Reconstruction of Topography at Archaeological Sites in Grevena, Greece

Elizabeth M. Russell
Department of Geology
Smith College
Northampton, MA 01063

Introduction

For the past several summers a large scale reconnaissance survey has been conducted in the province of Grevena, Greece which is located in western Macedonia. The purpose of this survey is to identify the locations of as many archaeological sites as possible and assess the possibility of future excavations. In order to determine which sites would be the best candidates for full scale excavation, several aspects concerning the landscape of the site must be taken into consideration. During the four weeks of field work in Greece, we attempted to answer some of the geologic questions at several different sites. The purpose of this project was to restore the landscapes of two sites to their appearance at the time of occupation. These two sites, Emilianos-Aghios Nikolaos and Potamia-Itea, are both located with in 30 km of the town of Grevena.

Emilianos is a Hellenistic/Roman site that is characterized by an abundance of pot sherds, burned mud brick, and roof tiles. The eastern portion of the site has undergone severe erosion, while the land to the west has a gentle slope. The eroded portion of the site is composed of heavily weathered shale and is dominated by a series of small scale ridges and gullies. The material that has been eroded is not present on site, but has been carried downstream by the river that is located at the base of the slope.

The second site, Potamia, is comprised of a colluvial fill rich in anthropogenic material, including pot sherds, mud brick, and roof tiles. The colluvium is bordered on the south by alluvium with virtually no archaeological debris and to the north by limestone-shale bedrock.

Methods

The methods used at the two sites varied due to the different processes that caused the landscapes to change in appearance. At Emilianos, where the topography was formed by erosion, extensive surveying was conducted to generate a topographic map of the present landscape. The surrounding gently sloping topography was used as a rough estimate as to what the now-eroded portion of the site looked like at the time of occupation. After the topographic map was generated, a series of trend surfaces of increasing order were fit to the present day surface to estimate the stages of erosion (Figs. 1 and 2). The surfaces created by the computer are based on mathematical functions of differing order. A first order function produces a plane, a second order function results in a simple curved surface, and higher order functions generate more complex surfaces that more closely resemble the actual topography.

In contrast, Potamia is a site characterized by depositional processes. The portion of the site which is of major interest, the area underlain by the colluvium, was investigated so that the correct amount of material could be replaced upslope. A survey done at a Roman site in Portugal indicates that the area receiving sediment is four to eight times larger than the area supplying the material (Clarke, 1992). This rough parameter was used in the reconstruction of this site as the area of deposition can be measured. Extensive surveying also was conducted at this site, and a topographic map of the area was again created. Electrical resistivity and magnetic surveys were then conducted to help determine the thickness of the colluvium. An expanding-spread traverse was run across the fill to estimate the thickness of the deposit. Five magnetic lines with different orientations were surveyed across the colluvium in an attempt to identify the lateral extent of the fill. Although the contacts are not clear from the magnetic data, the depth of the objects causing individual anomalies can be estimated using a profile of the anomaly and the relationship between the width of the curve at half-maximum value and the depth of the object (Telford et al., 1990, p.84) (Fig. 3). Several point source anomalies, caused by concentrations of artifacts in the colluvium, were present on the magnetic map of the area. By estimating the depths to these anomalies the results of the electrical resistivity survey are supported.

Once the thicknesses of the colluvium at different points is known, the volume of the material can be determined by constructing an isopach map of the colluvial deposit. Once this volume is known, this material is then subtracted from its present location and added to the slope above the deposit. The colluvium was replaced first by adding an equal amount to each point in an area roughly a quarter of the size of the depositional area on the upper slope. A linear relationship

TABLE 1. MAGNETIC SUSCEPTIBILITIES OF COLLUVIAL LAYERS WITH ARTIFACTS

POTAMIA

Profile MS5

horizon	cm	susc LF SI units x10^{-7}	susc HF SI units x10^{-4}
A1	0-7	6.48	6.33
Bw	7-24	5.94	5.79
IIAb	24-60	6.68	6.27
IIBw2	60-90	5.55	5.24
IIIBw3	90-200+	5.14	4.89

Profile MS6

horizon	cm	susc LF SI units x10^{-7}	susc HF SI units x10^{-4}
Aj	0-5	5.80	5.53
AB	5 to 28	1.49×10^{-6}	1.43×10^{-3}
Bt	28-70	5.59	5.28
Bkj	70-100	4.75	4.35
IIC	100-120	4.97	4.64

bedrock

susc LF SI units	susc HF Si units
6.18×10^{-8}	6.57×10^{-5}

AGHIA PARASKEVI

Profile OB53

horizon	cm	susc LF SI units x10^{-6}	susc HF SI units x10^{-3}
A12	8 to 30	1.39	1.34
A13a	30-53	1.09	1.06
IIACa	53-82	1.00	9.87×10^{-4}
IIIACa	82-145	8.51×10^{-7}	8.33×10^{-4}

