The Mediterraneanization of Crimea

Physical and cultural processes in landscape transformation

Carlos E. Cordova

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La « méditerranéisation » de la Crimée, transformations physiques et culturelles des paysages

Abstract – The southern coast of Crimea has been recognized in the biogeographic literature as a Sub-Mediterranean vegetation territory. This recognition stems from the presence of Mediterranean plant taxa despite its relatively high latitude (43° 23’ 11” and 46° 10’ 26” N) and geographic separation from the Mediterranean biome. The evolution of the Sub-Mediterranean landscapes of southern Crimea involves a series of physical and cultural processes that over several millennia in the middle and late Holocene have interacted to provide this region with a Mediterranean character. This millennium-scale interaction is here referred to as the Mediterraneanization of Crimea. In this paper the two components, physical and cultural Mediterraneanization, are outlined and discussed.

Key-words: Biogeography, Palynology, Crimea, Black sea, Holocene

Although located in an area outside the Mediterranean region, the vegetation of the southern Crimean coast has been associated with the Mediterranean biome. But because of its geographic separation from the core Mediterranean region, southern Crimea has been identified as an exclave of Mediterranean vegetation along with other regions in the Caucasus (Gratsianskiy, 1971; Walter, 1974; Didukh et al., 1990) or as a Sub-Mediterranean biogeographic territory (Rikli, 1943; Walter, 1974; Yena, 1978; Didukh, 1992). The presence, and relative abundance, of Mediterranean floristic elements in Crimea depends primarily on a relatively mild winter and a relatively short, but substantially dry summer season (Douguedroit and Zimina, 1987; Cordova, 2007).

For palaeoecologists and biogeographers the question surrounding the Mediterranean flora and vegetation of southern Crimea has generated a great deal of interest and debate. The main question is when and how the Mediterranean flora and its communities became established in Crimea. Since the first studies of flora by 18th and 19th century naturalists, it has been believed that the Mediterranean floristic elements of Crimea were introduced by ancient Greeks and other settlers from Mediterranean lands, an idea that remained unchallenged until early ideas on connections between the Crimean and Mediterranean flora in the “deep” past began to appear in the 20th century (e.g., Vul’f, 1926 and 1944; Malayev, 1948; Grosset, 1979). Later on, studies involving the modern distributions of taxa (Vodop’yanova, 1986; Yena et al., 2005) and pollen (Cordova and Lehman, 2005) have revealed a complex process involving biogeographic processes, some of which were related to climatic and sea-level changes and some even aided by human intervention (Cordova, 2007 and 2016). Furthermore, the complexity of physical variables and their cultural counterparts go beyond the studies of vegetation. It is thus the objective of this paper to define physical and cultural Mediterraneanization in order to create a framework to understand the formation of the “Mediterranean” character of the Crimean landscapes.

I - Study area

The Crimean Peninsula is located between latitudes 43° 23’ 11” and 46° 10’ 26” N. It occupies an area of about 27,000 km². The territory of Crimea comprises three physiographic regions: the mountains, the piedmont, and the plains. The mountains and piedmont are formed by a series of folded and faulted sedimentary rocks spanning the late Triassic to the Palaeogene. Volcanic rocks of middle and late Jurassic age are interbedded in the sedimentary rock. The plains are formed by sedimentary rocks and sediments that infill a tectonic basin separating the mountains in the south and the Eurasian mainland in the north. The top of the sediment sequence comprises alluvial and aeolian (mostly loess) deposits.

The mountains of Crimea have an asymmetric shape; their southern slopes are steep, dropping from about 1,200 meters to sea level; their northern slopes are gentler and separated only by two sets of cuestas. This asymmetry influences the hydrology of the mountains. The streams draining the southern slopes are mainly small mountain torrents, while those draining the northern slopes have larger catchments and carry larger water volumes that drain along river channels in the northern plains.

