IMAGING AND ENHANCEMENT  
OF NEWLY DISCOVERED HOPEWELL ART (150 B.C. - A.D. 350)  
AT HOPEWELL CULTURE NATIONAL HISTORICAL PARK

Overview. Recent study of copper artifacts from all of the major, excavated mortuary sites of prehistoric Hopewell peoples in southern Ohio has revealed a form of art and telling images that previously were not recognized. The images show Hopewell leaders in their ceremonial costumes, and engaged in ritual displays and interactions. The compositions comprise the oldest known pictures of ceremonies of Eastern Woodlands Indians.

The purpose of the proposed research is to use digital photographic techniques to document and enhance these complex and sometimes subtly preserved artistic compositions, and to make these compositions readily viewable by visitors to Hopewell Culture National Historical Park and users of the National Park Service's existing World Wide Web site.

Background and Previous Research. The Ohio Hopewell were semi-mobile horticulturalists and hunter-gatherers who lived in south-central Ohio from ca. 150 B.C. to A.D. 350. They lived in small farmsteads and camps of a few households each, which were dispersed around earthwork-burial mound sites that held their dead (Brose and Greber 1979). The households around each earthwork were organized into a community that was integrated ritually by periodic mortuary ceremonies and feasts within the earthworks (Smith 1992), socioeconomically by local utilitarian exchange (Carr and Komorowski 1995), symbolically by the art and exotic raw materials displayed and used in such ceremonies, and politically by shaman-like leaders and clan or lineage heads.

The Hopewell are perhaps best known for their fine art, and their procurement of fancy raw materials from distant sources over the continent to make much of that art. Geometric and representational line art engraved on animal and human bone, terra-cotta and stone sculptures, and forms created out of copper, silver, meteoritic iron, mica, shell, obsidian, and other materials are well known (e.g., Brose et al. 1985), and are displayed at Hopewell Culture National Historical Park.

Not previously recognized were a variety of artistic compositions rendered on copper by painting, staining, heat and/or acid treatment, collage, and mastic-fiber buildup and bas-relief sculpting. These compositions became apparent to one of the PIs (Carr) over the past two years, during a 23 week survey and preliminary study that he made of all Hopewell grave goods housed at Hopewell Culture National Historical Monument (Chillicothe), the Chicago Field Museum of Natural History, the Peabody Museum of Harvard University, the Ohio Historical Society (Columbus), the Ross County Historical Society (Chillicothe), the Glenn Black Laboratory of Archaeology of Indiana University, and two large private collections. The survey revealed many previously unidentified images of leaders in ceremonial garb, including shaman-like impersonators of several kinds of animals (eagles, falcons, vultures, hummingbirds, bear, deer, deer-snake composites, felines), as well as persons with nonanimal headresses or geometric facial tattooing. Images of animals and abstract symbols were also found on the copper artifacts. All of these kinds of images also occur on some mica, conch shell, and lithic items, but they are rendered predominantly on

copper items -- breastplates, headplates, large celts, bird effigies, and geometric symbols.

These images had not been recognized before because their compositions are complex to the Western eye, and their preservation is sometimes subtle or partial. The compositions involve many conjoined, nested, and/or overlaid figures, with figure-ground reversal and figure ambiguity. These approaches are common in shamanic art generally, and similar to the better-known art of the Northwest Coast Indians.

The images are important to an understanding of not only Hopewell art, but also their society, ritual life, and religion, and its development through time. (1) The images show various kinds of leaders of Hopewell society in their public ceremonial dress. (2) The variety and impersonator nature of the discovered images point clearly to the evolution, diversification, and specialization of leadership roles in Hopewell society from earlier, more generalized shamans who led societies in the Archaic and Early Woodland Periods (see Converse n.d. for examples). (3) Many of the copper breastplates and headplates have compositions that show secular and shamanic leaders engaged in ritual displays and interactions. These compositions give insight into relationships of equality, inequality, complementarity, and opposition among leaders of different kinds, and perhaps among the social groups that they may represent, such as different clans. (4) The compositions provide insights into the kinds of activities that were a part of Hopewell ritual. The images are the oldest known pictures of ceremonies of Eastern Woodlands Indians. (5) The compositions reveal the roots of the more politically-oriented art of later Mississippian societies of the 13th - 15th centuries (e.g., Phillips and Brown 1978, 1984) within Hopewell mortuary-ceremonial art.

(6) The format and symbols used in the compositions augment our understanding of fundamental themes of Hopewell cosmology and philosophical-religious beliefs. These ideas are pervasive in Hopewell art, at large (Carr and Case 1996), and have analogs in the religions of historic Native Americans, to varying degree. The beliefs include: (a) the three-layered universe, and the attempt to separate, balance, and combine things associated with the three layers, (b) the 8 cardinal and semicardinal directions and their meanings, (c) the circular and spinning cosmos, (d) the duality of light versus darkness and their reciprocal transformation, and (e) the duality of sharply-bounded versus wispy beings and realities. (7) The compositions reveal essential ways in which philosophical-religious beliefs of the Ohio Hopewell and those of historic and contemporary Native Americans are both different and similar.

Examples. Figures 1 and 2 are high-resolution digital photographs of two copper breastplates, each of which has several "layers" of overlapping images. The images illustrate many of the above-mentioned, important aspects of Hopewell copper artwork. (1) The public ceremonial dress of the leader shown in Figures 1c and 1d includes face tattooing or painting in a design involving two hummingbirds, hair portrayed in the form of two hummingbirds and two long-beaked raptors, and perhaps a headdress of new deer antlers. (2) The diversification and specialization of leadership roles in Hopewell society is suggested by Figures 2c and 2d. Here, in contrast to Figure 1, a leader is outfitted with a bear costume and surrounded by long, sharp-beaked (humming?)birds. Also different is the human in the upper-left corner of Figures 1e and 1f; the person wears a headdress comprised of three tiers of birds and a large, protruding bird's or deer's head. (3) Relationships of equality and complementarity among

leaders may be depicted by the equal size and similar vertical positioning of three mammal and bird impersonators at the bottom of Figures 1e and 1f. In turn, these persons may be subordinate to the human on the far left and the central, tattooed leader (Fig. 1c, 1d), who are larger in size and positioned higher on the plate. (4) The total composition of the plate shown in Figure 1, with leaders facing left, right, and looking forward so as to form a symmetrical arrangement, may represent a specific arrangement of leaders in a ceremony -- an idea to be tested by looking for similar patterns in other breastplates. (5) The roots of Mississippian bird-men leaders of the late prehistoric period are seen in the earlier, Hopewell bird impersonators rendered in Figures 1e and 1f. (6) A Hopewellian belief similar to the historic Native American religious concept of the 4 directions and their animal powers is found in Figures 1g-j and Figures 2i-l. On each breastplate are four raptors or raptor-men, who face in four directions.

Preliminary Work on Digital Photography. Figures 1 and 2 also show the results of our experimentation with digital photography and image processing, and how these can be used to three great advantages over ordinary color photography. (1) Computerized digital photography facilitates the recognition of subtle images on copper items by enhancing the contrast and/or sharpness of those images. For example, Figures 1a and 1b, and 2a and 2b, compare color digital photographs that are unaltered to those that have been enhanced using "contrast-stretch" and "histogram equalization" mathematical filters. (2) Computerized digital photography allows the multiple, overlapping images on an item to each be traced and presented as separate "layers" of graphic information on multiple copies of the original photograph (e.g., Figures 1c, e; Figures 2c, e, g). (3) Block-area diagrams, which simplify and clarify compositions, can easily be made (Figures 1d, f, g-j; Figures 2d, f, h, i-l).

The specific camera equipment and computer hardware and software used to make these photographs, and to be used for the proposed work, are listed in Appendix 1. The key points to be made are as follows. (1) The digital camera provides ultrahigh resolution photographs, with 3380 x 2253 pixels. This resolution is state of the art, currently. The system, at large, is comparable in quality to those at the forefront of the museum world (e.g., the American Museum of Natural History). (2) The system was custom-designed in both its software and hardware to efficiently and effectively document archaeological specimens.

Proposed Work. Hopewell Culture National Historical Park (HOCU), in its its federally authorized form, includes five major Hopewell earthworks-burial mound centers within its intended scope of interest: Mound City, Hopewell, Seip, Hopeton, and Highbank. (Currently, only Mound City and Hopeton are under direct control by the National Park Service; the Hopewell Mound Group is owned primarily by the Archaeological Conservancy, Inc., and the Seip Earthworks are owned primarily by the Ohio Historical Society.)

From the sites of Mound City, Hopewell, and Seip, there are 140 copper breastplates, headplates, large celts, and/or bird effigies, all of which bear artistic compositions. No such items have been excavated from Hopeton or Highbank.

The project will focus on 21 breastplates, headplates, and celts, equating to 42 compositions on the items' two sides. Of these, 15 items will come from Mound City, and 6 from Hopewell and Seip for comparative purposes. The sample

will thus represent a wide diversity of persons in regalia and arrangements of them. The objects will be photographed, and line and block-area drawings like those in Figures 1 and 2 will be made. Interpretations of the social, ceremonial, and religious life of the Hopewell, which are revealed in the compositions, will be written for displays for Park visitors, in order to deepen and widen access to the Park's resources. Representative photographs and interpretations will also be placed on the National Park Service's "ParkNet" World Wide Web site, providing literally millions of people in schools, community groups, and homes with remote access to the Park's archaeology.

The following specific steps will be taken. The personnel responsible for each step are shown in brackets.