Profile MS4

horizon	cm	susc LF SI units x10^{-6}	susc HF SI units x10^{-3}
A2	5 to 25	1.75	1.70
Bj	25-46	1.62	1.59
B2	46-75	1.31	1.28
BC	75-94	5.23×10^{-7}	4.97×10^{-4}

bedrock

LF SI units	HF SI units
5.37×10^{-7}	5.12×10^{-4}

PALEOGLA

Profile PG3

horizon	cm	susc LF SI units x 10^{-7}	susc HF SI units x 10^{-4}
B1	9 to 53	8.61	7.90
B2	53-100	5.84	5.25

Profile PG4

horizon	cm	susc LF SI units x 10^{-7}	susc HF SI units x 10^{-4}
C	7 to 15	3.94	3.73
IIABb	15-40	7.40	6.64
IIB2	65-109	4.30	3.82
B4	50-60	3.87	3.57

Profile PG5

horizon	cm	susc LF SI units x 10^{-7}	susc HF SI units x 10^{-4}
A	0-5	7.09	6.54
B1	5 to 49	9.20	8.53

Profile OB29

horizon	cm	susc LF SI units x 10^{-7}	susc HF SI units x 10-4
IIA11	5 to 35	8.68	7.81
IIA12	35-55	1.11×10^{-6}	1.00×10^{-3}
IIAB	55-95	8.62	7.31

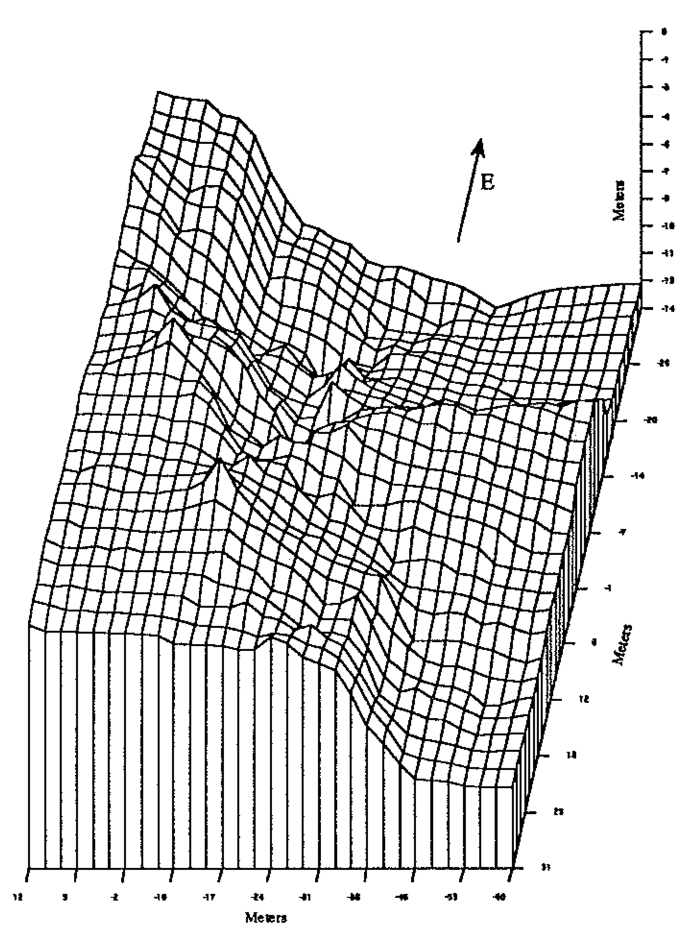

Figure 1. Three-dimensional representation of the topography at Emilianos. Looking east.

was then used to return the colluvium to its original location, and finally, an exponential relationship was used. Each of the topographic maps generated represents a possible appearance of the landscape during the time of occupation (Figs. 4 and 5).

Discussion

The trend surfaces generated to fit the Emilianos data are mathematical estimates of the stages of erosion which occurred at the eastern edge of the site. This method was chosen to approximate the occupation topography because the sediment eroded is no longer present.

The results of the electrical resistivity and magnetic data show that the colluvium at Potamia is approximately 10 m thick, whereas the objects causing the magnetic anomalies are roughly 6 m deep. This information and the isopach map generated by this study indicate the total volume of the colluvium to be approximately 79,000 m^3. This amount of material can then be added to the appropriate area upslope of the colluvium to create three possible occupation landscapes at Potamia.