The asymmetry and orientation of the mountains also influence climate and vegetation (Fig. 1). On the northern slopes, vegetation types from the plains to the highest
Soil parts of the mountains include steppe, forest-steppe, and broadleaf forests. The latter vegetation type presents altitudinal belts of oak-oriental hornbeam, oak-hornbeam, and beech hornbeam forests. The top of the mountains is a treeless landscape known as the Yaila (summer pasture in Turkish languages). The southern slopes have different vegetation belts from those on the northern side. The lowest belt from sea level to 300 m is dominated by the Sub-Mediterranean shrublands and woodlands, and the highest belts are dominated by mixed broadleaf-pine forests and pine forests.

Fig. 1 – Crimea vegetation zones, climographs for three localities, and the distribution of three Mediterranean taxa – Cordova et al., 2011 and Cordova, 2016.

Soils in Crimea respond to topography, geology, and the distribution of vegetation, and to some extent to long-term land use (DRAGAN, 2004; CORDOVA and LEHMAN, 2005; LISETSKII et al., 2012). The plains sustain mainly steppe soils such as chernozem (black earth) in the south and center and castanozem (chestnut soils) in the north. The areas in the north, around the Sivash lagoon, are characterized by salinized soils of the solonchak type. The high productivity of the chernozem and castanozem soils was for a long time not exploited due to the low and highly variable rainfall in the plains. But with the opening of the North Crimean Canal, which brings water from the Dnieper River, vast areas of the plains have been opened to cultivation since the early 1960s. This process occurred as part of Nikita Khrushchev’s Virgin Land Campaign, which in the Crimean plains resulted in the destruction of most of the steppe vegetation.

2 - Climate and vegetation of southern Crimea

Temperature and precipitation vary considerably across the Crimean Peninsula. There is a strong gradient of precipitation between the plains and the mountains (Fig. 2). Temperatures tend to be more extreme in the plains than in the mountains and the south coast. The higher parts of the mountains receive the largest amounts of precipitation, in some places over 1,000 mm a year and temperatures are extremely low in winter; snow can remain on the ground for three months on the Yaila. The northern and southern low areas of the mountains have very different climatic patterns as can be seen in the disparities between Simferopol and Yalta (Fig. 1). The northern parts, that is to say the piedmont, have cold and relatively dry winters and hot, but sometimes wet summers. In contrast, winter temperatures on the lower areas south of the mountains tend to be lower than in the rest of the peninsula. It is in this area where most of the Mediterranean taxa are concentrated (Fig. 1).
Fig. 2 – Crimea: Topography and climatic variables – Cordova, 2016.
Although the climate of southern Crimea is classified as temperate with rains all year (corresponding to Cfb in Köppen's climatic classification), the narrow coastal area south of the mountains and southwest of the Peninsula is often referred to as Sub-Mediterranean (DIDUKH et al., 1990). Two aspects of the south coast’s climate support this idea: the relatively high winter temperatures in the south in relation to the north and the relatively maximum amounts of precipitation in winter (Fig. 2). But whether this is a true Mediterranean climate and whether vegetation communities can be classified as Mediterranean is a matter of debate.

To test the similarities between the Mediterranean climate and that of southern Crimea, A. DOUGUEDROIT and R.P. ZIMINA (1987) compared temperature and precipitation parameters between southern France and southern Crimea. The test showed that in essence there is no Mediterranean climate in Crimea because winters are slightly colder and the summers rainier than the Mediterranean coastal regions of Europe. It is obvious that the maximum of precipitation is not quite in winter, but autumn-winter; the peak occurs between November and December (Fig. 1; Yalta climograph).

Furthermore, due to its high latitude, the causes of a relatively wet cold season and dry warm season in Crimea are not caused by the same climatic factors that cause the true Mediterranean climate. I.P. VYED’ (2000) points out that the relatively mild winter of southern Crimea is due to the protective effect of the mountains against cold air incursions from the north. Additionally, the interaction between cold temperatures and the relatively warm waters of the Black Sea tends to produce a large amount of rain in autumn and winter (VYED’, 2000). Interestingly, however, the mountains protect the south coast from convective and orographic rain storms that originate to the north of the mountains, which results in a relatively dry summer. In the end, the climate of the area between Sevastopol and Sudak tends to be characterized by three aspects: relatively dry summers, relatively mild winters, and conspicuously wetter late autumns and winters. Given these climatic characteristics, the southern Crimean coast is able to sustain those Mediterranean floristic elements that can tolerate winter temperatures lower than in the Mediterranean biome.