(1) Digital photographs of each object will be taken and then computer enhanced with either contrast-stretch or histogram equalization transformations, as appropriate. The photography and most of the computer work will be done at the facilities where the objects are stored, so that transportation of the objects is eliminated. The objects are housed in two locations: at Hopewell Culture National Historical Park (Chillicothe) and the Ohio Historical Center (Columbus). [Lydecker]

(2) Each complex composition will be decomposed, through hand-drawing and study of its enhanced digital image, into its component images of various ceremonial leaders, ceremonial paraphernalia, abstract symbols, and animals. [Carr]

(3) The photographs of each composition will be clarified for analysis and for public viewing and distribution on the World Wide Web by making computerized line drawings of all images in the composition. Overlapping images will be separated into different "layers" of graphic information, each of which will then be displayed on its own copy of the enhanced photograph (e.g., Figures 2e, g). Simplified, block-area illustrations (e.g., Figures 1d, 2d) will be made of the most telling layers of information for display in the Park and web distribution. [Carr, Lydecker]

(4) Analysis of the images will begin with the construction of a typology of leadership roles, based on the costumes, headgear, and paraphernalia of the persons shown, in preparation for making social and religious interpretations. The typology may also suggest the existence of various social groups (e.g. bear, deer, and wolf clans or sodalities) within Hopewell society. [Carr]

(5) Each composition will be analyzed and interpreted in several ways. (a) The arrangement of figures in respect to each other, and their relative emphasis, will be documented, in order to infer socio-political relationships of equality, inequality, complementarity, and opposition among leaders of different types or among different social groups, as well as the degree of leadership role differentiation in Hopewell society. (b) Role differentiation will also be assessed from the degree to which ceremonial leaders share or are distinct in elements of their dress. (c) The kinds of activities that comprise Hopewell rituals and that are rendered on the objects will be identified, or at least classified, to the degree possible. (d) Repeating, specific arrangements of leaders in ceremonies will be sought, as evidence of ceremonial forms. (e) Positional relationships between human beings, animal impersonators, and animals, as well as their shading and boundary definition, will be studied for evidence of beliefs about the three-layered universe, the eight cardinal

directions, and other dimensions of Hopewellian cosmology mentioned above.  
[Carr]

(6) The images revealed and ideas inferred from this work will be used to update the Visitor Center's display of the Park's resources with both photographs and interpretive text. [Ruby, Carr]

(7) Representative photographs and interpretations will also be placed on the National Park Service's "ParkNet" World Wide Web site, and will be provided to the Ohio Historical Society for possible display on their Web site [Ruby, Carr]

(8) The results of this project will also be reported to the archaeological profession in a national archaeological journal and at national and regional archaeological meetings. [Carr, Ruby]

Justifications Relative to the Park's Primary Theme and Planning Documents.  
Justifications for the proposed project are found in both the "Draft General Management Plan for Hopewell Culture National Historical Park" and broader National Park Service documents.

1. The Park's approved Resource Management Plan specifically identifies two needed projects which the proposed work addresses:

- \* HOCU-C 001 Replace Museum Display Cases and Exhibits. The proposed project will produce digital images and text that can be effectively incorporated in a renovation of the museum display cases.
- \* HOCU-C 003 Survey Hopewell Artifacts and Records. There is a need for studies that document artifacts collected from the sites of Hopewell and Seip, but that are housed elsewhere, and to make such documents available to visitors and researchers. The proposed project will create very high quality, interpreted photographs of artifacts from both Hopewell and Seip.

2. The Draft General Management Plan/Environmental Assessment for Hopewell Culture National Historical Park (July 1996, pp. 42-43) identifies electronic media as needed components of an expanded interpretive program for the Park. Digital photography of key Park artifacts, as proposed here, is a primary effective means by which graphic representations of them can be disseminated electronically within the Park's museum exhibits, and the only means for their distribution over the National Park Service's World Wide Web site.

3. The 1992 "Vail Agenda" of the National Park Service (L. M. Dilsaver 1994: pp. 434-445) makes two specific recommendations to which this project responds:

- \* "The Park Service should invest in innovative expansions of its ability to provide interpretation that enhances visitor enjoyment and enlightenment." The proposed project, through digital photography and image processing, will transform the subtle, complex, and overlapping images of Hopewell peoples, creatures, and symbols that are rendered on their artifacts into images that are more apparent to visitors and that are separated into interpretable components.

- \* "The National Park Service should launch a specific program of educational outreach, directed at schools and community groups, and designed to maximize the public's access to the unique ecological, historical, cultural, and geologic lessons contained in the park system." The proposed project will produce interpreted images of Hopewell artifacts that can be directly incorporated or linked into the National Park Service's "ParkNet" World Wide Web site. This will give millions of people in schools, community groups, and homes a remote access to the Park's resources.

4. At a more general level, the 1916 Organic Act of Congress established the National Park Service "to conserve the scenery and the natural and historical objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations (U.S.C., title 16, section 1; see also Dilsaver 1994). The proposed project will produce high resolution digital photographs of key Park's resources (artifacts), making them available to a wide pool of visitors and researchers without risking damage to the artifacts, themselves. The photographs will also serve as benchmark documentation that can be used to track changes in the condition of the artifacts through time.

5. The enactment of the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.) raises the possibility that many of the objects under consideration here may be repatriated to Indian tribes. This project will produce lasting documentation of such objects, and preserve access to them by visitors and researchers.

Schedule of Research. Digital photography and enhancement of the photographs of 21 items will be done at Hopewell Culture National Historical Park and the Ohio Historical Center between June 15 and June 22, 1997. Partitioning each complex composition into its component images will be done by studying its enhanced digital image and by making preliminary study sketches of the original item from June 22 to August 7, 1997 at Hopewell Culture National Historical Park and the Ohio Historical Center. Clarification of the photographs for public dissemination, through computerized line drawing of all images will be done at ASC Group, Inc., Columbus, from August 7 to August 22, 1997. Block-area diagrams of select compositions will be made at Arizona State University from September 1 to October 1, 1997. Social and religious analyses and interpretations of the imagery will be made, and interpretive texts for each item will be written, between September 1 and December 30, 1997. Photographs and their accompanying text will be placed on the NetPark World Wide Web site from January 2 through February 1998, and given to the Ohio Historical Society for possible use on their Web site. Updating of the Park's museum exhibits with the photographs and interpretive text will be done at a time depending on other Park project schedules.

Permissions and Rights. Of the 21 items to be examined here, 15 are from the Mound City earthwork and are housed at Hopewell Culture National Historical Park (HOCU), Chillicothe. The remaining 6 come from the Hopewell and Seip earthworks, and are owned by and housed at the Ohio Historical Society (OHS), Columbus. The OHS will grant HOCU the right to exhibit images of the OHS's 6 copper items at the Park, and the right to place low-resolution images of its plates on the ParkNet World Wide Web site, but will retain copyright and rights of distribution over all high-resolution digital photographs taken of its plates

and all derived, low-resolution images. Reciprocally, HOCU will allow the OHS to exhibit images of HOCU's 15 copper items, to place low-resolution images of its plates on the OHS's Web site, and to link to the ParkNet World Wide Web site, if the OHS so wishes. HOCU will acknowledge the courtesy of the OHS for all images of OHS objects that HOCU displays; likewise, the OHS will acknowledge the courtesy of HOCU for all HOCU images of objects that the OHS displays. Interpretative texts of all the items for HOCU museum exhibits and Web displays will be written by Carr and Ruby with the counsel of relevant OHS and HOCU personnel.



BUDGET AND BUDGET JUSTIFICATIONS

1. Personnel:

Digital photographer - computer graphics specialist for:	
Photographic image processing and enhancement	\$ 1,210.65
Packing, transport, and handling of digital camera and computer	\$ 225.00
Set-up of digital camera and computer system (2 times)	\$ 150.00

2. Equipment rental:

Digital camera and computer system (Appendix 1)	\$ 2,705.85
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3. Transportation and insurance of digital camera and computer system:

Van rental	\$ 116.00
Fuel	\$ 16.50
Insurance	\$ 88.00

4. Photographic print costs:	\$ 252.00
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5. Plane fare	\$ 230.00
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TOTAL	\$ 4,994.00
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Justifications.

1. (a) No salaries or wages are submitted for the 2 PI, Christopher Carr and Bret Ruby.

(b) The cost of the camera and computer operator doing digital photographic image processing and enhancement work has been estimated by trial work as: 21 items x 2 sides/item x 2.5 hrs/side x \$11.53/hr.

(c) Personnel costs for the packing, transport, and handling of the digital camera and computer system are \$150 for the trip from ASC Group, Inc., Columbus, to Hopewell Culture National Historical Park, Chillicothe, OH; plus \$75 within Columbus from ASC Group, Inc. to the Ohio Historical Center.

(d) The cost of the camera and computer operator setting up and taking down the digital camera and computer system in Chillicothe and Columbus, OH are \$75. per location x 2 locations of set-up and take-down.

2. Rental of the photographic and computer system have been estimated by trial work as: 21 items x 2 sides/item x 2.5 hrs/side x \$25.77/hr.

3. (a) Van rental and fuel costs cover the round-trip transportation of the camera and computer system, and its operator, from Columbus to Chillicothe.

(b) Insurance of the camera and computer system while it is being used at Hopewell Culture National Historical Park and the Ohio Historical Center, for 6 days. The remaining 8 days of graphics work will be done at

ASC Group, Inc., Columbus, where the equipment is already insured.

4. Cost of color prints made by the Sinko CHC-S446i dye sublimation color printer is 21 items x 2 sides/item x 2 prints of each side x \$3.00/print. Two prints will be made, one for archiving and one for museum display at Hopewell Culture National Historical Park.

5. (a) Partial cost of round-trip plane fare for PI (Carr) from Phoenix to Columbus. (Total airfare cost is ca. \$306).

(b) No lodging, food, or other costs to the PI are requested.

## APPENDIX 1.

### SPECIFICATIONS OF THE DIGITAL CAMERA AND COMPUTER SYSTEM TO BE USED IN THIS PROJECT

#### 1. CPU

- a. TCR Systems PC
- b. Asus Computer P/I-P55TP4N motherboard with an Intel 133 mhz Pentium processor
- c. 32 MB RAM
- d. 2.1 GB hard drive
- e. Diamond Multimedia Stealth 64 Video VRAM graphics accelerator card
- f. Soundblaster 16 bit audio card
- g. Adaptec AHA 2940 SCSI interface card
- h. Hewlett Packard HP Surestore 4020i CD writer, 2x write, 4x read
- i. 1.44 MB 3.5" floppy disk drive
- j. Colorado T1000 tape backup drive
- k. Supraexpress 288 28.8 v. 34 internal fax/modem
- l. Panasonic Panasynch/Pro C-2192P 21" super VGA monitor
- m. Microsoft Mouse
- n. Fujitsu keyboard

#### 2. Digital camera system, by Leaf Lumina

- a. 3 CCDs, 12 bit RGB color
- b. 3380 x 2253 maximum image size
- c. 62 mm and 28 mm Nikon lenses
- d. 2 Smith-Victor 500W lamps

#### 3. Printers

- a. Sinko CHC-S446i dye sublimation color printer -- 300 dpi maximum resolution
- b. Lexmark Optra R+laser printer -- 1200 dpi maximum resolution

