14 November 2001

Seven known errata made it into the final thesis hard copies I turned into the University of Minnesota Graduate School for binding. Those are enumerated below, and corrected versions of the affected pages are included in this file.

#1--thesis p. 25/PDF p. 37

- on the second line from the top “13” should have been “14”

#2--thesis p. 28/PDF p. 40

- on the eighth line from the bottom “15” should have been “14”

#3--thesis p. 39/PDF p. 51

- the 12 meter above sea level contour line is missing because it was too complex to print

#4--thesis p. 69/PDF p. 81

- on the fifth line from the bottom the "1.7" and "4.2" should have been "1.2" and "4.7" respectively

#5--thesis p. 72/PDF p. 84

- on the eighth line from the top, the "NC-93-21" should have been "NC-94-21"

#6--thesis p. 94/PDF p. 106

- for the Waters (1994) reference, initials of the author should have been “D.W.” instead of “J.”

#7--thesis p. 96/PDF p. 108

- #18 in the the “Appendix A Table of Contents” section was skipped, so #19-29 should have actually been #18-28 instead

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primarily by the author and various members of the Nikopolis Project, with the participation of Z. Jing during the first several weeks. The 14 cores collected during the 1992 and 1993 seasons were concentrated primarily in the lowest part of the valley closest to the sea. Approximately half of the cores collected during the 1994 field season came from near the Mesopotamon/Tsouknida valley constriction, and the other half from localities further up the valley.

Cores from all years are labeled using the same convention. All labels begin with "NC" (Nikopolis core), are followed by two digits which designate the field season (either "92", "93", or "94"), and then are terminated by a two digit extension that indicates the number assigned to that core during the field season. Core NC-94-23, for example, was the twenty-third core collected during the 1994 field season. Sediment cores from other localities in southern Epirus were also being collected by the Nikopolis Project geologic staff during the same field seasons, and were assigned numbers within this same system. As a result, core numbers from the Acheron Valley are not necessarily continuous.

All cores were retrieved in sections consecutively downwards by means of a one meter long, three centimeter diameter Eijkelkamp gouge auger. Because of equipment failure, cores NC-94-02 and NC-94-03 were taken with a 20 cm long, seven centimeter diameter Edelman auger bit. Depending on the consistency and induration of the sediment being cored, the use of a sledge hammer was sometimes necessary for penetration. For nearly all cores, use of the sledge hammer was necessary for penetration of strata at more than three to four meters depth. In this fashion, approximately seven to eight meters of core recovery was achieved on average, with the deepest penetration being 12.5 m (core NC-93-14). Cores shorter than the average penetration resulted because either a subsurface barrier or bedrock was encountered, or because of core hole collapse in coarse sediments. Overall, the gouge auger provides a cheap, simple, and rapid method for studying subsurface strata; however, sample size is limited, and sedimentary structures with the exception of thin layers and laminae are not preserved.

samples were burned a second time at 1000°C for one hour to drive the carbon dioxide out of calcium carbonate, then cooled and weighed again. By calculating the loss of mass after each of these burns with respect to the original mass of the dry sediment, the weight percent of organic and inorganic carbon contained in a sample can be calculated. Results of organic carbon content from this analysis are presented graphically along core stratigraphy in Appendix A. Both organic and inorganic carbon content results can be found in Appendix D.

Pipette Grain Size Analysis:

Though a field approximation of sediment grain size was recorded during core logging, a more exact analysis of the grain-size distribution for 23 samples was also determined by pipette according to the method of Folk (1980). Samples were selected on the basis of information collected from other analyses, in particular the microfossil and loss on ignition analyses. Approximately 30 g of sediment was disaggregated by gently crushing between fingers. The crushed samples were placed in suspension in one liter graduated cylinders with a 2.55 g/l Calgon solution as a dispersant. Twenty milliliter aliquots were removed at specified times that depended on temperature and grain-size (Folk, 1980). The aliquot parts were dried in an oven at 100°C, weighed to determine the mass of sediment they contained, and then calculations made to determine the grain size distribution (Folk, 1980). Results from this analysis can be found in Appendix C.

Rock Magnetic Analyses:

Rock magnetic analyses were performed at the University of Minnesota—Minneapolis on all sediment samples from 12 of the 14 sediment cores collected during the 1994 season. Dual-frequency magnetic susceptibility was determined on the Bartington susceptibility bridge at the Limnological Research Center, and anhysteretic remanent magnetization was determined at the Institute for Rock Magnetism. Anhysteretic remanent magnetization was imparted to samples using a Schonstedt Alternating Field Demagnetizer in a 0.1 T peak alternating field with a 0.1 mT biasing field. It was then measured on the fully-computerized 2-G Cryogenic Superconducting Rock Magnetometer.