Many of the Mediterranean plant species have the northernmost limit of their distribution in Crimea, as is the case of Pistacia mutica, Juniperus oxycedrus, Arbutus andrachne, Cistus tauricus, and Pyracantha coccinea, among others (VODOPIANOVA, 1986). In fact, Pistacia mutica (blunthead pistachio) is perhaps the one that marks that area with mild winter temperatures and autumn-winter rainfall (CORDOVA, 2007). The distribution of each of the Mediterranean elements varies; some occupy restricted areas along the south coast (Fig. 1). While Arbutus andrachne (strawberry tree or madrone) is more restricted to the warmest areas of the south coast between Cape Aya and Yalta or in protected canyons in the western piedmont, Pistacia mutica extends outside the more protected areas of the south coast, mainly in the southwestern part of the piedmont. Pinus brutia var. pityusa (locally known as Stankiewicz’s pine) is even more restricted to small enclaves, although it is possible that in the past this species may have occupied larger areas along the south coast.

It is not clear whether the native Mediterranean species in Crimea are post-glacial immigrants or relicts that have survived the cold phases of the Pleistocene in glacial refugia. These refugia, if they truly existed, may have been protected valleys on the south coast, now under water, where conditions were warmer. The lack of continuous pollen diagrams during the Pleistocene in areas south of the mountains is a problem for supporting this hypothesis.

It has been hypothesized that many of the Mediterranean floristic elements of Crimea may have been present in this region since the relatively warm periods of the Miocene and Pliocene (DIDUKH, 1992). However, Miocene and Pliocene pollen diagrams from southern Crimea show a variety of subtropical plants that are today found in Georgia, northeastern Turkey, and northern Iran, but not particularly those found today in the Mediterranean region (see CORDOVA, 2016). One exception, however, is Pinus brutia var. pityusa, which is related to other Pinus brutia varieties on the western Caucasus coast and Turkey (YENA et al., 2005). Thus, the distribution of these pine varieties and their genetic diversity suggests perhaps a geological or climatic disjunction that may be related to survival in refugia.

Inferences based on distribution, and changes in sea level and currents in the Black Sea, suggest that some of the species are more recent immigrants, whose arrival in Crimea occurred in post-glacial times (GROSSET, 1979; YENA et al., 2005; CORDOVA, 2007). However, these inferences do not completely reject the idea that some species that had been in Crimea longer survived the glacial phases of local warm refugia, or that some species intermittently retreated south during glacial and repopulated the Crimean south coast during interglacials. Perhaps DNA studies may help to shed light on which species have had a longer stay in Crimea and which ones arrived in the Holocene.