#### 4. Software

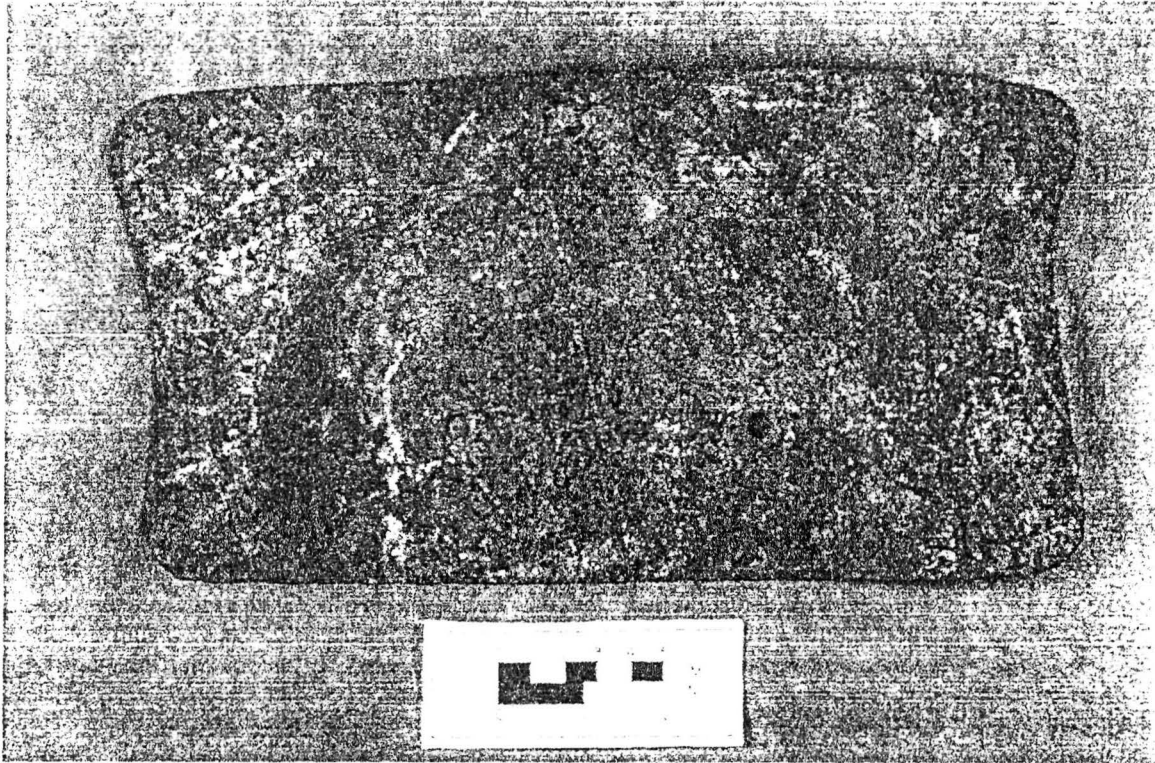
- a. Microsoft Windows 3.11
- b. Adobe Photoshop v. 3.01
- c. Lumina Easyscan v. 1.1
- d. Macromedia Freehand v. 5.0

This system is owned and made available for this project by Archaeological Services Consultants Group, Inc., Columbus, OH.

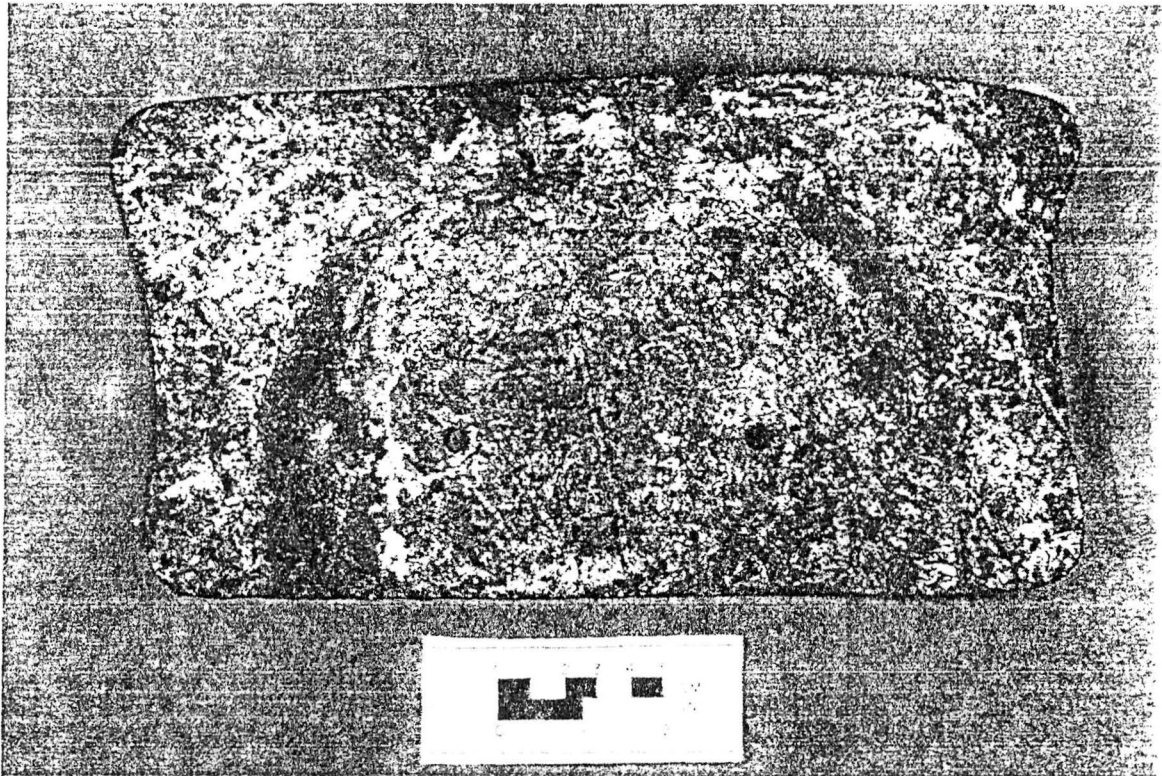
## FIGURE CAPTIONS

Figure 1. A painted copper breastplate, Seip site, Ohio Historical Center, catalog no. 957/. (A) A high-resolution, color digital photograph without any enhancement. (B) Imagery is enhanced using a contrast-stretch mathematical filter. (C) One layer of graphic information, separated out by computerized line drawings, from the multiple overlapping images on the plate. The top two-thirds of the head of a ceremonial leader with facial tattooing, painting, or scarification including the outlines of two hummingbirds beak-to-beak, hair in the form of two hummingbirds beak-to-beak, and a headdress of possibly new deer antlers. The person is surrounded by the heads of two long-beaked raptors neck-to-neck, which may also be part of the headdress. (D) A simplified, computer-made block-area diagram of C. (E) A second layer of graphic information, separated out by computerized line drawing, from the multiple overlapping images on the plate. Creatures at the bottom of the plate, from right to left, are: a possible bird impersonator light in shade, a second possible bird impersonator dark in shade, a mammal impersonator dark in shade, and two stacked human heads. The lower human head has no ceremonial gear, the upper human head wears a headdress with three tiers of birds and a large, protruding bird's or deer head. (F) A simplified, computer-made block-area diagram of E. (G, H, I, J) Images noticeable when the plate is held vertically rather than horizontally: four long-beaked raptors and/or bird-men facing in the four "cardinal" directions. Only their heads, necks, and wings/shoulders are rendered. Image I is more clearly a human face with a bird nose mask similar to two of the impersonators in E.

