time. After using exclusively DOS-based image processors, this was a refreshing and quite flexible option.

Most of my concerns about the program relate to the limitations of the available functions. This may not be a completely fair criticism of an admitted basic image processor, but some of these deficiencies could be easily addressed. First, I would like the option to write files out in the same format that they were read in. Many programs work with generic byte-binary formats and it would be useful to be able to export at least this additional format. Second, I was surprised that the composite function did not seem to automatically stretch the three component images as it was creating the full color composite. I had to do that as a preliminary step. Lastly, I was a bit disappointed in the manual. It did not offer much detail or explanation as to why certain functions might be desirable. The on-line documentation in the program was essentially the same as the manual. While basic users may not miss this, I was left wondering how long it would have taken me to use the program efficiently if I hadn't already had a fairly thorough background in image processing. It would seem that more extensive documentation would make EASY IMAGE a much more accessible product to the neophyte user. Overall, these are fairly minor concerns. The program appears to be exactly what it proposes to be–a low priced (I would say moderate), basic image processing program for the DOS-Windows environment. ❑

technical notes

The cover for this issue of *Cartographic Perspectives* is of a portion of the Oregon Department of Geology and Mineral Industries' *Elbow Quad Geologic Map*. The original map is in full color and measures 26.75 inches high and 40 inches wide. This *technical notes* section describes the design considerations and execution of the full color map.

AUTOMATED LARGE-FORMAT GEOLOGIC MAP PRODUCTION

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INTRODUCTION

The Department of Geography at the University of Oregon and the Oregon Department of Geology and Mineral Industries (DOGAMI) entered into a cooperative agreement to conduct cartographic research and to work on the development of an automated procedure in order to produce and to publish a multi-color version of *The Elbow Quad Geologic Map*. The work included: (1) the creation of digital cartographic files and geologic symbols, (2) the delivery of check plots, and (3) the creation of color-separation PostScript plot files.

METHODS

The research and production work was conducted on two computer platforms running MicroStation CAD software, an Intergraph Unix workstation, and a 486-PC. Intergraph MicroStation was chosen as the software package because of its compatibility with the computer mapping installations at the DOGAMI office, the Oregon Department of Transportation (ODOT), and the University of Oregon InfoGraphics Lab. The DOGAMI cartographers have traditionally created registered geologic overlays and combined them with existing U.S.G.S. film-separates of base map information. One of the purposes of this coorperative agreement was to developed a procedure to automate the creation of the geologic overlays.

PROCEDURE

The procedure developed for the creation of a geologic map was based on the on-going research being conducted for the publication of the *Official Highway Map of Oregon*. The cartographic procedure includes four major steps: (1) File Organization, (2) Map Data Input and Manipulation, (3) Geologic Symbol Design and Creation, and (4) Output of Map Images.

File Organization. The File Organization step includes: (a) planning and creating design files with the appropriate naming convention, (b) setting up of an organization scheme within the design files, and (c) determining the geographic coordinate and projection specifications of the design files.

Two files were created for the map portion of the project: *elbowmap.dgn* (line work, polygons and area patterns) and *elbowtxt.dgn* (text and symbols). These two files were referenced to each other using MicroStation's reference file capabilities. The time rock chart and geologic cross sections were created in another design file (*elbowpro.dgn*).

All the graphic cells (symbols) were designed and built from primitive elements and a description of each cell was contained in a separate design file (*zdogami.dgn*). From the design file the cells were added to a cell library (*dogami.cel*). Each data level was assigned a name corresponding to its geologic unit. A modified PostScript plotting configuration file was created (*elboptrn.plt*). A level organization scheme was setup for the *elbowmap.dgn* and the *elbowtxt.dgn* files. These two files were referenced to one another.

The projection was defined in the Intergraph Projection Manager software package. The projection definition came from *The Elbow Quad* U.S.G.S. map. The projection and coordinate system was based on *The Elbow* U.S.G.S. quad projection definition of Polyconic, NAD27, and Clarke 1866 (ellipsoid). This allowed for acceptable registration of digital images to the U.S.G.S. quad base.

Map Data Input and Manipulation. The Map Data Input step consisted of capturing the line, area, and point information by digitizing the green-line mylar provided by the DOGAMI geologists. This began by setting up a design file in the correct projection with the four latitude, longitude coordinate points that corresponded to the U.S.G.S. quad corners that were identified with circles in the design file. The mylar was used as the source map for digitizing the contacts, faults, and contact-faults. Check (pen) plots were compared to the original green-line mylar. A Linotronics image was created to check the line quality of the digital image to the mylar. Unit areas were created into polygons on the proper unit level (example, level name Qls or lv=21).

