

# EVALUATION OF THE ENVIRONMENTAL CONDITIONS OF THE NEA PAPHOS LOCATION IN CYPRUS (IV BC - IV AD) IN THE LIGHT OF PHYSICO-GEOGRAPHICAL MAPPING OF GEOSYSTEMS

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## Abstract

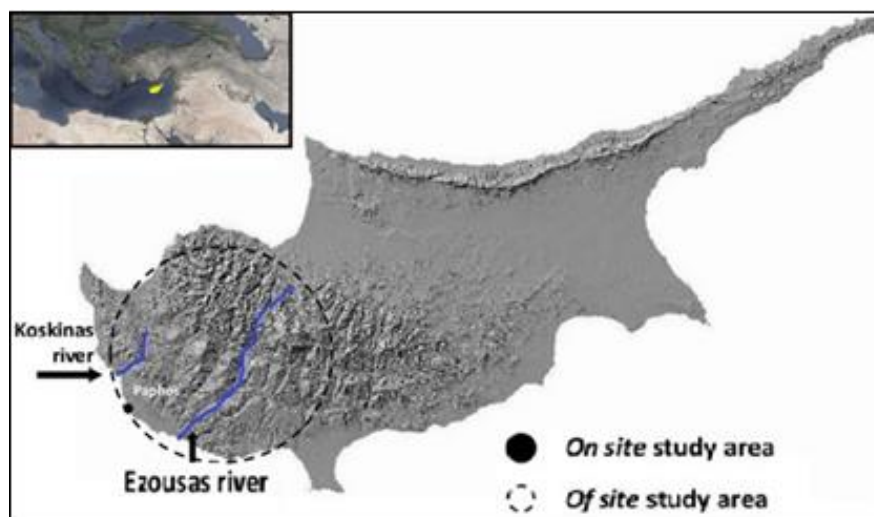
In 2014-2019, geoarchaeological research of the ancient city Nea Paphos and the Paphos region (SW Cyprus) was carried out. One of the aims was to determine the environmental factors for the location and functioning of this city in the period from 4th BC to 4th AD. Based on the field survey and thematic maps, physico-geographical mapping of geosystems of various orders was carried out. Next typology and regionalization were carried out on two levels: geocomplexes (“uroczysko”) and landscapes (terrains). The separated geocomplexes were grouped into 162 subtypes and 13 types, and then five landscapes were grouped into two types. As a result of the evaluation of separated landscapes, the landscape 1 - the lowest uplifted marine terrace is the most suitable for ancient Nea Paphos settlement. It is characterized by high heterogeneity, a relatively high presence of valleys (15%), the presence of monadnocks and rock walls (quarries) and the presence of sandy clay soils (pottery). In the light of geographical analyzes, it seems that during the location of the ancient Nea Paphos, environmental factors were not as important as economic and political conditions.

**Keywords:** Cyprus, Paphos, geosystems, geocomplexes, landscapes.

## INTRODUCTION

Paphos region is located on Cyprus which is situated in the eastern part of the Mediterranean Sea, in the Mediterranean zone (Fig. 1). The studies are focus on interaction between human and environment in this region. So far, research has been related only to the generally understood

natural environment or archaeological works. Settlement in coastal areas of the Mediterranean Sea is mainly related to geology, tectonics, sea level changes, tsunami threats, climate change and land use.



**Figure 1.** Map of Cyprus and Paphos region

## STATE OF RESEARCH

There are no so many synthetic geoarchaeological studies of the Mediterranean area. There are two works that deal with the subject of geoarchaeology of the Paphos region. They include, among others, dissertation on the Quaternary marine terraces in Cyprus [1]. The author has conducted a series of environmental studies, some of which concerned the most important archaeological sites in Cyprus. The influence of environmental factors on the establishment of settlement in the Prehistoric and ancient periods in Cyprus was also presented in