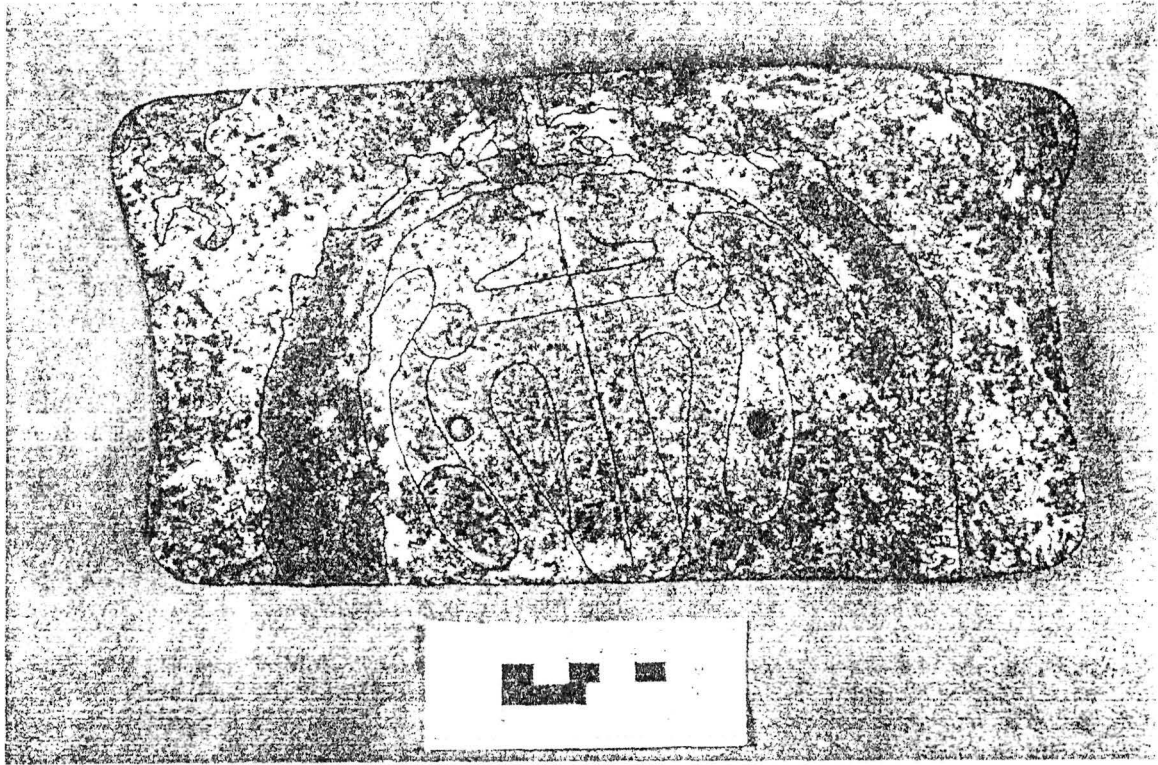
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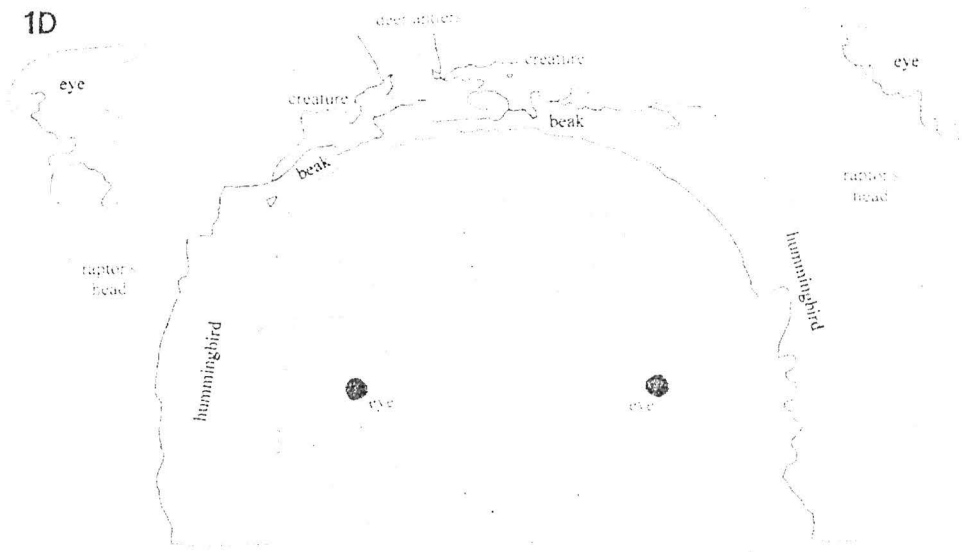
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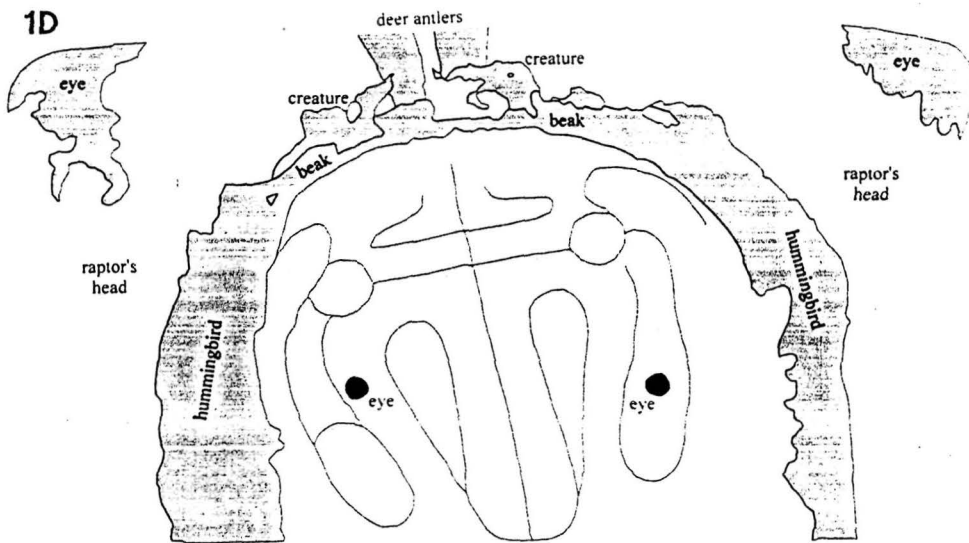
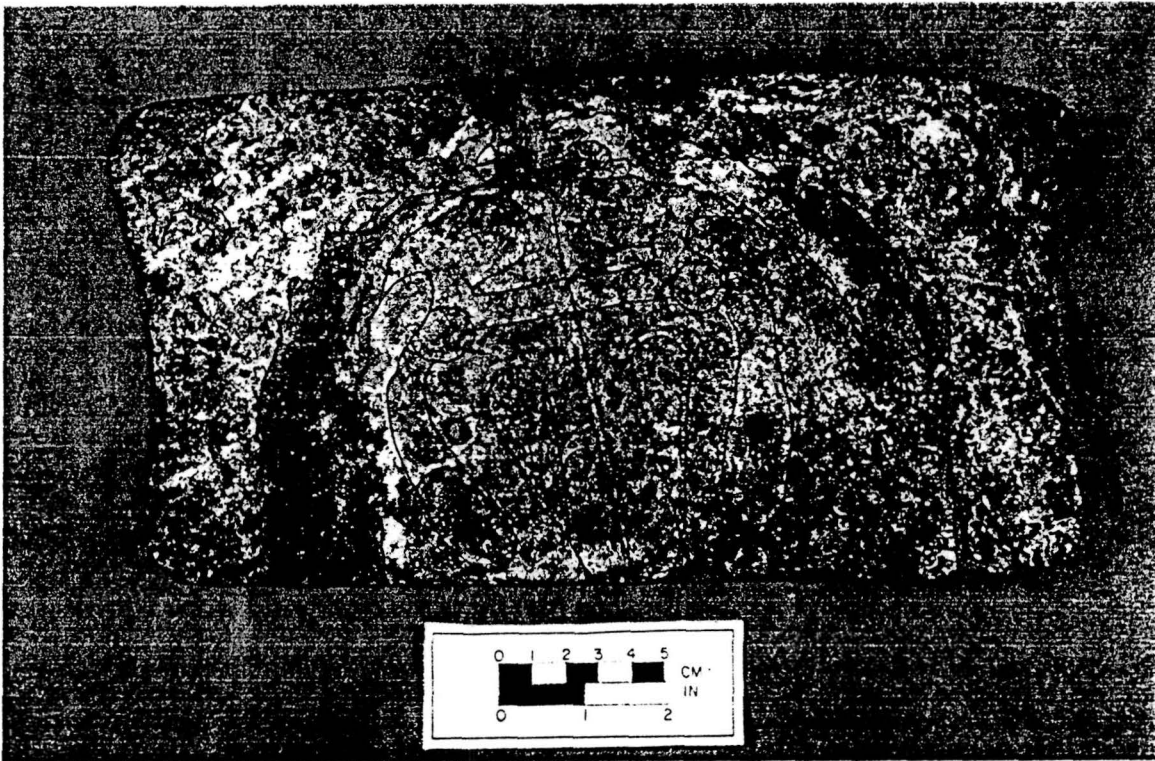
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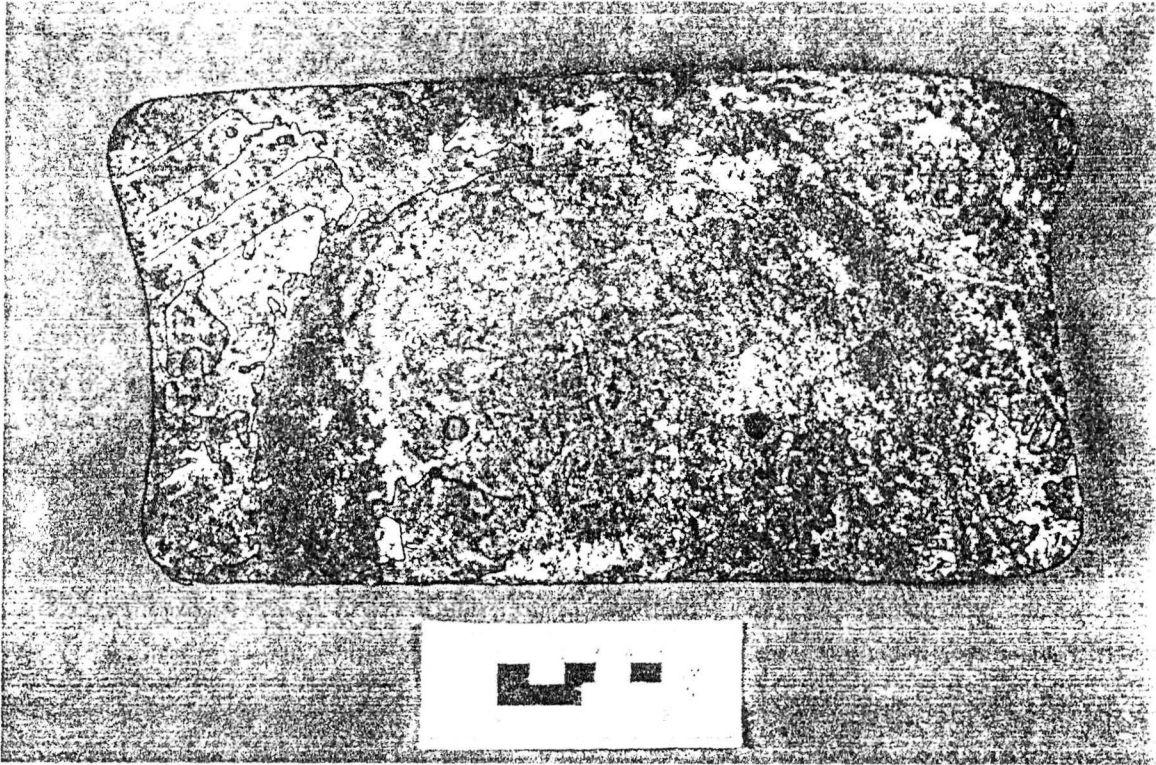
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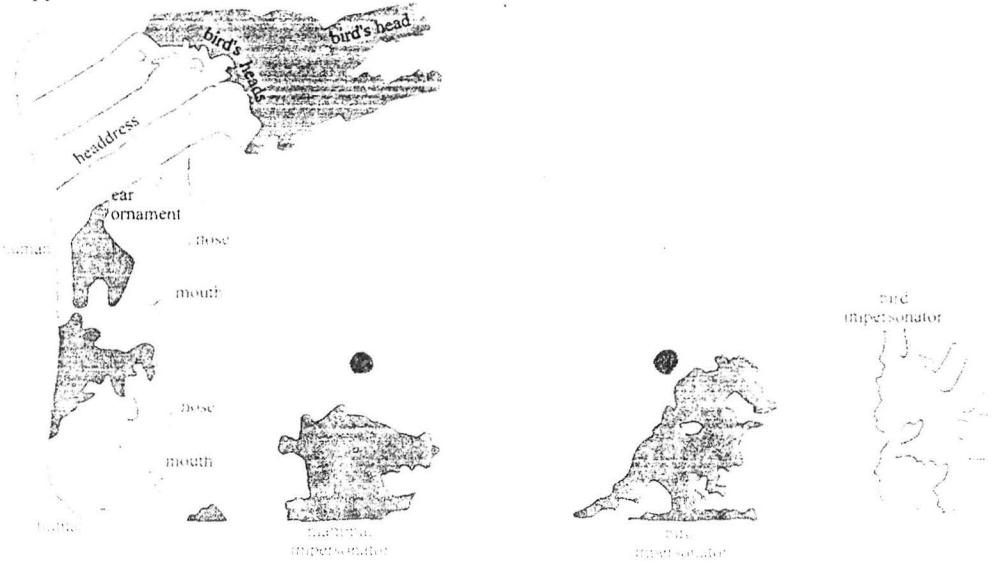
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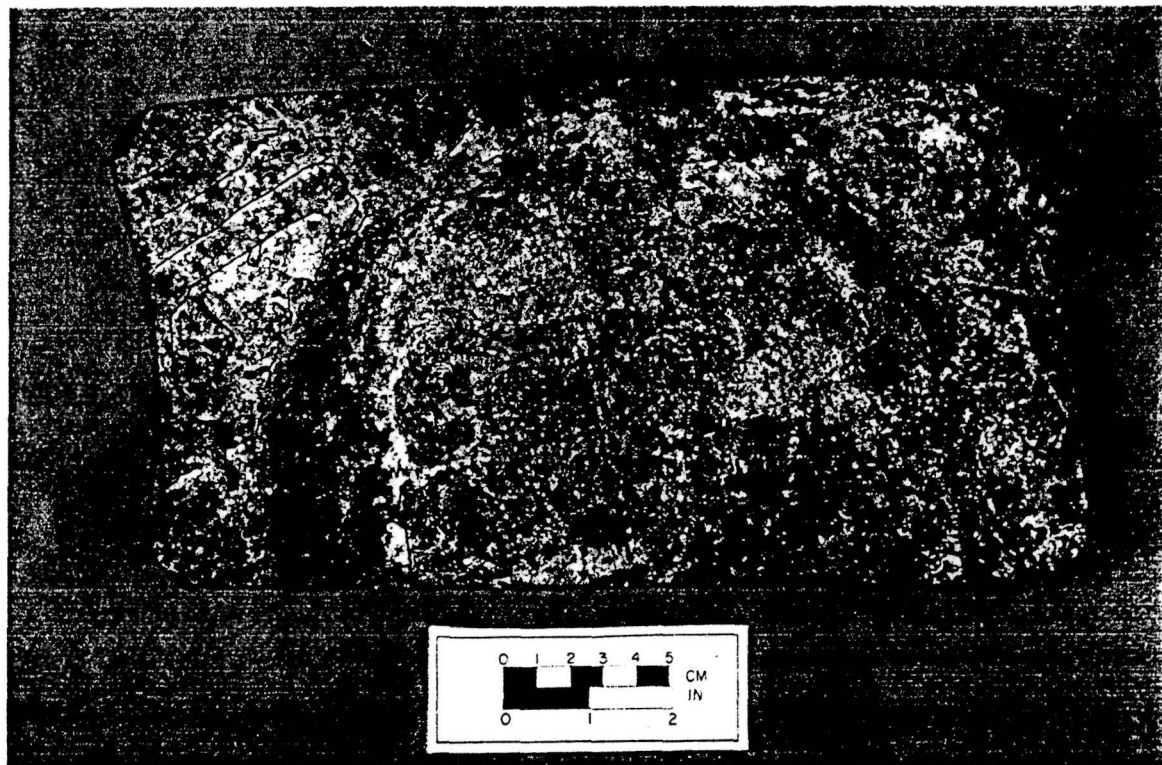


