LANDSCAPE EVOLUTION IN THE PHILIPPI-DRAMA PLAIN FROM THE NEOLITHIC TO THE OTTOMAN PERIOD [*]

by Laurent Lespez [**]

The following text summarizes the research carried out in Eastern Macedonia from spring 1993 to winter 1999[1], in the context of the Dikili Tash excavations program, which is a collaboration between the French School at Athens and the Archaeological Society at Athens.

The site of Dikili Tash and the Plain of Philippi

The research concentrated at first on the Dikili Tash tell, but was later extended geographically to the whole Philippi plain and the surrounding mountains and chronologically to the entire Holocene period. It was evident that one had to focus on the relationship between the prehistoric settlement and its surroundings in order to determine the human impact on landscape evolution in Eastern Macedonia from the Neolithic period until now. The aim was to trace the landscape changes of the last seven thousand years and demonstrate the phases of balance and rupture in the geosystems. The period under study is characterised by the arrival of farming societies in the environment of this landscape. It was, therefore, particularly important to determine the impact of natural and human factors respectively.

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[*] This is a summary of L. Lespez's chapter *in* Koukouli-Chryssanthaki H., Treuil R. (eds.), *Dikili Tash, village préhistorique de Macédoine orientale. Recherches franco-helléniques dirigées par la Société Archéologique d'Athènes et l'école française d'Athènes (1986-2001), Bibliothèque de la Société Archéologique d'Athènes* n° 254, Athènes (2008), 21-394.

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[1] As part of Laurent Lespez's PhD thesis in Geography, entitled " *L'évolution des modelés et des paysages de la plaine de Drama et de ses bordures montagneuses (Macédoine orientale, Grèce) au cours de l'Holocène" (Evolution of landforms and landscapes of the Drama plain and the surrounding mountains [Eastern Macedonia, Greece] during the Holocene*), supervised by Professor René Neboit-Guilhot and presented on January 15, 1999 at the Blaise Pascal University of Clermont-Ferrand (France). Since then research continued and led to more recent publications that detail some of the results discussed above: particularly in LESPEZ L., Landscape and environmental change since the Neolithic in Eastern Macedonia (Greece). *Proceedings of 6th Pan-Hellenic Geographical Conference*, 3-6 octobre 2002, Vol 1, Aristotle University of Thessaloniki, Ministry of Culture, pp. 131-138 (2002) and LESPEZ L., Geomorphic responses to long-term land use changes in Eastern Macedonia (Greece). *CATENA* 51, 3-4, pp. 181-208 (2003).

The text begins with a presentation of the area under study and the aims and methods of research. The argument is divided into three parts. The first part focuses on the Pleistocene relief and landforms: their place in the catchment area is of chief importance but had never before been studied from a geomorphological or paleoenvironmental point of view. The second part presents the Holocene stratigraphy of the various drainage basins based on field and laboratory research, and the influence of climatic and morphostructural factors on the morphogenetic systems. In the third part we try to determine the role of human societies in the transformation of the landscape and within the function of the morphogenetic systems during the last seven thousand years.

Research methods

In order to analyze the function of the morphogenetic systems and the transformation of the anthropic landscapes, it was necessary to combine geomorphological, paleoenvironmental, geo-archaeological and historical methods. The first studies were geomorphological. To understand the Holocene morphogenetic system we had to study the ancient aggradation cycles. We have been able to define the process and the origin of sediment deposition after much fieldwork, precise stratigraphic chartings and laboratory analysis. To establish chronostratigraphy we relied mostly on archaeological information from various sites, and particularly pottery, because the scarcity of organic sediments and of charcoal limited the use of radiocarbon dating. It has been thus possible to pinpoint the important alluviation episodes and the global evolution of the sedimentary flows in the various drainage basins during the Holocene.

During the last seven thousand years erosion and alluviation have been influenced by both natural and human factors. Paleoenvironmental research is necessary in order to understand the bioclimatic evolution but geo-archaeological and historical methods are essential as well in order to understand land use and land management. Such complicated research requires important financial investments and the collaboration of many experts. We were able to get all these requirements together in the case of the Dikili Tash project. Because of the relative inadequacy of paleoenvironmental data in the plain, particularly from historical periods, we had to

focus on the study of human activities, based on the evidence from settlements and farming activities , whose start goes back at the beginning of Late Neolithic (5500 BC).

We concentrated principally on three periods: Prehistory, Antiquity and the Ottoman period, because during them information is abundant and the morphogenetic evolution can be established with some precision. To examine the evolution of land management during the prehistoric times we started on the local scale of the Dikili Tash settlement and its immediate environment. The scope of the study was expanded to a regional scale: the distribution of the population and the farming activities revealed in other archaeological sites were examined and compared to the natural landscapes in the region. Archaeological information from Antiquity has been enriched by the use of early texts and inscriptions. As for the Ottoman period, abundant additional sources are available: tax records, census reports, travel books, maps and old photographs. All these elements contributed to a global reconstruction of the evolution of the landscape and the conditions under which the morphogenetic systems evolved from the Late Neolithic on.