## AIM OF STUDY AND METHODS

The research was conducted in 2014-2018 [4], [5], [6]. One of the aims was to determine the environmental factors for the location and functioning of this city in the period from 4th BC to 4th AD. Based on the field survey and thematic maps, the physico-geographical mapping of geosystems of various orders was carried out. The geological structure, Quaternary cover, relief, slope, surface and groundwater, soil, vegetation and

the work of Deckers [2], where geomorphological processes were taken into account in the context of selected archaeological sites. The paleoclimatic situation in the eastern part of the Mediterranean was presented by Issar [3], who indicated that from around the 3rd century BC until about the 3rd century A.D., the Levant area initially had a cooler and wetter climate with annual precipitation of more than 500 mm, and in the first centuries of present era the climate changed to more dry (precipitation dropped about 50 mm).

morphogenetic processes were taken into account as the separation criterion [7]. Then, typology and regionalization were carried out on two levels: geocomplexes (“uroczyska” in Polish) and landscapes (“terrain” in Polish). The separated geocomplexes was grouped into 13 types and 162 subtypes (Fig. 2A). Subsequently, five terrains were separated, grouped into two types (Fig. 2B).

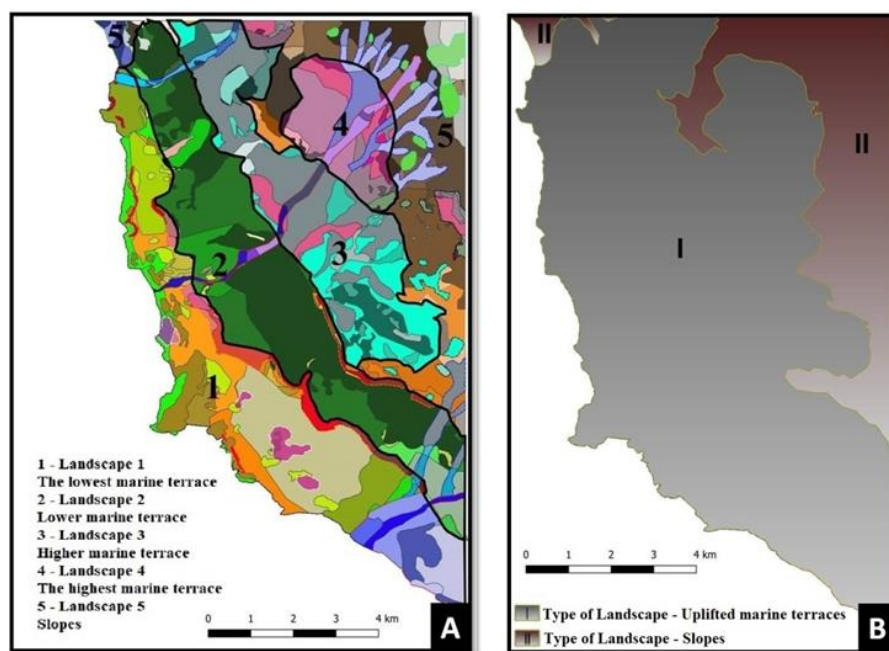


Figure 2. A: Map of geocomplex types (“typ uroczyska”) and landscapes (“terrains”), B: Map of landscapes types

## RESULTS

The bonitation of the five designated areas was developed for different directions of their potential use by ancient communities as: residential area of the ancient city of Nea Paphos, economic area (ancient agora market), the area of sacred places, such as the royal necropolis and temples, cultural areas (theater and odeon - musical theater), areas with other functions, such as harbour and haven, areas of exploitation of rock and mineral resources (rock mining and mineral), craft areas (pottery),

agricultural areas (cultivation and breeding) (Table 1) [8].

The valuation scale was divided into three stages and described the conditions as bad (1), medium (3) and good (5).

More than 40% of the sum of valuation points is concentrated in landscape 1 (Table 1, Fig. 3). It shows great heterogeneity, as there are numerous subtypes of geocomplexes, which consist of one or two individual geosystems. It proves it with a large

physic-geographic diversity of this area and at the same time offers various possibilities of its use. Valley geosystems cover only 15% of the area, but due to the presence of watercourses, they play a very important role in its functioning. In landscape 1, there are also incidental outliers and rock walls constituting outcrops of older rocks that could have

been used in ancient times as areas for obtaining building material (quarries). In addition, in landscape 1, in the valleys of periodic watercourses and on fluvial terraces, there are soils containing sandy clays (Mora soils) which could be a raw material for pottery production [1], [8].