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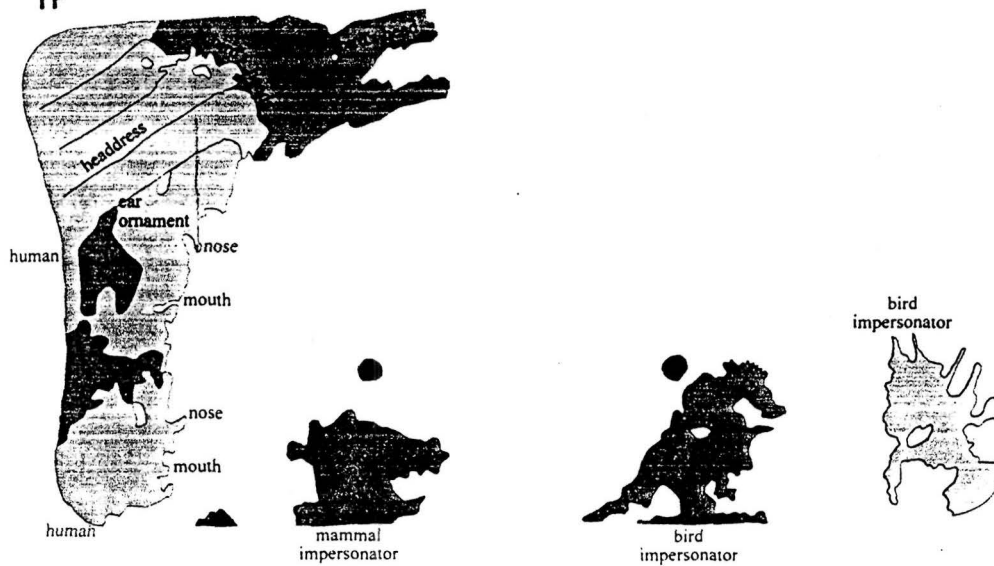