Many other Mediterranean plant species were introduced deliberately by humans in more recent times. Several of these species have already been naturalized and grow among the natural vegetation (see CORDOVA, 2016). Although many of the non-native species were introduced after the foundation of the Nikistky Botanical Gardens in 1812, many were certainly introduced earlier. Unfortunately, pollen resolution and pollen records are restricted to certain areas and certain periods, which makes it difficult to establish dates for the arrival of adventive flora before the 1800s. The introduction of adventive Mediterranean flora probably goes back to at least the Greek colonization in the mid-1st century BC. After all, Crimea had been dominated by Greeks, Romans, Byzantines, Genoese, and Ottoman Turks, all of which have their origin in the Mediterranean region.
Another aspect of the Mediterranean flora in Crimea that has received attention is at the level of the community. Based on several classifications of vegetation types in Crimea, the southern coast has at least five types of vegetation communities: (1) oak-eastern hornbeam (Quercus pubescens-Carpinus orientalis) woodlands, (2) small isolated communities of Pinus brutia var. pityusae, (3) juniper-pistachio (Juniperus excelsa-Pistacia mutica) woodlands, (4) shiblyak communities and (5) phrygana communities (Cordova, 2016). The shiblyak is a community of shrubby forms of Quercus pubescens, Carpinus orientalis and Pistacia mutica with other less important species such as Ruscus ponticus, Juniperus oxycedrus, J. excelsa, Rhus coriaria and Cotinus coggyria, and Palurus spinus-Christi, among others. The phrygana is a community dominated by unpalatable, aromatic herbs found mainly on thin calcareous soils, often dominated by herbs of the Lamiaceae family, Cistaceae, and Liliaceae (e.g. Asphodeline spp.). The Crimean shiblyak and phrygana are often equated with the Mediterranean maquis and garrigue, respectively, although some differences make them unique (Rikli, 1943). Unlike the predominantly sclerophyllous nature of the maquis, the shiblyak is dominated by deciduous species. But like the maquis and garrigue, the shiblyak and phrygana are considered to be secondary vegetation created by the degradation of Mediterranean forests (Didukh, 1992; Cordova, 2016). In particular, the phrygana is seen as the extreme case of degradation caused by pastoralism.

3 - Defining Mediterraneanization

The term “Mediterraneanization” appears in the literature in different contexts. In the scientific context, the term has been used to imply the post-glacial formation of the Mediterranean biome in southern Europe as vegetation is redistributed as temperatures rise (Hempel, 1987). The term has also been used to refer to the natural expansion of Mediterranean biota into areas outside the Mediterranean (e.g., Cordova, 2007; Oguz and Ztürk, 2011). But in a socio-economic context, the term is used to refer to the adoption of Mediterranean life-styles, either in deep cultural aspects such as cuisine, or in the tourism industry (Morris, 2003). In the latter case, it is implied that tourist areas, often beach resorts, outside the Mediterranean are adopting many of the ways of the Mediterranean to attract tourists.

In view of the multiple uses, as well as the ambiguity of the term, C.E. Cordova (2016) redefines the term in the context of the transformation of the landscape in Crimea, hence giving it a biogeographic sense. Accordingly, biogeographic Mediterraneanization includes the following: (1) the physical or natural processes by which Mediterranean plant taxa have become established in Crimea and formed communities similar to those of the Mediterranean region; and (2) the cultural processes that have created a Mediterranean-like landscape economy, not only the deliberate introduction of plants (including cultivars), but also the creation of land management methods and a rural economy similar to that of the Mediterranean and, overall, an economy linked to Mediterranean-like landscapes, including tourism.

More simply, it is possible to refer to two main sets of processes by which Mediterraneanization in Crimea has occurred: physical and cultural. In theoretical terms, the physical processes preceded the cultural processes. More precisely, the physical processes facilitated the cultural processes (Cordova, 2016). The processes by which physical and cultural Mediterraneanization occurred spanned several millennia. Physical Mediterraneanization began in the early Holocene as temperatures warmed up and the sea approached its present level, and currents began to develop (Cordova, 2007). Cultural Mediterraneanization begins later as Neolithic settlers begin to introduce pastoralism and farming, both of which are traits that by diffusion irradiated from the Mediterranean region into Europe. Later, in the late Holocene, with the migration of settlers from the Mediterranean region to Crimea, cultural Mediterraneanization began to move faster resulting in the environment that we see today in Crimea.

Seen from a biogeographic perspective, it is the physical Mediterraneanization that created the scene for cultural Mediterraneanization. But as time passed, the latter became more intense.