PART ONE: AN INTRA-MONTANE BASIN IN SOUTHERN RHODOPES

The area of study

The plain of Philippi is in North-Eastern Greece. It is surrounded by mountains, has a roughly elliptic shape and stretches over 80 km in length and 70 km in width. It is situated from 45 to 80 m above sea level and has a sub-Mediterranean climate. A large marsh, the Philippi marsh, covered the southern part of the plain till the 1930s. The plain is enclosed by medium altitude mountain ranges which are part of the crystalline metamorphic bedrock of the Rhodopes. The height of the surrounding mountains of Pangaion, Phalakron, Menoikion, Lekani and Symbolon varies between 600 and 2229 meters above sea level. The region is drained by the Angitis River which rises in the North-Western part of the plain (spring of Maara) before replenishing the water in the ancient Philippi marsh and then flowing into the Strymon River. The lithology of the mountainous massifs consists mainly of marble, gneiss, mica schist and granodiorites. The relief has resulted from alpine, ductile

deformations, whose surfaces were smoothed during the Neogene. The features of the basin have mainly resulted from fault tectonics, mostly active since the Pliocene and throughout the Quaternary.

The Dikili Tash tell is located at the junction of the lower slopes of the Mt Lekani and the former marsh of Philippi. The geomorphological situation is complex: a tongue of the ancient marsh and a small depression at the foot of the tell add to the diversity of the landscape and to the complexity of its evolution.

Incision and shaping of an intra-montane drainage basin

It turned out that it was necessary to broaden the scope of the study and devote part of our research to the Pleistocene relief and landforms, which had never before been studied closely. The piedmont zone was formed during the Upper Pleistocene and the arrangement of the main valleys was set in motion by the dissection of detrital formations towards the end of the Middle Pleistocene. There is sharp contrast between the long slopes deeply cut through by imposing valleys on the northern part of the drainage basin, and the shorter piedmonts cut by small inter-cones bordering the southern part. This asymmetry can be explained by the progressive southward migration of the subsidence throughout the Pleistocene era. This provoked the early onset of incision at the northern part of the basin from the middle Pleistocene on, and the continuation of piedmont formation on the south till the Würm glaciation. The details of topography are even more complicated because neotectonics has affected the Middle Pleistocene detrital layers and has disturbed the development of incisions. For the last two million years, tectonic forces have determined the principal trends of the morphogenetic process and thus the deposition of the great detrital layers and the development of the major incisions. The paleoenvironmental changes of the Quaternary influenced the pace of the morphogenetic systems in a more subtle manner. The relief that formed the living environment of the first Neolithic farmers who settled in the area came into being from these processes.

PART TWO: MORPHOGENESIS DURING THE HOLOCENE

The cycles of morphogenesis during the Holocene

The study of the Holocene morphogenesis shows the continuation of the major geomorphological trends, which started since the end of the Middle Pleistocene. In the bordering mountains the erosion and incision of the relief and landforms continued, while detrital layers moved in to fill in the centre of the depression. However, during the second part of the Holocene things changed fundamentally: the sediment deposition rates in the centre of the Drama basin has doubled since the end of Bronze Age (0.5 à 0.6 mm. an^{-1}) compared to the average rate during the Holocene (±0.25 mm. an^{-1}) or during the Würm glaciation, the last cold period of the Pleistocene (± 0.3 mm. an^{-1}). Even though there are still a few doubts because of the inaccuracy of chronological correlations and the lack of information from certain areas, we can now point out the principal stages of morphogenesis since the Neolithic Age.

No substantial alluvial infill has occurred during the first part of the Holocene. Incision dynamics were predominant. Moderate aggradation, which favoured pedogenesis, has been observed only in the lower valleys of the most important watercourses, like that of the Angitis River. The first traces of soil erosion and aggradation appear from the Late Bronze Age in the alluvial fan of Krenides, in the vicinity of Dikili Tash, and in the larger fan of the Xeropotamos River. However, the first real accumulation starts during the 4th century BC. Therefore there has been no noteworthy aggradation before Antiquity.

The first major aggradation event occurred in most of the drainage basins during Antiquity or at the beginning of the Byzantine Era. Large quantities of detrital material filled the larger and smaller valleys, apparently as a result of major soil erosion upstream. Those first alluvial deposits appear much later than in other regions of Greece. The second major accumulation recorded in all catchments is the result of recent erosion, which started during the Ottoman period (from the 15th century on) and continued until the beginning of the 20th century. This accumulation triggered the deposition of coarse sediments about 1 m thick or more into the fluvial channels and of overbank silt in the flood plains.