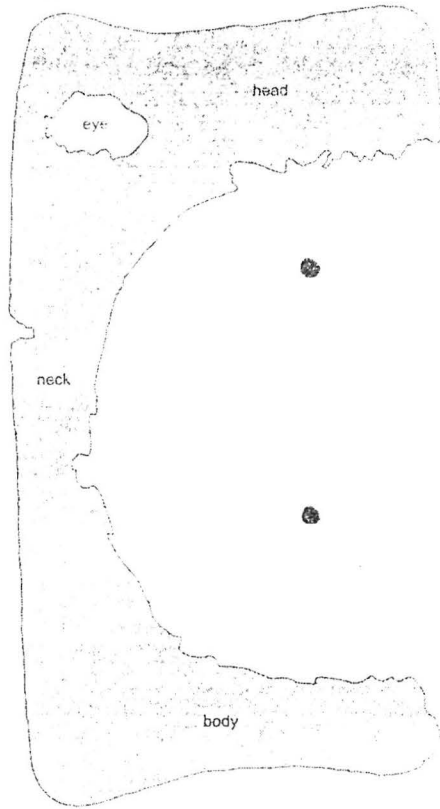
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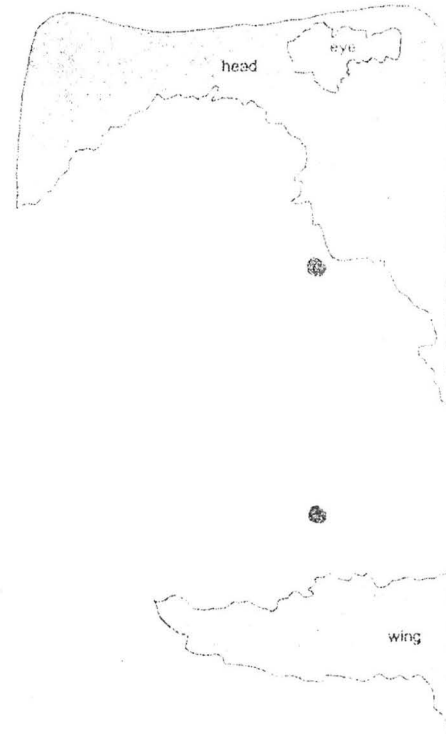
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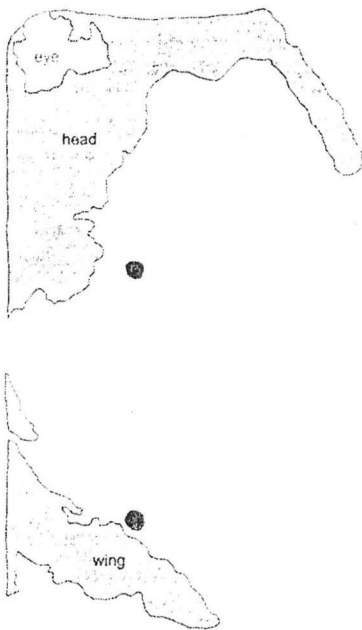
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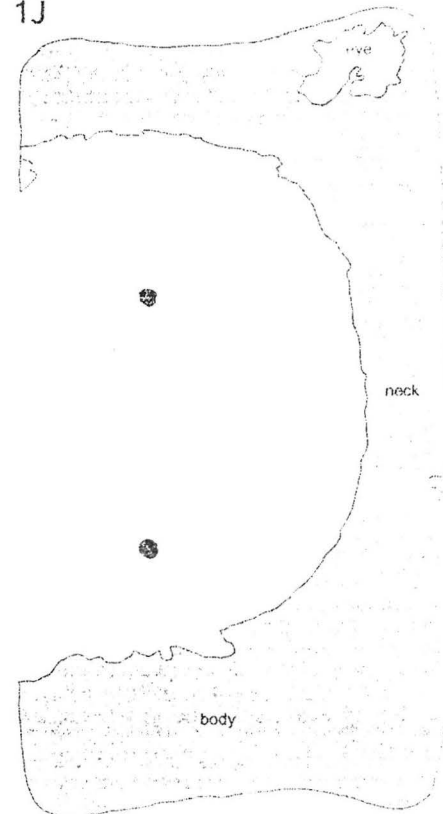
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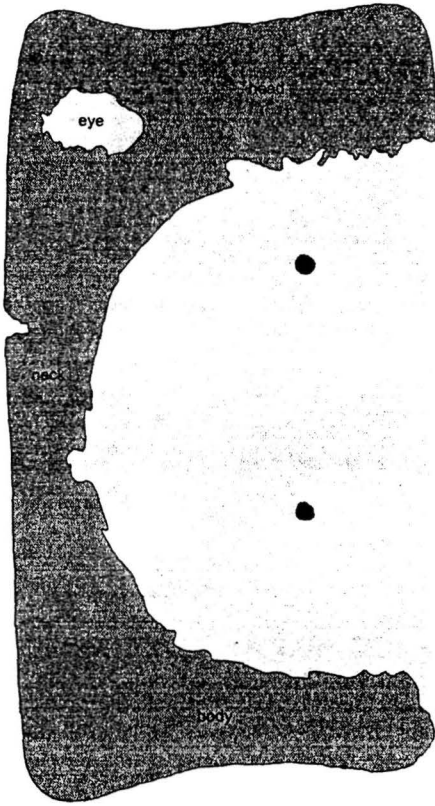
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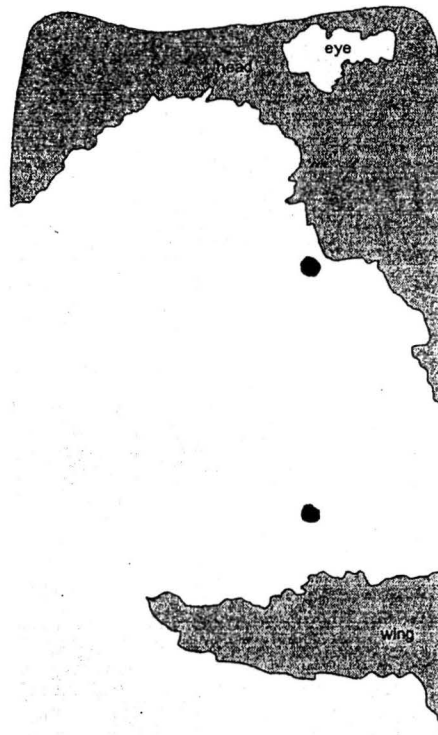
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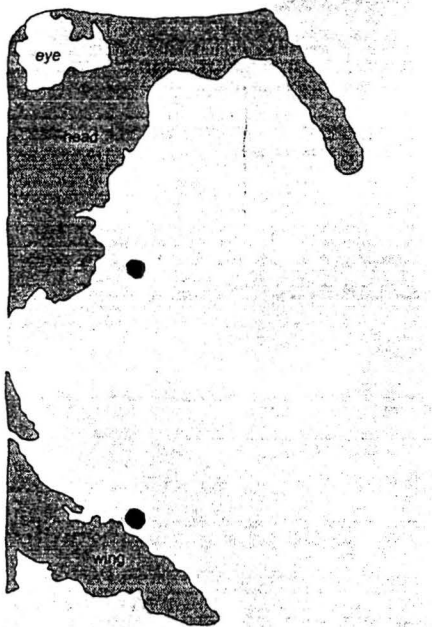
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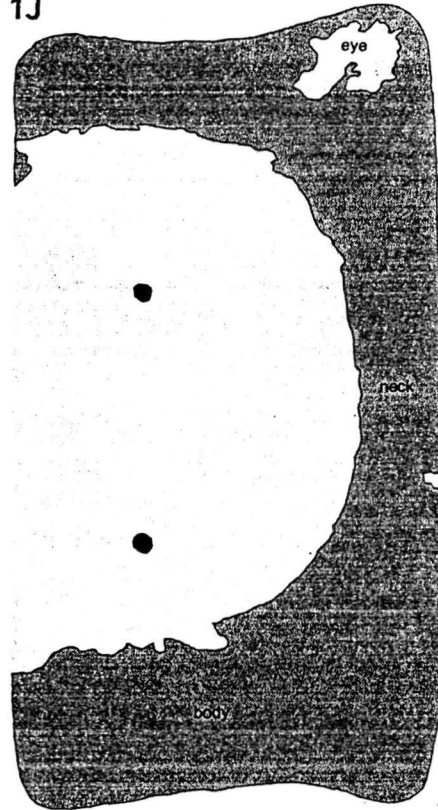
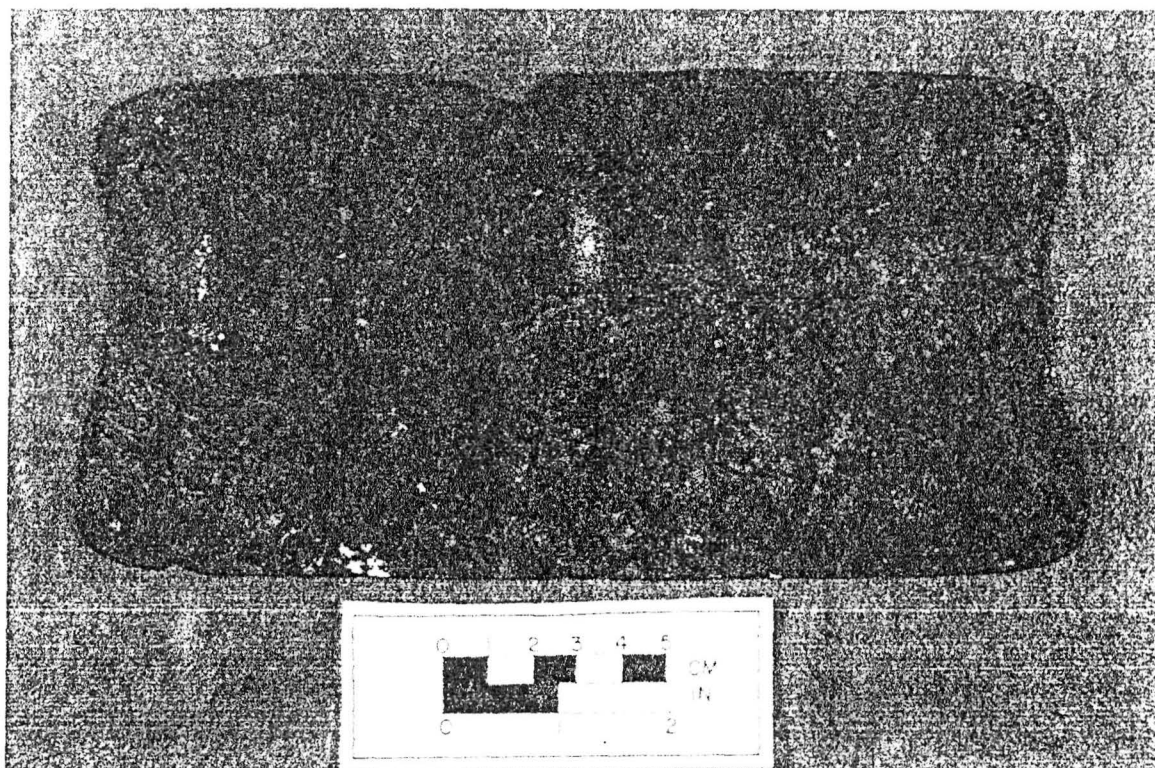
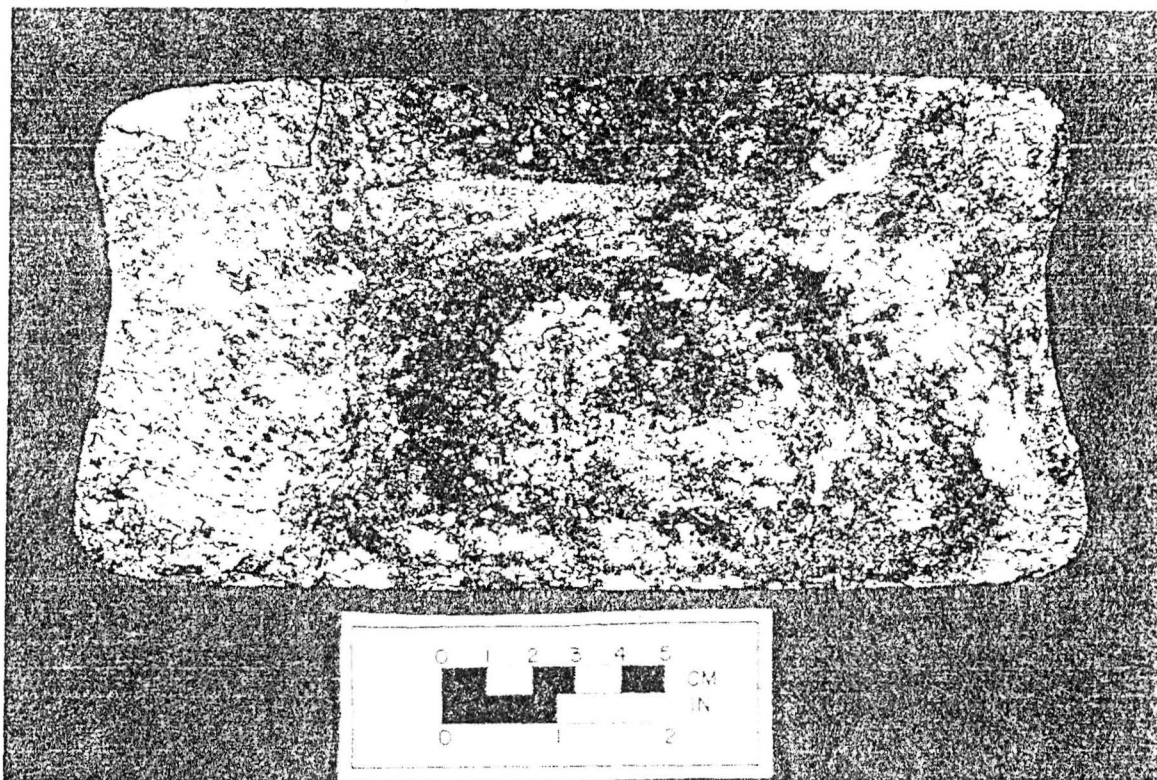


Figure 2. A painted/colored copper breastplate, Hopewell site, Ohio Historical Center, catalog no. 283/. (A) A high-resolution, color digital photograph without any enhancement. (B) The imagery is enhanced using a histogram-equalization mathematical filter. (C) One layer of graphic information, separated out by computerized line drawings, from the multiple overlapping images on the plate. The top two-thirds of the head of a bear or a ceremonial leader with a bear-headress, surrounded by the heads of two long-beaked raptors neck-to-neck, which may also be part of the headress. (D) A simplified, computer-made block-area diagram of C. (E, G) Two other layers of graphic information, separated out by computerized line drawing, from the multiple overlapping images on the plate. A long-beaked (humming?)bird's head and beak, and a full-bodied hummingbird in flight, respectively. The two are positioned beak-to-beak, as in the plate in Figure 1. (F, H) Simplified, computer-made block-area diagrams of E and G. (I, J, K, L) Images noticeable when the plate is held vertically rather than horizontally: four long-beaked raptors and/or bird-men facing in the four "cardinal" directions. Only their heads, necks, and wings/shoulders are rendered.