4 - Physical Mediterraneanization

The appearance of Mediterranean taxa in the pollen record of the early Holocene marks the beginning of physical Mediterraneanization (Fig. 3). The increase in pollen taxa such as Pistacia and the development of cinammonic soils between 7500 and 5000 BP, suggests mild winters and relatively long, dry summers (Cordova and Lehman, 2005). This event coincides with the rise in the level of the Black Sea, which meant the transgression of the peninsula by seawater and the establishment of the sea current gyre, leading to more marine influence (Cordova, 2007). The marine conditions surrounding the peninsula may have reduced the temperature differences between summer and winter at a time when the relatively warm waters brought by the gyres from the south may have constituted a source of moisture in winter. The presence of Mediterranean taxa in the record and the conspicuous reddening of soils suggest that in the middle Holocene an annual summer drought with mild winters existed (Cordova and Lehman, 2005). In the late Holocene Mediterranean taxa persisted in lower frequencies and soils turned more to rendzinas and chernozems.

5 - Cultural Mediterraneanization

In a very narrow sense it is possible to think that the process of cultural Mediterraneanization began with the arrival of Greek colonists in the mid-1st millennium BC. But in a broad view, it is possible to say that cultural Mediterraneanization had already begun during the
Neolithic period, particularly because the introduction of pastoralism and crops is a process that radiated through cultural diffusion from the Levant (eastern Mediterranean). Nonetheless, farming in Crimea lagged behind other regions, and the dates of its beginning are often difficult to define (COHEN, 1996), although the cultures that evolved into the Bronze Age were clearly practicing some sort of husbandry (ANDRYEYEV, 1997). In the 5th century BC, around the time of the Greek arrival in southwestern Crimea, the native Tauri practiced a form of husbandry that may have been reminiscent of the rural management that had been practiced in the Mediterranean region in general a few millennia earlier. Certainly, the Tauri depended on horticulture and pastoralism, but never achieved the degree of rural development reached by Mediterranean farmers at the time.

It is not possible to view the introduction of Greek agriculture in Crimea as a direct transplant from agriculture on the Greek mainland or the coastal areas of Asia Minor where many of the colonists who settled in Crimea came from. The case of grape introduction shows that soil management in the Mediterranean region was similar to that in the Greek homelands, but different in terms of managing varieties adapted to different climatic patterns. Thus, archaeobotanical studies on grape introduction suggest that the processes of vine production involved careful hybridization with local wild varieties that were more resistant to the cold (YANUCHEVITCH et al., 1985).

But overall, the layout of the farm system bears some similarities to other areas that the Greeks colonized in the Mediterranean (CARTER et al., 2000). The land-use system established in the Greek world at the time was referred to as the *chora* (plural, *chorai*) and included demarcated fields and farmhouses around the main cities (see example in Fig. 4a). Associated with the farms were plantation lines, irrigation structures, check-dam terraces, and other structures (STRZHELETSKIY, 1961). Many of these structures are still visible in the landscape in the Heraklean Crimea on the outskirts of Sevastopol (Fig. 4b).

The Greek agricultural territories expanded beyond the original Greek city limits (Fig. 5). The system became very complex as non-Greek and Hellenized natives adopted crops and practices introduced by Greek farmers (JANUSHEVICH and NIKOLAENKO, 1979). The maximum
extent of grape and wheat plantations occurred sometime in the 4th and 3rd centuries BC, presumably under optimal climatic conditions (CORDOVA et al., 2011) to the point that even areas of the meadow steppes and forest steppes were farmed (Fig. 5). Today these areas are farmed only with the help of irrigation.

During the 2nd and 1st centuries BC this unprecedented agricultural expansion began to contract, presumably because of climatic deterioration and nomadic tribe invasions from the steppes (CORDOVA et al., 2011). This contraction was followed by periods of political instability, abandonment, and takeover of Greek cities on the northern Black Sea shore by mainland tribes. In Crimea, Chersonesos fell under Roman protection, but its economy suffered from the loss of agricultural territories.
The cultural connections between the southern part of Crimea (e.g., the mountains and the southern coast) and the Mediterranean region continued through the Middle Ages as the Byzantine Empire became the dominant power in the region. Intense settlement of the mountain slopes, particularly in the southwest of Crimea, occurred in unprecedented proportions. In this process, agricultural terracing was implemented in mountain areas (SCHREG, 2010 and 2011). Pastoralism in the mountain region also became prominent, particularly in the Yailas (summer pastures on the summits of the mountains) (CORDOVA et al., 2011; CORDOVA, 2016).