Bioclimatic and morphogenetic factors of the Holocene geomorphic system

Despite the fact that some major depositional episodes have been identified and seem to be common in all drainage basins, the variety of the sediments within the same bioclimatic context coming from similar geological surroundings proves the diversity of the local morphogenetic systems. In the area of the Drama catchment and of the surrounding mountains, the morphology and the size of the drainage basins, along with the fragility of the superficial landforms, which are naturally prone to erosion, are partly responsible for the nature and the volume of the deposition. The type of flows is very important as well. The fairly thin alluvium deposit and the persistent incision forces in the lower course of the Drama River contrast with the strong aggradation and overbank flows on the alluvial fan of the Xeropotamos. The karst regime of the Drama River generates perennial flows, which can carry away the newly deposited fine sediments as soon as the floods are over. In contrast the torrential character of the Xeropotamos limits re-incision. During every flood the flows carry away some sediment but as the flows run out quickly, the removal of the sediments is limited and the re-incision even more so. Because of the hydrological and morphological differences it is difficult to compare the various catchments and to establish a global chronostratigraphy of the region. As a whole, research in the Drama plain and its borders confirms the chronological diversity of the Holocene deposits in the area of Greece and also the fact that it is extremely difficult to compare the chronostratigraphy of the various regions because of the differences between the local morphogenetic systems, scale effects and the remaining chronological imprecisions.

Climate change must be taken into account for both major aggradation episodes recorded in the area under study. Based on the thin alluvial deposits observed in most drainage basins during the Hellenistic and Roman period, it has been possible to demonstrate an increase of flood flows at the end of the Roman and during the Early Christian period, particularly in the Xeropotamos valley. This seems to be the cause of the abundant sedimentation during the historical period in this particular catchment. It must have been contemporary to a colder and more humid climate oscillation attested in many European regions.

During the Ottoman period flood flows became more frequent and abundant as suggested by the frequent overbank flows and the significant increase of the

volume and the size of sediments in flood plains. This observation could be related to the changes observed in many areas of the northern Mediterranean coast in the context of the climate changes during the Little Ice Age.

PART THREE: THE IMPORTANT ROLE OF HUMAN SOCIETIES IN LANDSCAPE EVOLUTION AND THE MORPHOGENETIC SYSTEMS FOR THE LAST 7 000 YEARS

The impact of human societies on the metamorphosis of the landscapes and their role in the function of the morphogenetic systems has been examined as thoroughly as possible.

The prehistoric societies and their environment

The paleoenvironmental investigations around the Dikili Tash tell reveal the specificities of the settlement and its relationship to the local environment. It comes out that the tell is situated on a detritic piedmont of the Pleistocene era. This situation is quite common to many contemporaneous settlements in the plain, and in Eastern Macedonia in general. However three geographical advantages contributed to the development and the longevity of Dikili Tash. The proximity of one of the most important exsurgences of the Drama plain provided the inhabitants with a permanent source of good quality water. The Neolithic and Bronze Age populations had a wide range of land at their disposal: the damp marshy plain, the deep soil of the smooth lower slopes and the thin soil of the steep mountain slopes. They could put them in good use for all their farming and gathering activities (hunting, fishing, picking, collecting material for building clay…). As time passed, the defensive assets of the site became stronger and constituted a definite advantage during the Late Bronze Age.

Local palynological investigations have shown that the activity of the first shepherds and farmers contributed to the deterioration of the natural vegetation as early as the Late Neolithic and the Bronze Age. This means that the prehistoric people lived at Dikili Tash in an open environment, though not far away there still remained a significant forest cover. Palynological analyses in the Philippi marsh show that the first woodland clearances of the Neolithic and Bronze Age probably

did not last long and were confined to small areas. What is more, they were concentrated in the lower parts of the basin and on the fairly clayey soils, which are not prone to erosion. This is probably why the impact of these clearances on the morphogenetic systems is limited and the initial agricultural use of the land does not seem to have triggered any severe aggradation in the Drama plain, in contrast to many other Greek areas. During the Late Bronze Age however, the population moved uphill. The more fragile soils on the apical parts of the great detrital cones and on the lower slopes of the surrounding mountains were cleared and put to use. Here the regeneration of vegetation was more difficult and the exploited cultivated soils eroded more easily. The first traces of colluvium and alluvium observed around the Dikili Tash site and in other catchments, for example the Xeropotamos catchment, date from this period. Therefore it seems that the change in the landscapes and the morphogenetic system from the Neolithic to the Bronze Age is more due to the location of the population than to its size.