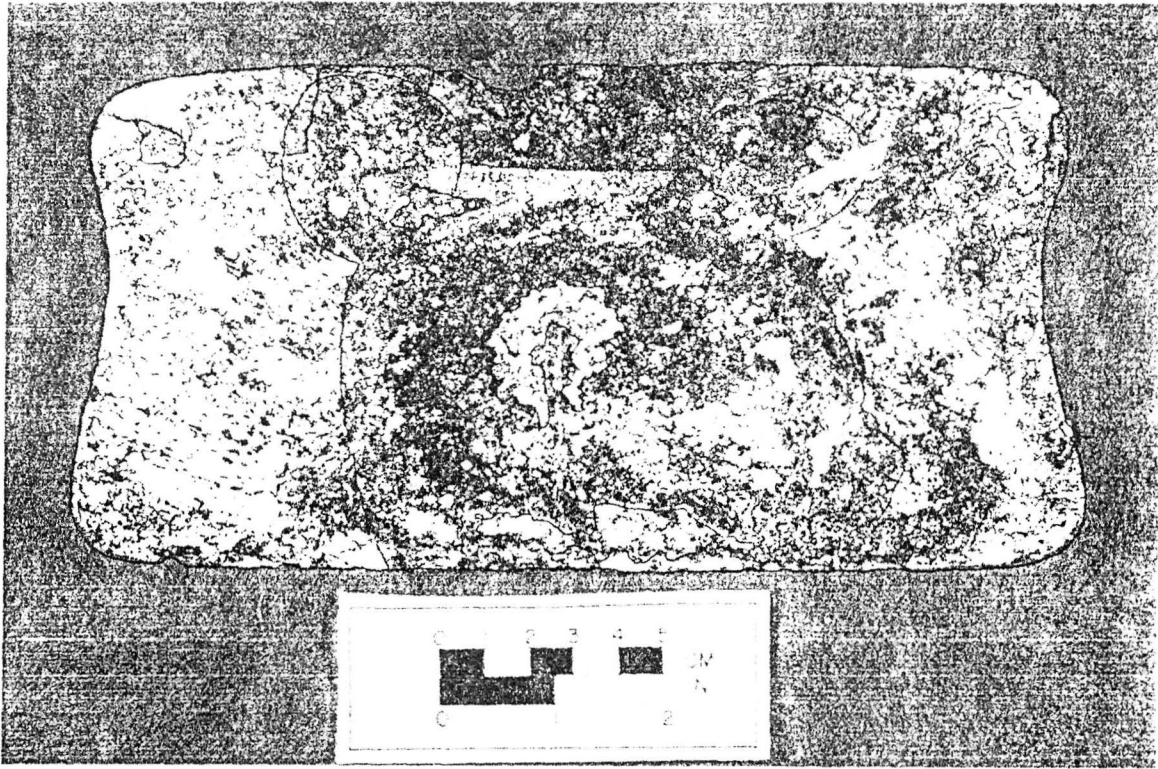
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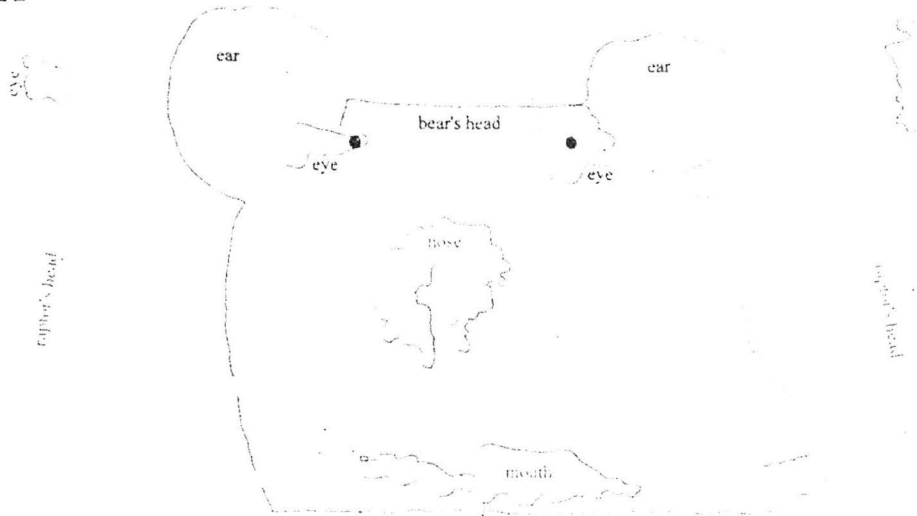
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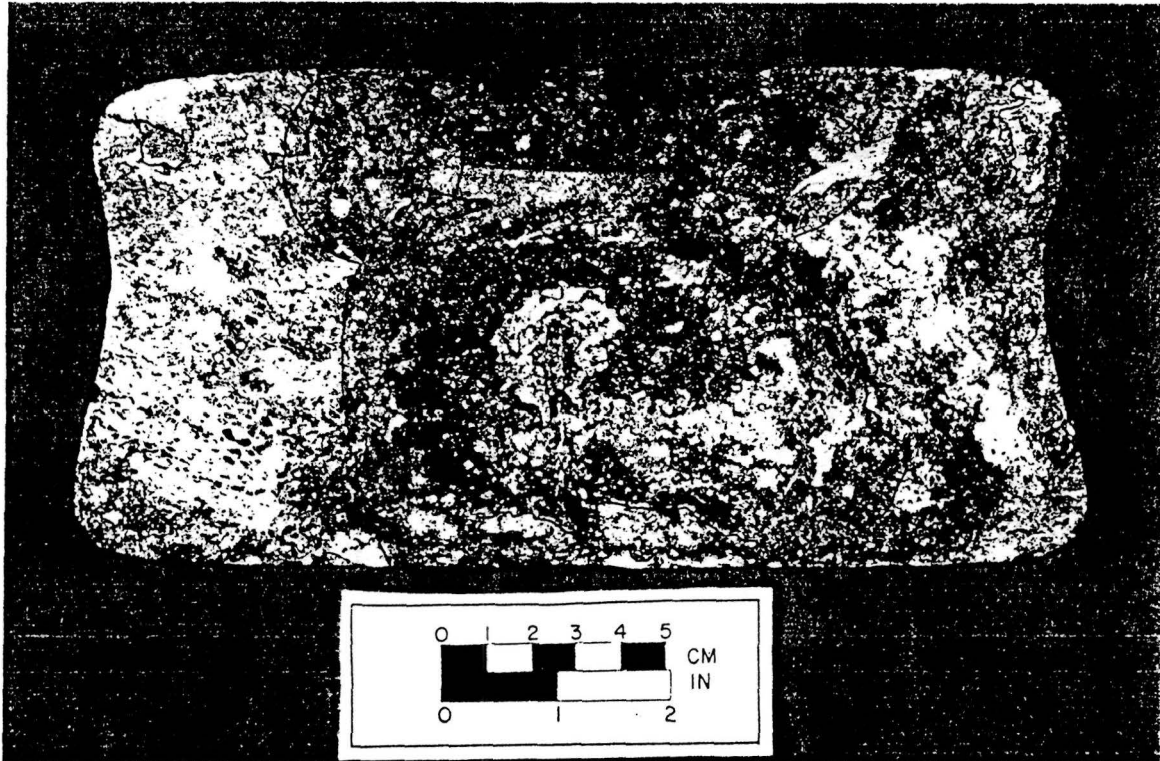
2C



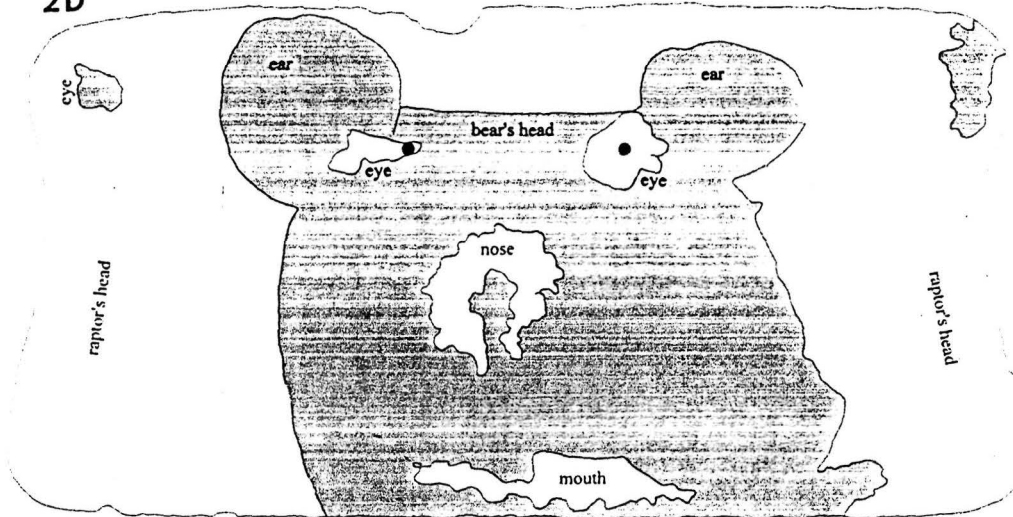
2D



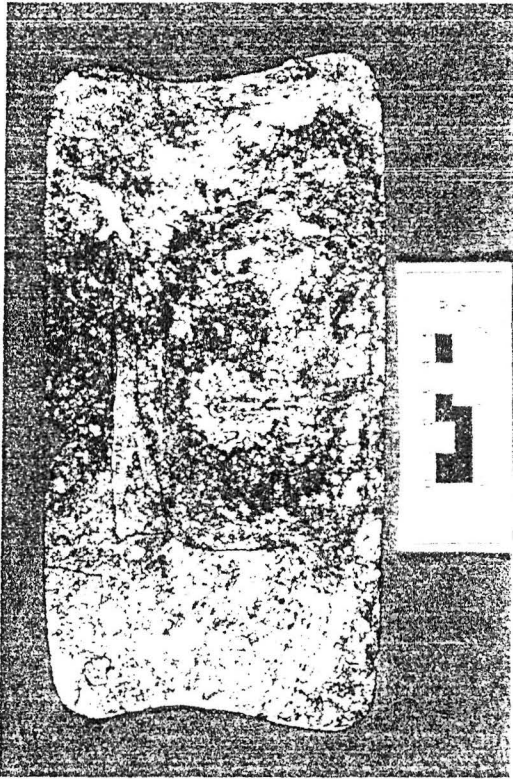
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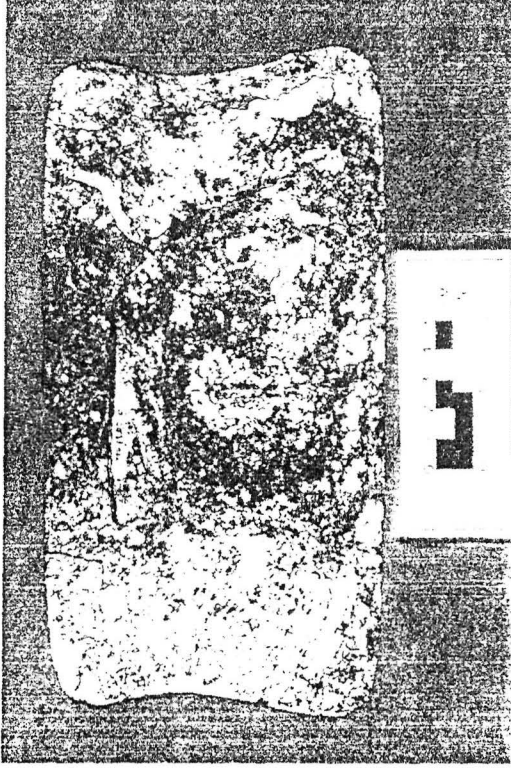
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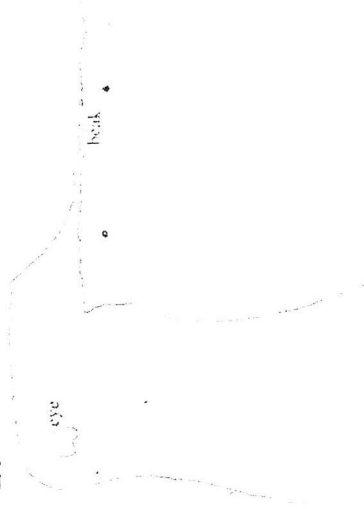
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2G