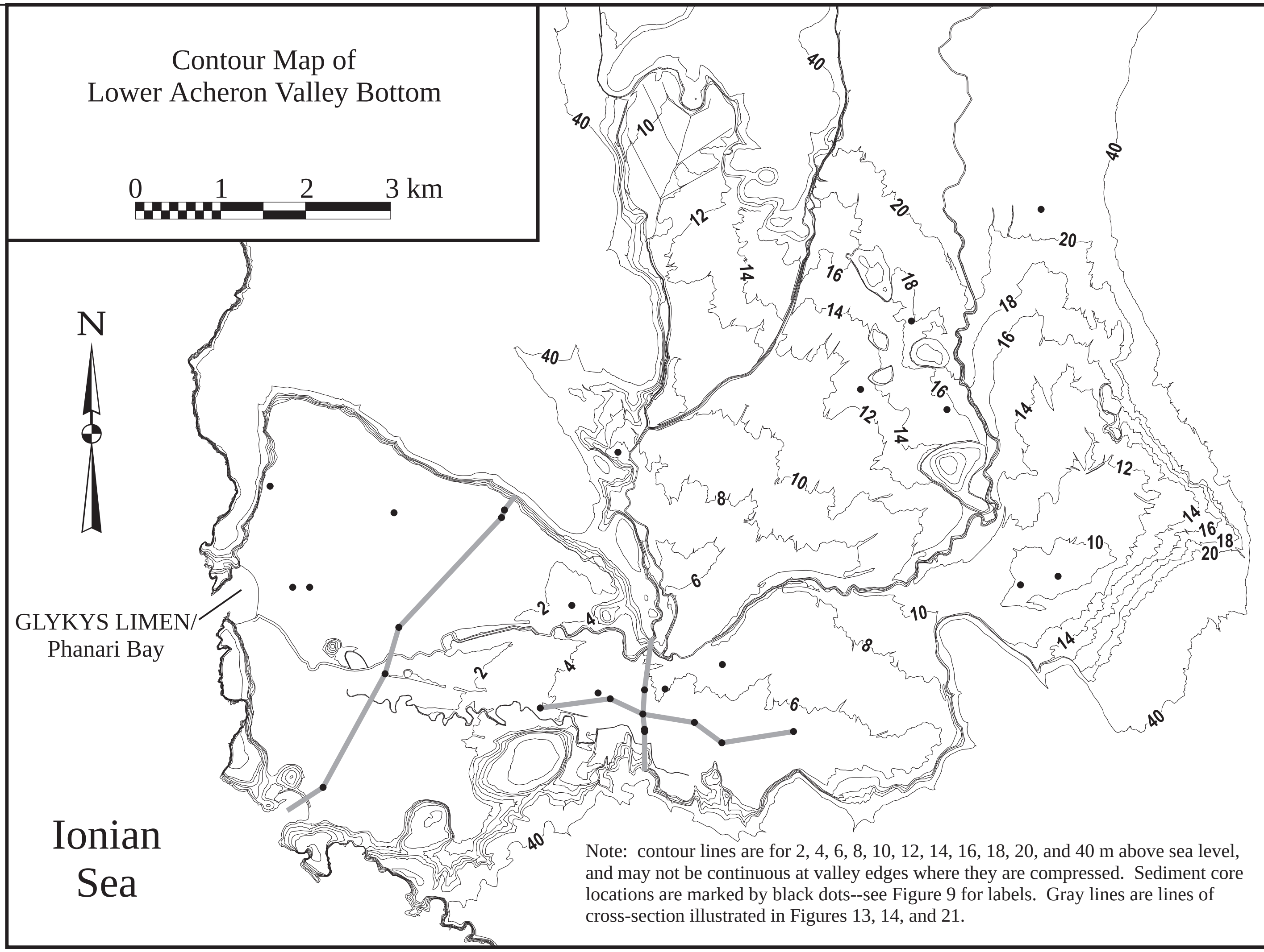

Figure 11--Contour map of lower Acheron Valley bottom

Assuming the Acherousian lake came into existence at some point between 800 and 433 BC as outlined above, then the 5.5 m of fluvial plug material noted in core NC-94-12 which impounded the lake accumulated in approximately the last 2500 years. Subsidence of the lake bottom and sediment compaction can be estimated using core NC-94-23. The base of the brackish water delta top marsh in this core was radiocarbon dated to approximately 4000 BP. Because the tidal range in the region is minimal, it is assumed that the brackish water delta top marsh was deposited at an elevation close to mean sea level. At 4000 BP, relative mean sea level in the region was about two meters less than at present (Figure 6). The brackish water delta top marsh material that was radiocarbon dated was retrieved from 5.25 m below modern sea level. Therefore, the lake bottom has subsided approximately 3.25 m (= 5.25 m - 2 m) in the last 4000 years. Together then, the aggradation of the fluvial plug at the valley constriction (5.5 m), and subsidence of the lake bottom and sediment compaction (3.25 m) have accommodated nearly nine meters (actually 8.75 m = 5.5 m + 3.25 m) of sediment infill into the lake.