The changes in the landscape and the environment during the last two millennia

Eastern Macedonia was densely populated from Antiquity: to the first Thracian population were added Greek tribes who settled in the coastal areas, followed by Macedonian and later on Roman colonies. A combination of historical and archaeological evidence shows that almost the entire depression area was already used for farming since Antiquity. According to historical accounts, cereals and vines occupied the largest part of the cultivable space, except for the marshy areas. Progressive clearance in the foothills and the lower slopes of the surrounding mountains occurred and apparently aggravated the erosion of the most fragile soils formed on the Pleistocene detrital cones and on the Neogene shale. However, the majority of sedimentation seems to have occurred from the end of the Roman period, except perhaps in the Angitis valley. So there does not seem to be any simple and direct connection between the alluvial aggradation observed into the larger and smaller valleys and the increase of land use. Human activities and particularly increased clearance are not enough to explain the development of abundant alluvial deposition. The same seems to be true for the undoubtedly marked rural decline during the Early Christian period. The abandonment of hydraulic structures or

ancient agricultural terraces upstream could have triggered increased erosion, but no such traces have been found. It seems that the first alluvial aggradation recorded in most catchments has a complex explanation and this means that the direct consequences of human actions on the function of the morphogenetic system are limited. It also shows the influence of hydro-climatic oscillations on alluvial cycles.

Information from the Ottoman period is more precise and abundant. Land use in the plain and the bordering mountains is intensified. The foothills, the mountains and the central humid parts of the basin are put to use. The opening up of the Ottoman economy to international markets generated the development of commercial agriculture and favoured various kinds of cultivation: those adapted to the humid environment in the centre of the depression (rice, cotton and corn) and those suitable for the cramped plots of the mountainous valleys (tobacco). Upstream of the catchments, in the surrounding mountains, the population increased and so did agro-pastoral activities. All this triggered major changes in the landscape. The loss of vegetation cover was very advanced and apparently favoured soil erosion and runoff. Downstream the exploitation of wet environments was not paired to flow control and thus facilitated overbanking, which was undoubtedly stimulated by an age-long climate oscillation. Growing human pressure on the environment at the end of the 19th century and the beginning of the 20th seems to be the cause of abundant aggradation and flow instability in the principal water courses of the Drama plain.

During the last millennia the expansion of land use upstream seems to have seriously influenced the rate of landscape evolution and the Holocene morphogenesis. Human intervention has thus played a key part within the morphogenetic systems of the Drama plain and the surrounding mountains. It must be pointed out however, that the most serious and best known aggradation seems to be related to the concurrence of hydro-climatic events and the increase of land use in upstream areas.

CONCLUSIONS: THE COMPLEXITY OF THE HOLOCENE ENVIRONMENTAL DYNAMICS IN GREECE

The study of the Drama basin and the surrounding mountains underlines both the resilience in environmental systems and the complex functioning of morphogenetic systems. In the Philippi plain about 3000 years passed from the beginning of human settlement until the first changes in local vegetation and almost another 2000 years elapsed from the extended clearances till the first abundant aggradation can be recorded downstream. There is a considerable latent period between the actions of human societies and their consequences on the environment. However, human activity seems to have crossed a threshold during Antiquity and suddenly, from that point on, the impact of hydro-climatic events on the morphogenetic systems seems to have multiplied to a point never reached before.

Close examination also calls attention to the importance of spatial and temporal connections. During the last centuries the changes in the Xeropotamos river bed and the accumulation on the alluvial fan was undoubtedly aggravated by the parallel activity of human societies and climatic conditions. In contrast it seems that the first major erosive phase recorded in the Xeropotamos catchment proves a discrepancy between an ancient phase of slope erosion, which was clearly due to human interference, and a deposition that took place later on downstream and was due to exceptional hydro-climatic events. In this case there would be an indisputable connection between slope destabilization, which is a slow and progressive phenomenon, and the undoubtedly shorter but more powerful increase in flood magnitude. Understanding this connection seems to be crucial because it is the reason for the chronological discrepancy between human activity and the accumulation of coarse sediment downstream. It also plays a very important role in the catchments of the seasonal Mediterranean streams, the morphology of which is deeply influenced by extreme climatic events. Understanding the storage and transfer patterns is probably one of the keys to understanding the chronological heterogeneity of the severe aggradations recorded in the Aegean.

The history of landscape in the Drama plain and the mountains around it reveals the increasing impact of human societies on the evolution of the environment. It demonstrates the importance of scalar levels in the transformation of the

environment and shows thus that research into human societies and their environment on the micro-scale is the only way to understand the strong connection between the everyday actions of humans and the transformation of their environment. However, in order to be complete, this research must be extended to a regional level and to a study of the impact of larger social groups on the landscape.