References Cited

Clarke, Anthony Orr, 1992, Estimating soil erosion rates from archaeological sites and sedimentological evidence. Bulletin of the Association of Engineering Geologists, v. 29, p. 329-339.

Telford, W.M., Geldart, L.P., Sherrif, Robert E., 1990, Applied Geophysics, 2nd edition: Cambridge, Cambridge University Press, 770 p.

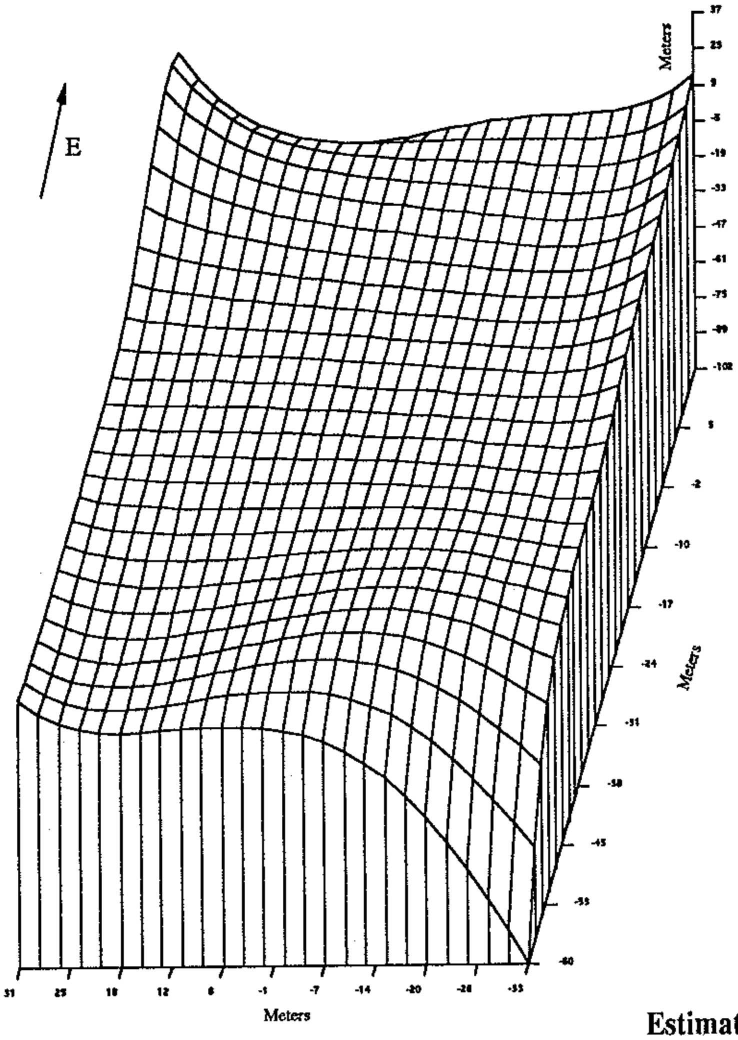

Figure 2. Surface fit to the Emilianos data using a 6th order function. Looking east.

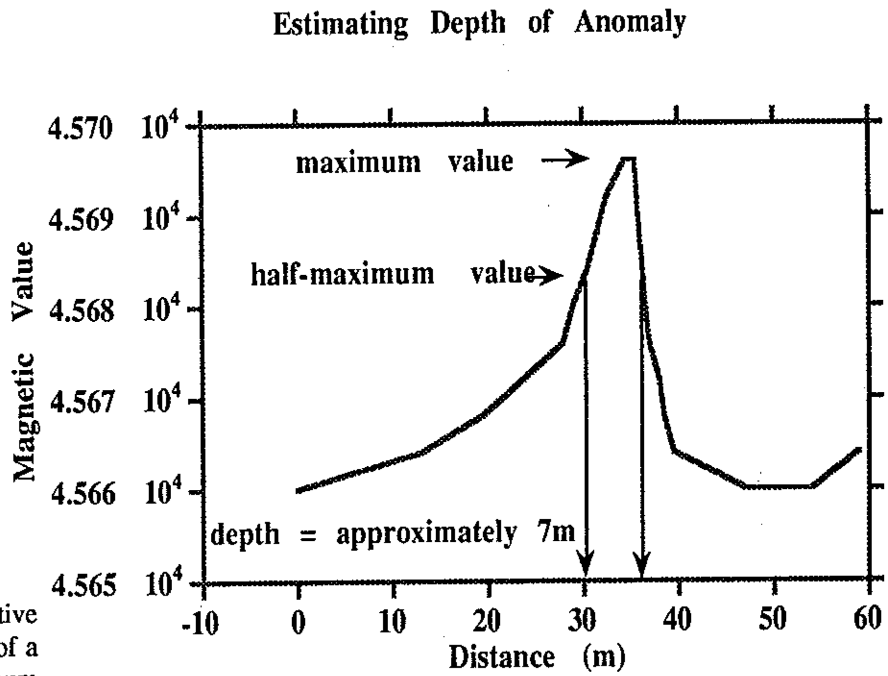

Figure 3. Profile of representative anomaly used to estimate depth of a buried object using the half-maximum method.