Increasing Lake Area Documented by Stratigraphic Onlap of Deposits Upvalley:

Evidence for the initial small size of the lake, followed by the expansion of marshy, swampy ground upvalley can be noted by comparing the stratigraphy in cores NC-94-23 and NC-94-17 with that of core NC-93-22 (Figures 9 and 14). Cores NC-94-23 and NC-94-17 are located just to the east of the fluvial plug in the valley constriction and contain 7.5 m and 5.9 m, respectively, of lacustrine mud and clay from the Acherousian lake (Appendix A). These lake deposits begin at 3.1 m and 1.7 m below sea level, and run to 4.4 m and 4.2 m above sea level, respectively. Core NC-93-22 is located approximately one kilometer east of NC-94-23 and NC-94-17 in the area considered by Dakaris and others to be the ancient lake. However at this locality, a much thinner sequence (3.5 m) of mixed lacustrine and marsh deposits occurs between 1.2 m and 4.7 m above sea level (Appendix A). The lake deposits in the core are underlain by a very stiff floodplain alluvium with some pedogenic development. This package of lacustrine and marshy deposits shows stratigraphic onlap upvalley, and its transgressive nature confirms the gradual increase of lake level through time (Figures 14 and 22). The lake probably floodplain deposit, because it is close to and shorter than the second core, it can be inferred that if it had penetrated further, the lower floodplain deposit noted in the neighboring core would also have been reached fairly quickly.

Recalling that the fluvial plug sediments in the Mesopotamon/Tsouknida valley constriction served as the spillway for the Acherousian lake, deposits from the lake must occur at or below the elevation of the spillway which reached a maximum elevation of approximately five meters above sea level (Figures 13 and 14) near the end of its existence. The lacustrine and marshy deposits in cores NC-94-03 and NC-94-21 occur in an elevational zone between 5.1 and 7.7 meters above sea level. Therefore, the standing water body that deposited these sediments must have had a significantly higher water surface elevation than the Acherousian lake (Figure 23). Consequently, it could not be confluent with the larger lake. This evidence definitively indicates that Dakaris' (1971) extension of the lake east past Kastri and Pountas ridge is incorrect.

Recent Evolution of the Acherousian Lake/Swamp:

By Turkish times, the Acherousian lake had become a swamp with a few isolated pools of water (Hammond, 1967) (Figure 17). Continued growth of the Acheron River channel and levee system split the remains of this swamp. This interpretation is supported by the broad topographic high (Figure 11) of the modern river channel and levee system to the east of Mesopotamon which is delineated by the 6 meter contour.

Leake (1835) provided an excellent summary of the marshy valley bottom from his travels through the region in the spring of AD 1809, and noted that several pools of open water existed at that point (Figure 20). After the First World War, the final marshy remnants of the former Acherousian lake were filled in (Dakaris, 1971), and the area has been used for agriculture since that point.

THE CHANGING COURSE OF THE ACHERON WITH RESPECT TO KASTRI

Instead of providing direct geologic evidence to demonstrate that the Acheron River had shifted its course to the south of Kastri since Classical times, Dakaris (1971) used reverse reasoning to suggest this was the case. His desire to identify the ruins on modern Kastri with those of ancient Pandosia forced him to reconcile the accounts of

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Appendix A--Core Stratigraphy (Including Organic Carbon Content, Microfossil Abundances, and Probable Environments of Deposition)

This appendix contains the sediment core stratigraphy from all field seasons. Width of the core, lithologic patterns, and a "Sediment Type" description reflect the grain size and type of sediment. Organic matter present in the stratigraphy is indicated by one of the symbols in the legend below. Locations of calibrated C-14 AMS dates are indicated by arrows. "Color" (according to the Munsell Soil Color Chart), weight percent of organic matter determined by loss on ignition analysis ("% Organic Matter"), and results of the microfossil analyses ("Microfossils") are included. An explanation of results from the microfossil analyses is found in the legend below, and in the "Qualitative Assessment of Paleosalinity Based on Microfossil Assemblages:" section of the text. The probable "Environment of Deposition" represents the author’s interpretation of the stratigraphy based on all available data.

Symbol	***Explanation***
	common coarse-grained organic matter
	abundant coarse-grained organic matter
( )	few to trace coarse-grained organic matter
	common fine-grained organic matter
( )	abundant fine-grained organic matter
	few to trace fine-grained organic matter
C-14: 4030 +100/-100 BP	calibrated C-14 AMS date in years B.P.
qty. 615: 1.3% F, 91.4% B, 7.3% R	qty. XXX = quantity/total number of freshwater, brackish to marine water, and reworked microfossils in the sample 1.3% F = percentage of freshwater forms in quantity XXX 91.4% B = percentage of brackish to marine water forms in quantity XXX 7.3% R = percentage of reworked microfauna in quantity XXX

Appendix A Table of Contents