The Tatar-Mongol invasions of the 12th and 13th centuries did not necessarily disrupt the Mediterraneanization process. The rural economy of the south coast continued under the sponsorship of Chersonesos, the Theodorite Kingdom, and the Genoese colonies. The Ottoman takeover of Crimea at the end of the 15th century disrupted the connections with former Mediterranean colonizers (Byzantium and Genoa), but it perpetuated several of the management forms of the land. After all, the Ottoman Turks had become adapted to the Mediterranean environment. Descriptions of the Peninsula by travelers, particularly the Ottoman Evlya Çelebi in the 17th century, portray the southern part of Crimea as an area producing grapes and other Mediterranean crops (ÇELEBI, 1996). Although the domination of Muslim power reduced the production of grapes, many areas with Christian or Jewish populations retained their vineyards for wine-making. Likewise, table grapes and leaves used in eastern Mediterranean cuisine allowed the cultivation of grapevines even in the Muslim areas (CORDOVA, 2016).

Russian domination of Crimea began with the official annexation of the Peninsula to the Empire in 1783. Ironically, it was under a culture with no Mediterranean tradition that the process of cultural Mediterranization intensified. To accelerate the process of Mediterranization, the Russian empire established the Nikitsky Botanical Gardens on the outskirts of Yalta. The role of the scientific wing of the gardens was to acclimatize Mediterranean and other sub-tropical crops and ornamentals to Crimea and other warm parts of the empire. Additionally, a state-sponsored program to intensify the cultivation of grapevines and improve wine production was implemented by bringing wine specialists from France (CORDOVA, 2016). By the end of the century, Crimea had virtually become Russia’s Mediterranean coast, dubbed the Russian Riviera.

The cultural Mediterranization process during the Russian period and its subsequent Soviet period was carried out primarily with scientific support and state sponsorship. Experiments with the adaptation of subtropical plants in Crimea intensified during the Soviet
Period (CORDOVA, 2016). This process, again, was carried out by the research staff of the Nikitsky Botanical Gardens. Additionally, grape cultivation was expanded into areas formerly unfit for grapes. Hybridization techniques and protective measures against the cold, and irrigation through the North Crimean Canal network, allowed the expansion of viticulture into many regions of Crimea, including the plains (FURSA, 1977; CORDOVA, 2016). Nowadays, viticulture occupies practically most low-elevation areas outside the original grape cultivation areas of the south coast (See Fig. 6).

Beyond aspects of plant introduction and adaptation, another concept developed inside the process of cultural Mediterraneanization in Crimea was the Russian Riviera. The properties of the relatively warm and dry climate were a catalyst for the development of tourism. Towards the end of the 19th century, the nobility and the intelligentsia began to equate southern Crimea with areas in the Mediterranean such as Trieste and Nice. Thus, a tourism industry developed in the early years of the 20th century. Mass tourism, often state sponsored, developed during the Soviet period, particularly after the 1950s. In tourism, even to this day, Crimea sells as an exotic, Mediterranean destination, at least in the minds of Russians and citizens of the former Soviet countries.

6 - Mediterranean crops in the transformation of Crimea

6.1 - The role of the ancient Greek colonies in the process of Mediterraneanization

Physical Mediterraneanization must have aided the processes of cultural Mediterraneanization by facilitating an environment where Mediterranean traits in agriculture and land management could be established. Physico-geographical features similar to those of the Mediterranean homeland may have played an important role in attracting Greek settlers to Crimea. These features included the mostly calcareous, rugged landscapes of southern Crimea and a relatively mild and wet winter and a warm and dry summer.