Table 1. Bonitation of geocomplexes

	Residential area (Nea Paphos)	Economic area (agora)	The area of sacred places (royal necropolis and temples)	Theatre, Odeon	Other (harbour, haven)	Rock mining (quarries)	Mineral mining	Craft area (pottery)	Agriculture area (cultivation)	Agriculture area (breeding)	Sum	Sum %
Landscape 1	5	5	5	5	5	5	1	5	5	5	46	41
Landscape 2	5	1	1	1	1	3	1	1	3	3	22	20
Landscape 3	3	1	1	1	1	3	1	1	1	1	14	12
Landscape 4	1	1	1	1	1	3	1	1	1	1	12	11
Landscape 5	1	1	1	1	1	1	1	1	5	5	18	16
Sum	15	9	9	9	9	17	5	9	15	15	112	100

Similar structure and heterogeneity as landscape 1 is shown in landscape 2. Relatively small rock walls (16%) may suggest that this area was also used in the past to obtain building material.

Valley geosystems cover only 8% of this area. The occurrence of episodic and periodic watercourses here probably played a smaller role in the founding of the city in antiquity than in landscape 1.

The soils that contain clay are also found in landscape 2 (Foinikas soils), [1], [8]. As a result of the value assessment, area 2 has 20% of the sum of valuation points (Table 1, Fig. 3). In the landscape 3, geosystems of valleys cover 7% of the total area.

The presence of a greater in the landscape 4, the valley geosystems cover only 6% of the area, however, due to the relatively large area of periodic watercourses (4%), both types may have played a role in the functioning of the area in antiquity. There are also small areas with clay soil (Foinikas soils), [1], [8].

Nevertheless, the lack of other, useful environmental values means that the sum of the valuation points is only 11% (Table 1, Fig. 3). In the landscape 5, the valley geosystems cover 16% of the area. However, due to the presence of a large number of episodic watercourses (10%) here, it

could not have played a major role in establishing the city. In site 5, there are also occasional clay soils (Foinkas soils), [1], [8]. In this landscape (slopes),

16% of the total valuation points are recorded (Table 1, Fig. 3).

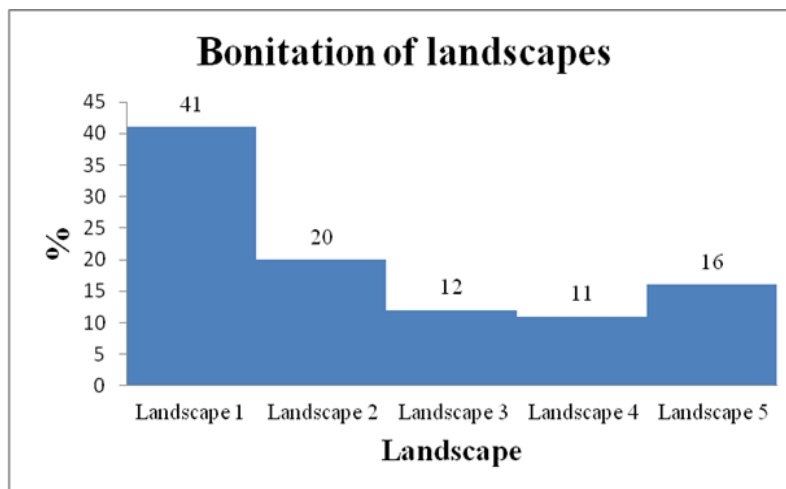


Figure 3. Bonitation of landscapes

The entire research area is poor in watercourses, the geosystems of which do not exceed 16% of the area's surface. In the landscape 1 and 5 there is also a geocomplex type of fluvial terraces, where groundwater may appear relatively shallow. They are relatively easily accessible to humans and therefore can be used for settlement purposes.

## DISCUSSIONS

The results of the research allowed to reconstruct the Quaternary evolution of the Paphos region (off-site area), conditioned by neotectonic movements and climate change, and to determine the state of the environment at the time the area was inhabited by the builders of Nea Paphos ("zero point", "on site" area). Cyprus owes its uniqueness to the well-preserved ophiolite complex, which, together with the cleared watercourses of the core and the coastal neotectonic activity of the Cypriot arc, causes a dynamic evolution of the environment and landscape. Along with regular, the Quaternary Sea level changes and permanent uplift, it created the features of coastal relief in the form of marine and fluvial terraces.

