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Severan Marble Plan of Rome data files

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In its original state, the Severan Marble Plan of Rome, placed on the wall of the Temple of Peace between AD 203 and 211, showed viewers the locations of buildings throughout Rome, and even the groundplan of each of those buildings. It is today an extraordinary piece of evidence for understanding the city in that time period, despite its ruinous state. It survives in over 1,100 fragments, representing only about 10% of its total surface area. To date, scholars have successfully placed only about 100 of those fragments with respect to the buildings they depict. Using GIS and CAD software, I have digitized those fragments whose locations are known and placed them in their appropriate positions over a topographical map and satellite image of the modern city. I correlated the placement of individual buildings with excavated remains. Scholars have long known that there are surveying errors on the Plan, though there is disagreement about the number and extent of those errors. One advantage of digitization is its flexibility; I can not only adjust the placement of any individual fragment for greater accuracy, but I can also change the spacing and orientation of different buildings on a single fragment. This project gives the most precise understanding yet of the surveying and cartographic methods employed on the Plan, and it allows for the ready integration of future information from newly excavated remains.

I began my work on this project with a “trial run” in order to fulfill the requirements of Professor Cooper’s seminar on “Computer Applications in Archaeology and Art History”. I consulted the major scholarly works on the plan: *La pianta marmorea di Roma antica*, by Carettoni, Colini, Cozza, and Gatti (1960); *Forma urbis*

marmorea: aggiornamento generale by Emilio Rodriguez-Almeida (1980); and *Forma Urbis Romae: The Severan Marble Plan and the Urban Form of Ancient Rome* by David West Reynolds (diss., 1996). I also began my search for an appropriate modern map of the city of Rome. The requirements for the map were that it cover the area displayed on the Marble Plan, that it be relatively large-scale (so that individual streets would be visible), and that it have latitude and longitude or some other georeferencing coordinate system (so that points on the map would correspond precisely to points on the screen and points in the real world). Using a 1963 property assessment map, I began digitizing by hand. I quickly realized the limitations of this process – namely the great amount of time it would take merely to produce a digital modern map, let alone the fragments as well. Luckily, at the same time I learned that I would not have to digitize all 1,163 fragments of the plan, but rather only the 100 or so which had been successfully identified with known remains.

When the seminar ended, I decided to pursue this project as a Plan B Master's Project. I applied to the department for a Summer Research grant so that I could spend time in Rome developing a strategy for working with the Marble Plan and obtaining an appropriate map for digitizing. I stayed in Rome for one week in the middle of July 1999. While there, I was able to purchase a pair of 1:25,000 military maps published in 1949 by the Italian *Istituto geografico militare*. They included both the latitude and longitude and the Universal Transverse Mercator (UTM) coordinate systems. The major monuments and all the streets were clearly visible, and the map had been created after the completion of Mussolini's building projects and post-war reconstruction. The

city has grown considerably since that time, but it has not changed drastically in the areas covered by the Marble Plan. I was also lucky enough to see the first newly-discovered fragments of the plan in almost 300 years. Fifteen new fragments were recovered during the summer of 1999 in excavations of the Forum of Nerva under Dott. Santangelo-Valenziani. The previously-known fragments were unavailable for my inspection because they had been moved from the Museo di Roma (under renovation for the Jubilee) to the Museo dei Conservatori (also under renovation).

The following semester I began work in earnest on this project. The process involved a number of steps:

- Creating digital “background” imagery – the map and other materials that would allow the fragments to be placed within a two-dimensional geographic space
- Assigning real-world coordinates to the background images
- Importing the background images into the drawing program AutoCAD
- Digitizing the fragments and the carvings found upon them
- Placing the fragments in their correct positions.

I had the two military maps commercially scanned at high resolution. I also purchased a digital satellite photograph of the city of Rome in TIFF format. Using the GIS software Imagine 8.3 and a Silicon Graphics Octane workstation at the University of Minnesota’s Soil and Landscape Analysis Laboratory, I rectified the satellite photograph to true north and set the coordinates for UTM. The advantage of using UTM is that it measures coordinates in meters north and east from an arbitrary

zero-point outside the range of the map. The distortion encountered when using latitude – that is, the shrinking distances between degrees north as one continues to move north – is thereby removed. Performing the same work on the map was slightly more complicated because I did not have access to the latitude and longitude of all four corners of the section I was using. I therefore picked a number of ground-control points until I was able to rectify the map with very little error (<3 m). In this way, I was able to give real-world UTM coordinates to the map. I verified the accuracy of the rectification by performing a “swipe” of the map and satellite photograph. This command essentially allowed me to lay one image over the other and move the border between them, so that I could check how the lines of the map matched up with the features (streets, etc.) in the photograph. My final work with the SGI workstation involved the extraction of lines from the rectified map. In effect, I had the computer digitize the map for me, using ARCEdit’s clump, recode, and sieve functions to produce a “drawing” from the TIFF image of the map. The end result was not beautiful, but it was accurate, and it provided a good starting point in AutoCAD. Even better, the computer was able to digitize the entire map in a little under an hour – an exponential improvement over digitizing by hand.

At the same time as I was working with the map and satellite images, I took photographs of the plates in the Carettoni, et al. publication of the Marble Plan. I was unable to digitize directly from the plates because the book could not be removed from the library. I planned, therefore, to use a digitizing board to draw the fragments in AutoCAD 2000 from my photographs of the plates. Unfortunately, the digitizing

board that was available did not work with the computer I hoped to use. The board was too old and the computer and software were too new to work together, despite a number of attempts to re-install digitizer drivers.

This problem threatened to scuttle the project, at least temporarily, until I discovered (with the help of Todd Brenningmeyer) a new way to digitize the fragments. I could scan the photographs I had taken and import them into AutoCAD as TIFF files. These raster images could be oriented and scaled until they sat over the appropriate areas. At that point it became a simple matter to digitize what I saw on the screen using only a mouse. This method also seemed to be even more accurate than using the board because I could see the fragment I wanted to digitize and what I had just done at the same time. In this manner I was able to insert all the “understood” fragments and place them accurately and precisely over both the satellite photograph and the map in about two weeks of work.

As I noted above, my work with the plan will hopefully lead to greater understanding of the ancient topography of Rome and how the ancient city relates to the modern one. With greater investigation of published excavations, I will be able to test my placement of the fragments. Likewise, other scholars can use my work to guide them in their explorations of the city. The results of future excavations will allow greater and greater refinement of our understanding of the plan. In order to expedite this process, I hope to make my work available to archaeologists and art-historians in two ways: I hope to present this project at the poster session of the next Annual Meeting of the Archaeological Institute of America, and I hope to make the

AutoCAD drawing and the associated raster images freely available on the World Wide Web.