



Conquests and land degradation in the eastern Maghreb during classical antiquity and the Middle Ages

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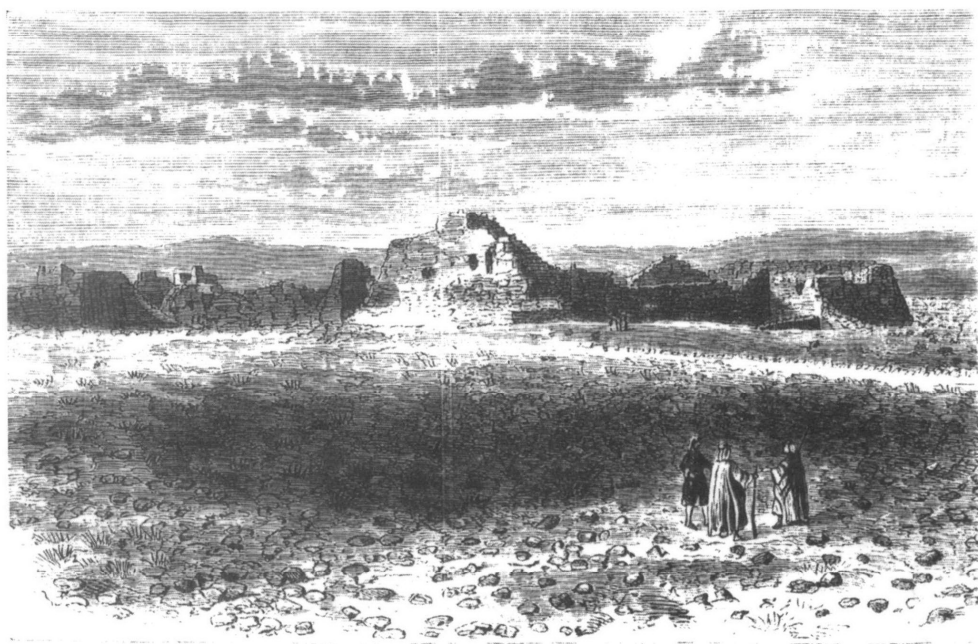
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Living at the margin



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7 *Conquests and land degradation in the eastern Maghreb during classical antiquity and the Middle Ages*

JEAN-LOUIS BALLAIS

INTRODUCTION

Ibn Khaldoun's description of the eleventh-century Arab invaders of the Maghreb (Ibn Khaldoun, 1968), in which he likened them to plagues of locusts, is well known. Since then, many historians have tended to believe that the Arab invaders were responsible for the land degradation that is so visible today in many parts of north Africa. More than twenty years ago, after French decolonization, controversy was particularly strong (Berque, 1970, 1972; Cahen, 1968; Idris, 1968a, 1968b; Poncet, 1967, 1968), though interest has since decreased. Since this period, however, advances in geoarchaeological research allow a reassessment of the role of Arab nomads in land degradation in north Africa, the basis for which was more ideological than factual. The purpose of this chapter is to discuss the geoarchaeological record of the eastern Maghreb (Fig. 7.1) and to compare it with the historical record of conquests, invasions and occupations, in order to assess the respective roles of climate and people in shaping this region's landscape in classical antiquity and the Middle Ages.

THE ARRIVAL OF THE PHOENICIANS

The Phoenicians settled on the eastern coasts of present-day Tunisia between the eleventh and ninth centuries BC (Decret, 1977). This period coincides with the beginning of the Late Holocene, a phase characterized throughout the region by a trend to aridification following the Middle Holocene climatic optimum (Ballais, 1991a). This aridification was the reason for the reappearance of aeolian deflation on the great 'chotts' or 'sebkhas' (salt flats) of southern Tunisia, as well as the incision of the lower prehistoric holocene terrace, especially in the present-day semi-arid subzone (Ballais and Benazzouz, 1994; Table 7.1). The phase is contemporaneous with the erosional crisis at the transition between the Bronze and Iron Ages in the northern Mediterranean