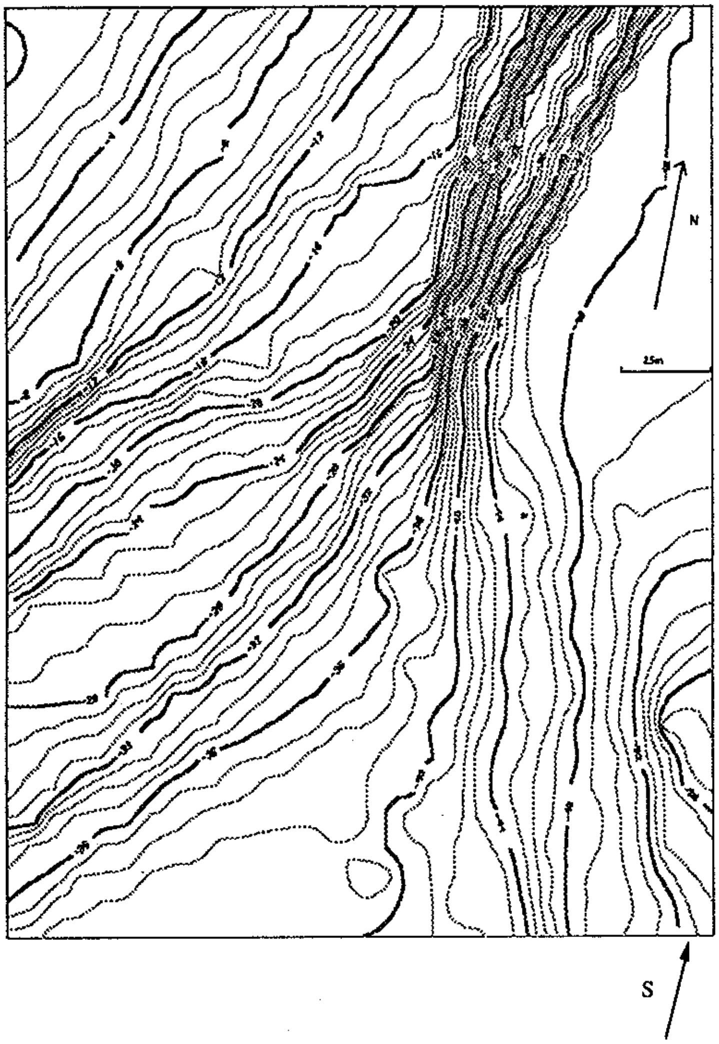

Figure 4. Topographic map of the present day Potamia site.