Geologic Symbol Creation and Placement. The creation of the cells took place in the *zdogami.dgn* design file. The symbol design was based on the standard symbol set given to the InfoGraphics Lab by the DOGAMI cartographers. The point symbols were created to match the existing the symbol set and then added to the cell library (*dogami.cel*).

The point symbols were digitized from the mylar quad. The strike and dip symbols were rotated to the proper angle. The text sizes were selected to match the existing standards.

The text was placed using the mylar as a guide. The linear feature thickness and line style design were based on geologic mapping standards. They were then assigned a MicroStation weight (WT=) and a specific plotting thickness in the plotter configuration file. The fault line codes were also tested for spacing of dashes and dots.

The area symbols were designed after standard transfer area patterns. Extensive testing was needed to develop the random "sand and gravel" like area patterns of many of the units. One problem was the appearance of rows where the pattern cell repeated. The solution was to interactively adjust the pattern cell elements in order for them to appear random when repeated during the area pattern execution.

The line and area pattern symbols were placed in the *elbowmap.dgn* file and the point symbols and text were placed in the *elbowtxt.dgn file*. The *elbowpro.dgn* contained all three groups of elements for the profile and time-rock chart. The map files were referenced to each other for the creation of plot files.

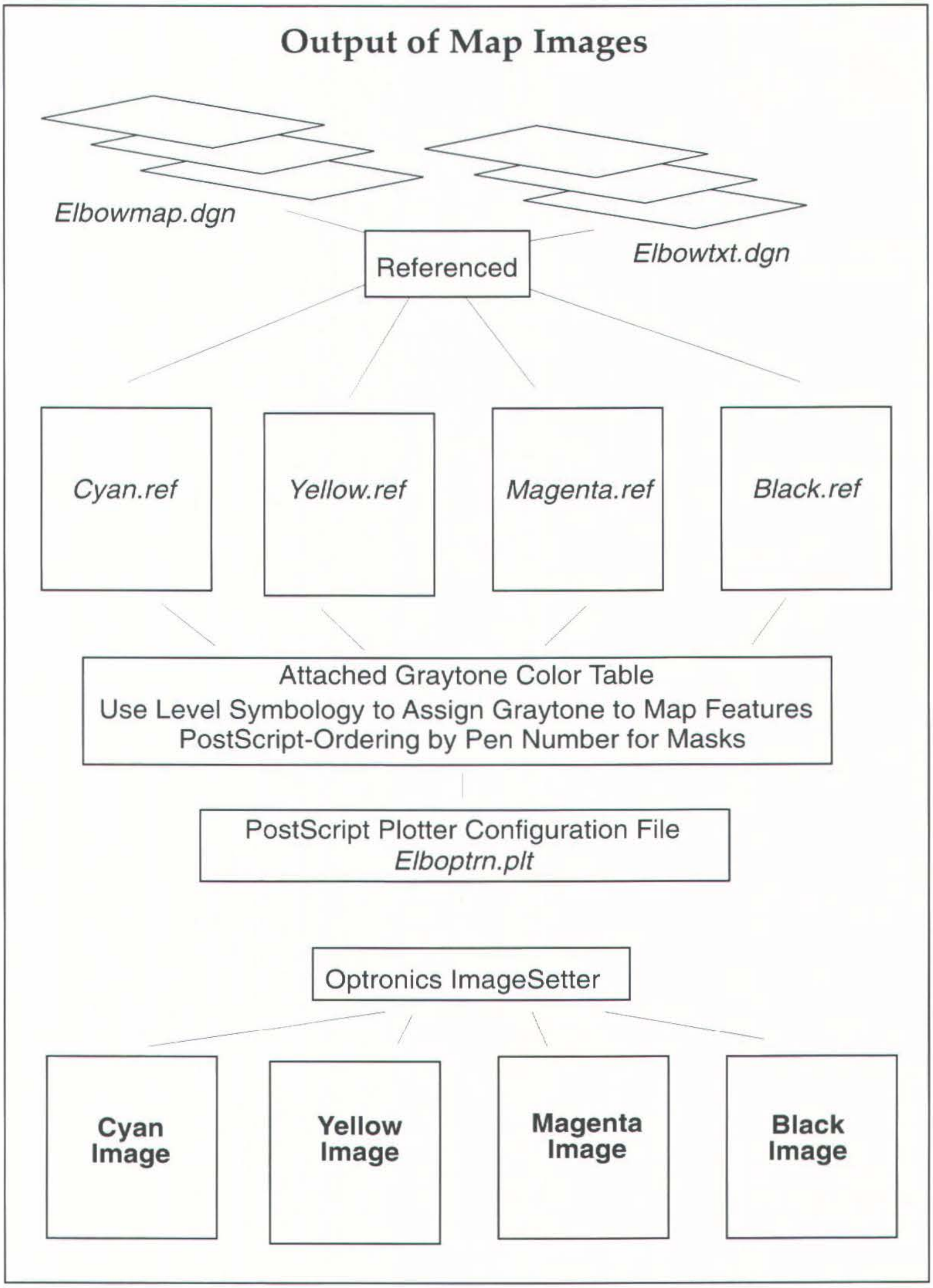
Output of Map Images. An HP Draftpro pen plotter, a laser printer, and a Linotronics image setter were used for the check plots. The final output was done on an Optronics 2000 image setter. The final map image size was 19 by 23 inches. The PostScript files were created using the *elboptrn.plt* configuration file. The method of production of color-separations with type-spreads and knockout masks was created directly from MicroStation CAD software. The procedure took advantage of level symbology, color tables, reference files, PostScript drivers, and PostScript ordering to produce high-quality large-format images with pre-angled screens. The PostScript files were created for the map area as one set and the time-rock chart and profile were created as another.