The survey shows that landscapes 1 and 2 (67% of the uplifted marine terraces) have all the best environmental factors necessary for the location and functioning of the city in antiquity.

In landscape 3 and 4, the area of episodic watercourse geosystems is clearly growing at the expense of periodic ones. This can cause specific problems in the water supply and thus in the agricultural and livestock activities. Therefore, these are areas less attractive to locate a city. However, as the cities developed, they could also serve as places from which access to mountain areas, where mineral mines operated, was much

All areas have carbonate soils containing over 40% calcium carbonate. These are generally fertile soils, but difficult to cultivate due to their low thickness and rocky ground. Moreover, large areas of terra rossa occurrence, which are associated with carbonate outcrops, may hinder agriculture.

easier. Landscape 5 is the area with the lowest number of periodic watercourses (2%) and the highest number of episodic watercourses (10%). Poor access to water and relatively steep slopes (approx. 20°) make it the least favorable area for settlement.

Taking into account all these factors, it is possible to consider landscape 1 and 2 as ecumene (61% of valuation points), landscape 3 and 4 as subecumene (23% of valuation points), and landscape 5 as anecumene of the so-called badlands (16% of valuation points) [8]. Ancient Nea Paphos was located on the uplifted marine terrace MIS 5-7 in the area of landscape geosystem 1 - the lowest marine terrace. In terms of geological structure, it is located on the sediments of marine terraces with episodic and periodic surface waters and underground karst waters. The absolute altitude is 0-55 m, and the slope is approx. 0-2°.

The area is characterized by carbonate lithosols and terra rossa weathering cover. The secular morphogenetic processes include physical and chemical weathering, karst, rockfall on cliffs, periodic and episodic surface and linear wash, fluvial erosion and accumulation, marine abrasion, and anthropogenic processes. However catastrophic processes caused by earthquakes as landslides and tsunami also occurred. This

geosystem is quite heterogenic, which proves its great diversity. The ancient city was built on the original ground with Holocene soil in the top, without leveling works and with the use of natural relief.

The TL dating of weathering cover on limestone below the anthropogenic layers gave the result of  $6.7 \pm 1.01$  ka. The location of Nea Paphos on the trade routes from Egypt and Asia Minor to Greece and Italy is undoubtedly the main factor that determined the founding and functioning of the city. The period of its operation dates from the 4th century BC to the 4th century AD, when the eastern part of the Mediterranean basin was heavily influenced by the Ptolemaic rule.

They were the ones who decided to establish the city in a convenient place due to the bay, which was a natural port and about the directions of trade. Apart from political factors and geographical location, the environmental conditions of landscape 1 ensured that Nea Paphos could be built and operated for many centuries. These conditions included:

1. availability of water, conditioned by the existence of periodic watercourses, deep karst groundwater on whole area and shallow groundwater on river terraces,
2. the presence of soils suitable for cultivation and breeding in fluvial terraces,
3. outcrops of rocks in old cliffs that could have served as quarries for the exploitation of building material,
4. a gentle slope and plains of uplifted marine terraces, on which it is relatively easy to build residential and other buildings related to the proper functioning of the city,
5. large physic-geographic diversity of the area,
6. shores of the coast with the possibility of locating a port.

The environmental conditions of landscape 1, compared to the rest of the studied area, proved to be another factor that, on the one hand, allowed for its existence and development, and on the other hand, caused its fall (earthquakes in 342 AD and 394 AD).

## CONCLUSIONS

Analysis of environmental factors that may have influenced the location and the functioning of the ancient city of Nea Paphos in the period IV BC - IV AD, showed that landscape type I is the most favorable in this respect, and within it landscape 1. It is possible to consider landscape 1 and 2 as ecumene, landscape 3 and 4 as subecumene, and

landscape 5 as anecumene of the so-called badlands. However, in the light of physic-geographical analyzes, it seems that during the location of the ancient Nea Paphos, environmental factors were not as important as economic and political conditions.

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