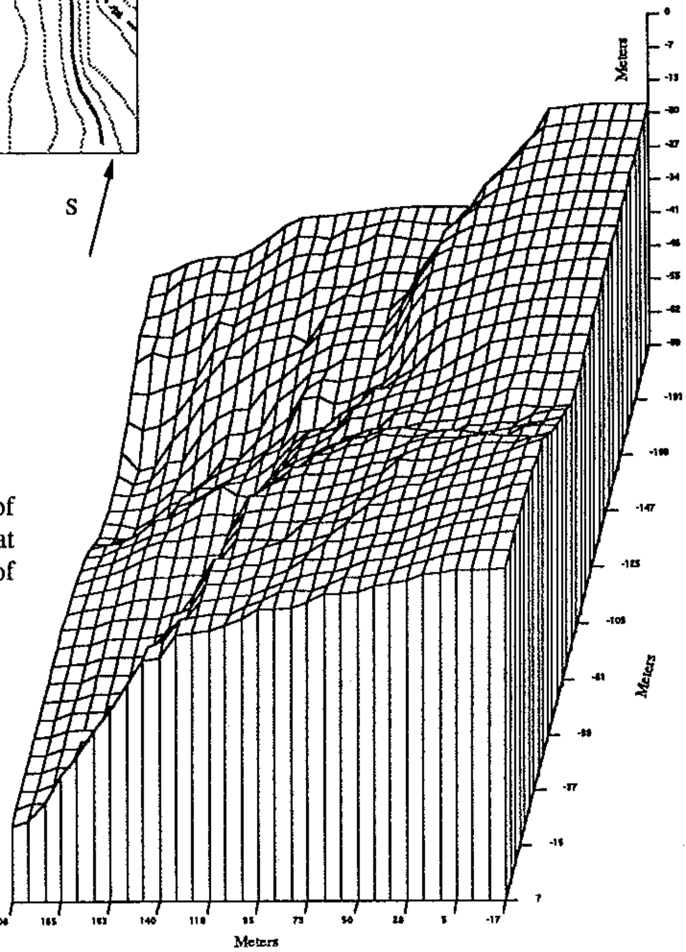

Figure 5. Three-dimensional representation of one possible restoration of the landscape at Potamia created by adding equal amounts of material to all points in the source area.

Fluvial Terrace Evolution and Landscape Change; Potamia, Grevena Province, Northern Greece

Julianne M. Williams
Carleton College
Northfield, MN 55057

Introduction

The site of Potamia is located in a mid-catchment area. The Potamia Valley is drained by a small, effluent stream that is a tributary to the Haliakmon. Bedrock in the area is fine-grained Miocene sandstone with inter-bedded marls. In most places it is overlain by Vourinos-derived conglomerates that are Plio-Pleistocene in age.

The Potamia Valley contains Late-Pleistocene and Holocene fill-terraces and some cut-fill terraces. These terraces reflect changes that have occurred in the valley in recent geologic time. The main problem I address is the nature and chronology of terrace evolution in a small reach of the valley. The main method for reconstructing terrace development is sedimentary stratigraphic analysis of the sediments underlying the terraces. Although C^{14} dates are still outstanding, paleomagnetic data and development of modern soil profiles have allowed me to develop a tentative chronology. This information can then be compared to that from other catchments in the area, as well as climatological studies to determine the causes of changes.

Site and Terrace Description

My field area covers approximately $1km^2$. It is located in a transition zone where the physiography of the valley changes significantly. In the upstream section of my field area, the modern stream flows virtually north-south and is confined to narrow valley, with a flood plain approximately thirteen meters wide. (see Figure 1) Downstream, the stream converges with another from the south, and they are both re-directed west. At this point, the valley changes from a closed gorge to a broader plain.

The Potamia stream is currently incised approximately sixty meters below the level of the upland landscape. On the eastern side of the valley, an erosive scarp separates this surface from the terrace plain below it. A number of landslides have originated from this scarp, some of which have extended as far as the current stream valley. Of particular interest, is a large landslide dividing my study area from fellow Keck participant Bob Wilson's. In Bob's area, upstream of the landslide, the stream runs NE-SW, the terraces are narrow, and the topography is steep. Colluvial fill is a significant stratigraphic component of the terrace sequences in his area.

Along my reach of the stream, stratigraphy is predominantly alluvial, with a distinct absence of colluvial input. Here, the topography below the scarp is more gradual, the main feature being an extensive terrace of approximately one-hundred meters width. This is the highest described terrace on the eastern side, and stands nine to fourteen meters above the modern stream channel. Approximately five meters below this terrace, slope wash and slump blocks create a somewhat level surface. From there, the valley steeply slopes to a small terrace 0.6 meters above the stream. (see Figure 1)

On the west side, the highest observed terrace detailed is six meters above stream level. The work conducted by Julia Daly, Katie Donelly and Mary Greene was conducted on slopes above this surface. One and a half meters below this terrace is an intermediate terrace that is about six meters wide, and bisected by a large gully. From this level, a concave slope grades into a small terrace 0.4 meters above the stream. (see Figure 1)

Stratigraphy

I studied the stratigraphy below the main terrace on the east side and the intermediate terrace on the west side. These two terraces were chosen due to exceptional exposure, on the east side by stream incision (and subsequent slumping), and on the west side by gullying.

Stratigraphic analysis reveals that the two terraces were deposited at different times, under distinct fluvial regimes. The stratigraphic sections differ in 1) grain size, shape, and composition, and 2) anthropogenic material.

The stratigraphy of the eastern terrace is primarily fine-grained, containing some gravel deposits. The fine-grained alluvium is well sorted, very fine sand and silt. The gravel deposits show a range from large, laterally extensive boulder deposits to lenticular deposits of imbricated gravels, and isolated pebble lenses. All of the gravels are rounded, and most are bladed to oblate. Their composition is predominantly limestone and igneous lithologies, with some quartz. Overall, fine-grained alluvium dominates the section, comprising 75% of the observed alluvium (by thickness).