Figure 1 (page 58) shows the work flow from the design files to the final images. The map data in *elbowmap.dgn* and *elbowtxt.dgn* are referenced to color separation design files. With the use of level symbology (a MicroStation feature) and a gray tone color table, percentages of each process ink are attached to the appropriate map feature level. PostScript ordering by pen number that relate to color table number allowed for type-spreads and knockout masks. Each of these color separation files were plotted to PostScript files using the plotter configuration file *elboptrn.plt* (Figure 2, page 59). The PostScript files were sent to an Optronics 2000 image setter with screen angle instructions for the creation of the film negatives.

CONCLUSIONS

The Elbow Quad Geologic Map project was the first effort by the Oregon DOGAMI to automate their map publication process without loss of graphic quality. The procedure described here was developed in order for the Oregon DOGAMI to incorporate cartographic production advancements and enhancements into their work flow.

Figure 1: Work flow for The Elbow Quad Geologic Map.



UO InfoGraphics Lab 1994

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Meacham, James E. 1993. *The Electronic Publication of the Official Highway Map of Oregon.* Paper presented at the Association of American Geographers 89th Annual Meeting.

Geology and Mineral Resources Map of the Elbow Quadrangle, Malheur County, Oregon. 1992. GMS-62, Geological Map Series: Oregon Department of Geology and Mineral Industries. ❑

PostScript Plotter Configuration File (*elboptrn.plt*)

```
;    Optronics 2000 dpi  (postscript) Plotter Cfg File (MicroStation)
;    elboptrn.plt max 19.00 x 23.5 inches
num_pens=8                          ; required record
change_pen=weight                   ; either "color" or "weight"
size=(7.45,10.55)/num=0/off=(.55,.35)/name=A
size=(16.00,10.00)/num=0/off=(.35,.55)/name=B
size=(17.80,31.45)/num=0/off=(.21,.21)/name=C
size=(19.20,23.60)/num=0/off=(.21,.21)/name=Q
resolution(IN)=(0.0005,0.0005)      ; specifies both res and units
stroke_tolerance=4.5                ; unitless num  0 < tol <10
model=laserwriter                   ;plotter model number
autocenter
style(1) = (4,12)
style(2) = (120,60)           ; pattern 360 hatch
style(3) = (0,40,278,0)       ; approximately located fault
style(4) = (33,12,8,12)
style(5) = (0,40,40,0)        ;  concealed fault
style(6) = (75,15,15,15,15,15)
style(7) = (75,10,10,10,10,10,10,10)
weight=(5,10,15,21,30,33,43,52,62,72,81,1,1,1,1,1,1,1,1,1,1,1)
hardware_arcs = 1
font("AvantGarde-Book") = (1) /KERN=35
font("Times-Bold") = (2) /KERN=45
font("Helvetica") = (7,71,103) /KERN=40
font("Palatino-Bold") = (3) /KERN=0
font("Symbol") = (26) /KERN=10
font("Helvetica-Oblique") = (23,24,72) /KERN=20
font("Helvetica-Bold") = (73) /KERN=40
rotate = cw                         ; clockwise rotation
; border/pen=1/filename/time              ; leave this out for no border
communication=(eol1=10,eol2=0)
communication=(handshake=1,port=2,baud=19200,par=none,data=8,stop=1)
end_plot=eject
```

Figure 2: PostScript plotter configuration file (elboptrn.plt) for plotting color separations.