2F

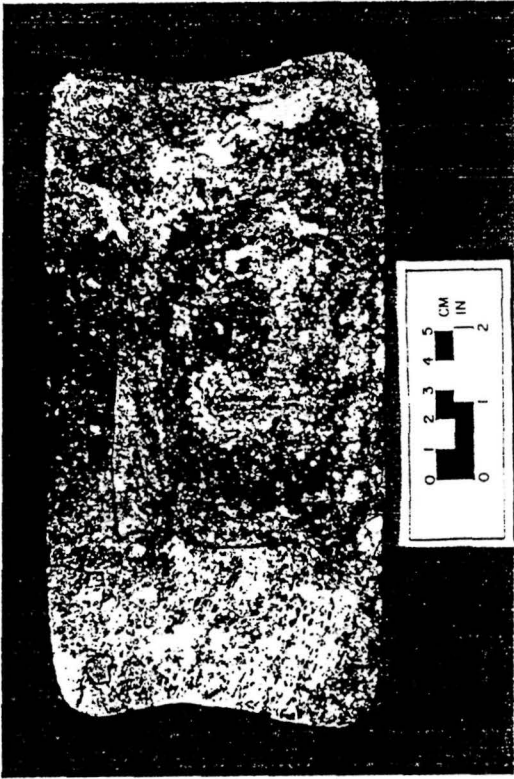


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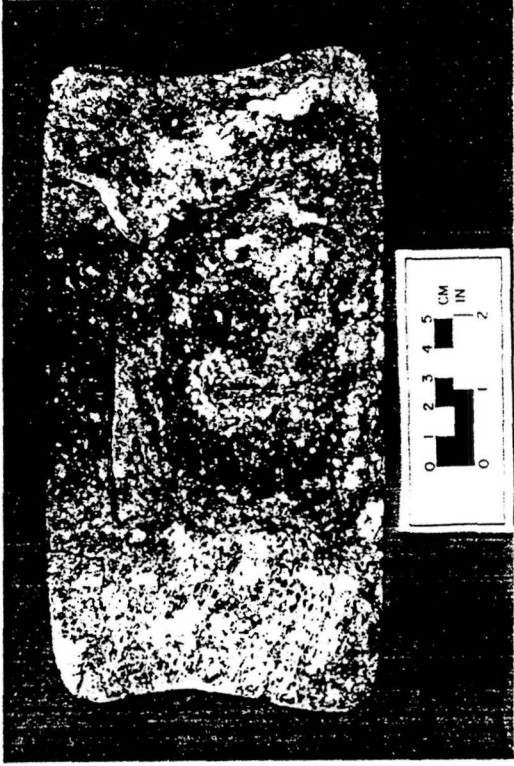




2E



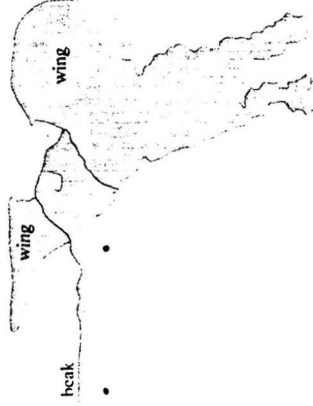
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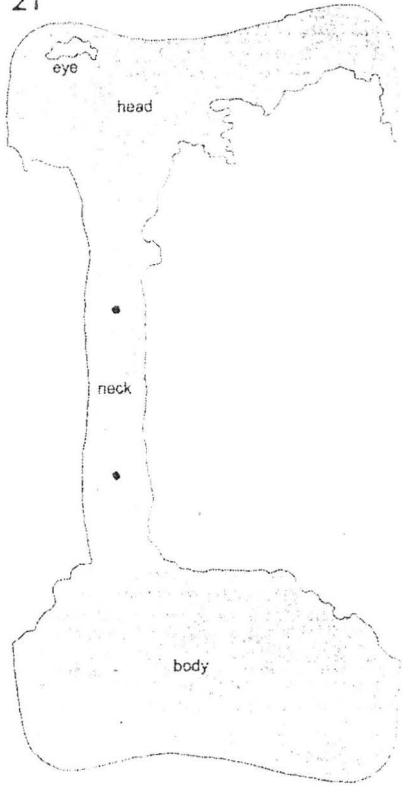
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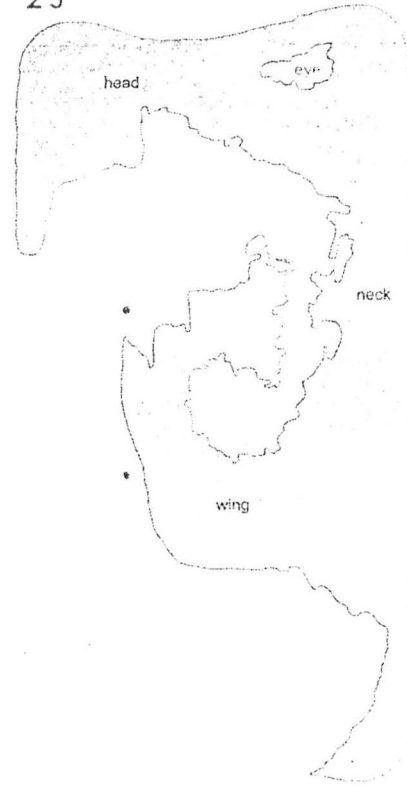
2H



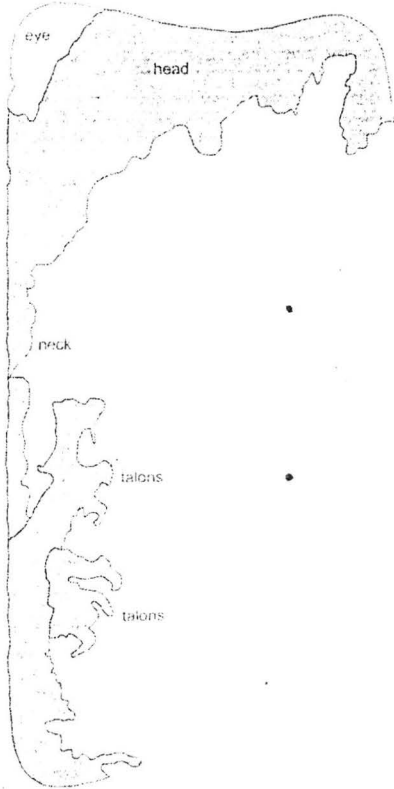
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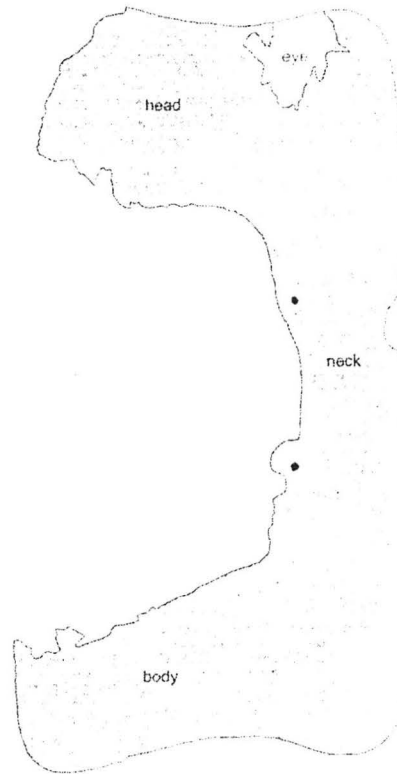
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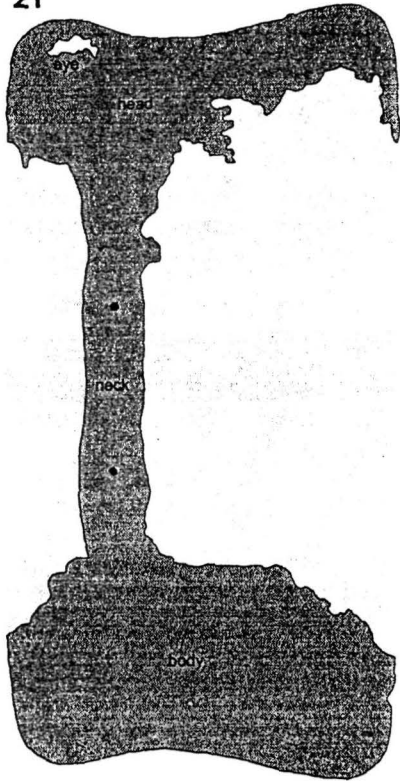
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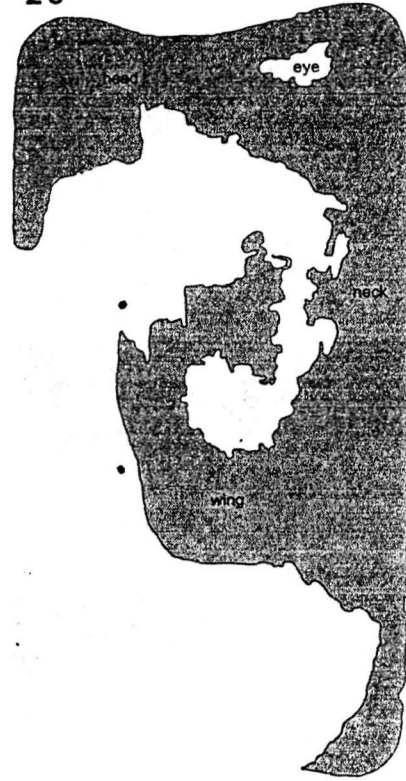
2L



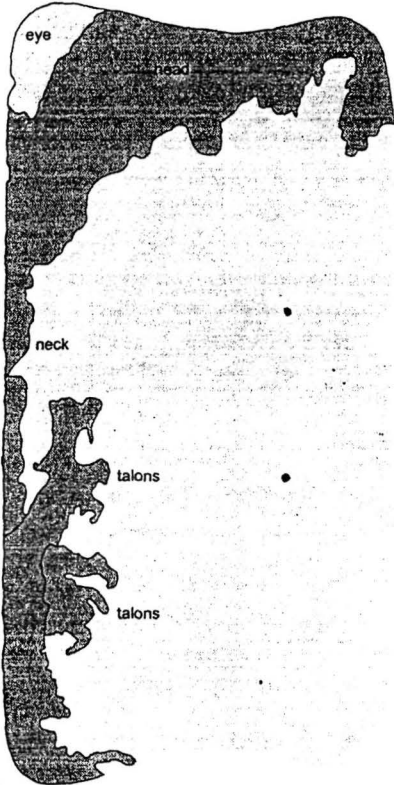
2I



2J



2K



2L



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