The ancient Greek settlers in Crimea transformed the environment in many ways similar to the transformation in other parts of the Mediterranean world where they had settled (CARTER et al., 1997). Not only was the polis and the chora system brought to Crimea, but also various techniques for planting crops on thin, calcareous soils (e.g., Fig. 4b). Later during Byzantine times, as populations expanded in the mountains, terracing was introduced (SCHREG, 2010; CORDOVA, 2016). In addition to grapes and cereals, other Mediterranean crops that withstood the local climatic conditions survived, e.g., pulses, figs, pistachios, and walnuts. It is possible that the same physical characteristics attracted other Mediterranean
settlers, such as Romans, Byzantines and Ottoman Turks, and Genoese traders and colonizers. If the conditions did not attract them, perhaps the environment similar to the Mediterranean made the use of the land easier.

6.2 - Mediterranean crop successes and failures
The study of the morphology and morphometric parameters of grape pips obtained from excavations showed that local wild varieties and domesticated ones were hybridized to adapt the crop to the local climatic conditions of Crimea (YANUCHEVITCH et al., 1985). In addition to the archaeobotanical record, evidence of grape cultivation and wine production exists in many forms, from structures and artifacts for wine processing in the farms to rows of stone in the landscape (Fig. 4). Soils for grapevine cultivation may not have been a problem, since Crimea has a number of areas with calcareous shallow soils and red Mediterranean soils (locally called cinammonic soils) very similar to those of the Mediterranean region (CORDOVA, 2016). The elaborate rows for planting the grapes were created from the shallow stony soils as revealed by archaeological excavations (STRZHELYETSKIY, 1961). Some of these structures are visible in ancient farm plots in the Chersonesos chora (Fig. 4b).

There is no evidence that olives, the most iconic of Mediterranean crops, were established as a plantation crop in Crimea during antiquity. Olive stones appear in domestic archaeobotanical remains, but not in pollen diagrams (CORDOVA and LEHMAN, 2003). Although olive pollen grains can travel long distances (VAN ZEIST and BOTTEMA, 1991), at a local and regional scale, olive trees are well known as a moderate to under-represented plant taxon in modern pollen rain (BOTTEMA and WOLDRING, 1990; VAN ZEIST and BOTTEMA, 1991; FLORENZANO, 2013). Olive trees are moderately represented in modern pollen rain and their large-scale plantation in the past can be detected in pollen diagrams (CORDOVA, 2010). Therefore, widespread olive cultivation would have been recorded in the pollen diagrams in or near the Chersonesos chora on the Heraklean Peninsula (e.g., CORDOVA and LEHMAN, 2003 and 2005). Most likely the crop was never acclimatized to the colder climates of Crimea during antiquity. One of the problems for the adaptation of olive trees in Crimea is their intolerance to cold winters (ZHIGARYEVICH, 1955). Although winter temperatures in southern Crimea are mild compared to the rest of the Peninsula, the incidence of below-freezing temperatures is much more prominent than in areas of olive cultivation in the Mediterranean region (CORDOVA, 2016).

Existence of old olive trees in various parts of southern and southwestern Crimea suggest that in late antiquity there were attempts to introduce the crop. Peter S. Pallas reported an olive tree around the medieval fortress of Mangup in the late 1700s (VULF et al., 1916) and 500-year old olive tree stands in the grounds of the Nikitsky Botanical gardens (CORDOVA, 2016). In more recent years, adaptation experiments were carried out in the warmest part of the Peninsula by scientific staff of the Nikitsky Botanical Gardens in the 20th century (e.g., VULF et al., 1916). Although the experiments were successful, the commercial implementation of olives in southern Crimea was not possible because of the costs of protecting the crop from the cold and the fierce competition with cheaper olives from Mediterranean countries (CORDOVA, 2016).

Although macrobotanical remains from archaeological contexts attest to a variety of Mediterranean cultivated plants, in some cases it is difficult to tell whether they were imported or locally cultivated. Pulses, for example, are not well defined in the pollen record because of similarities with other Fabaceae plants (i.e., legumes) and because of poor dispersion and preservation, but their seeds are found in abundance in archaeological contexts (JANUSHEVICH and NIKOLAENKO, 1979). Figs are also among other Mediterranean crops that are often reported in archaeological contexts. However, fig plants are invisible in diagrams because of its dispersion limitations beyond the flower (CORDOVA and LEHMAN, 2003). This fact, however, does not exclude the idea that figs could have been cultivated as orchard products in the Mediterranean region, and in fact in many rural areas of southern Crimea today.

One crop that does appear in the pollen records is walnuts (Juglans regia). Although found in the archaeological context of early Greek settlements, Juglans pollen appears in palynological records only after the Roman period (CORDOVA and LEHMAN, 2003). The conspicuous phase of walnut incidence in the pollen record occurs in the Byzantine period, a time when perhaps the already existing crop was intensified. This process could have occurred perhaps not only in the former Chersonesos chora in Heraklean Peninsula, but also in the surrounding mountains, where settlements and farms proliferated after the 5th century AD.

6.3 - Agricultural intensification in pollen diagrams
Although the pollen of most crops fails to appear in pollen diagrams, the Greek colonization is clearly marked in the pollen diagrams by an increase in weeds and the reduction of arboreal pollen (Fig. 3). Although soil erosion is expected to accompany this process, soil records suggest that erosion during the Greek colonization in the second half of the 1st millennium BC was not prominent, at least compared with previous periods in the Middle Holocene (CORDOVA and LEHMAN, 2005). Soil modification during the Greek colonization and after is evident in changes in chemical and physical properties of soil horizons in the areas of farms in the Heraklean Peninsula (LISETSKII et al., 2012). However, widespread erosion is not evident in the sediment records inside the farm area, where very little accumulation occurred in the past 2500 years, i.e., after the initial Greek settlement (Fig. 4c). This is not the case of other Greek settlement areas of Crimea such as the northeast part of the Kerch Peninsula, where the Thakhanskaya Balka record shows the effect of erosion associated with Greek agricultural settlement (CORDOVA and LEHMAN, 2005; CORDOVA et al., 2011).
However, in the case of the Kerch Peninsula, vegetation, soil, and climatic conditions differ considerably from those of around Chersonesos.

Evidence of intense soil erosion exists in the mountain valleys of Southwestern Crimea, during the early Middle Ages, presumably caused by forest clearing, settlement, and farming on slopes (SCHREG, 2010 and 2011). Likewise, the intensification of pastoralism at higher elevations during the Middle Ages is evident in the sediment records in the mountain valleys and karstic depressions of the Crimean Yaila (CORDOVA, 2016).

Conclusions

Located in an area completely outside the Mediterranean region, physically, climatically, and biogeographically, southern Crimea is an exclave of Mediterranean vegetation. Its mild winters and relatively dry and warm summers are an important factor in maintaining Mediterranean floristic elements. Along with climate and vegetation, Mediterranean land use traits and crops are a signature that speaks of a process of physical and cultural processes of land Mediterraneanization.

Physical Mediterraneanization began with the establishment of Mediterranean floristic elements in southern Crimea during the warmer climatic conditions of the early and middle Holocene. In concomitance with the bioclimatic developments in the Holocene, the development of red cinammonic soils, and calcareous stony soils in a climate with relatively mild and wet winters and dry summers, provided a landscape somewhat similar to those of the Mediterranean region. In turn, landscapes similar to the Mediterranean developed along the southern and southwestern coast of Crimea. It is possible that these “Sub-Mediterranean” landscapes aided the process of cultural Mediterraneanization, which began with the arrival of Greek farmers in the mid-to-late first century BC.

Cultural Mediterraneanization evolved organically through the centuries of Greek colonization, Roman, Byzantine, Genoese, and Ottoman dominations. But starting in the early 19th century under Russian domination, the process of Mediterraneanization was institutionalized, firstly by sponsoring the development of Mediterranean crops and the viticulture industry, and secondly by the development of Mediterranean-style tourism. The process continued through the Soviet era and survives to this day.

References