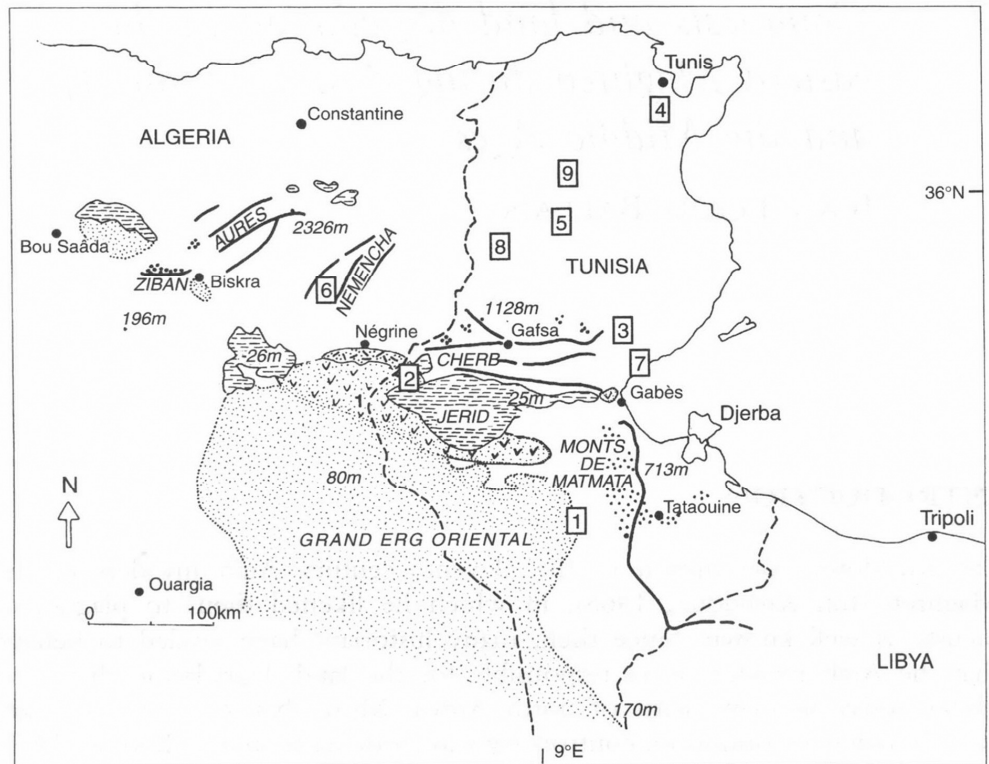


Figure 7.1 The eastern Maghreb, showing locations mentioned in Chapter 7

Key: 1. Ksar Rhilane; 2. chott Rharsa; 3. Ksar Rheriss; 4. Wadi Kébir-Miliane; 5. Henchir Rayada; 6. Wadi Chéria-Mezeraa; 7. Wadi el Akarit; 8. Haïdra. Stippling denotes major areas of sand dunes, horizontal dashed lines denote salt flats ('sebkhas' or 'chotts')

Table 7.1 Morphoclimatic evolution in the eastern Maghreb during the later Holocene; dates in radiocarbon years BP

<i>Isotopic chronology</i>	<i>Morphogenesis</i>
	<i>Shifting sands incision</i>
610 +/- 110	Terrace aggradation Incision
1350 +/- 70	Terrace aggradation
1470 +/- 190	Terrace aggradation
1730 +/- 185	Pedogenesis
2380 +/- 155	Flood deposits
2420 +/- 70	Gyttja deposits
2590 +/- 90	Pedogenesis Deflation Incision
3680 +/- 160	Terrace aggradation
4220 +/- 50	Terrace aggradation

(Jorda *et al.*, 1993). The characteristics of this sediment morphogenesis in the eastern Maghreb, as well as those of the associated pollen (Brun, 1989), indicate the occurrence of strong floods due to intense rainfalls, the latter probably highly concentrated and episodic. Thus, the climate was probably characterized by greater seasonality than before and a hydric balance less favourable than today. As far as we can tell, Phoenician colonization in the eastern Maghreb – for long limited to a few coastal sites – does not appear to have been responsible for this morphogenic crisis.

THE ROMAN CONQUEST AND COLONIZATION

From the Punic Wars up to the Vandal conquest, during almost six centuries, three morphogenic phases can be discerned in the region: the end of an aggradation period; an incision period; and a second alluvial aggradation period (Table 7.1).

The end of an aggradation period

Between c.2400 and 2200 BP, aggradation became widespread once more. The evidence includes: washed sand deposits with *Helicella* molluscs in dunes on the eastern margin of the Grand Erg Oriental sand sea, at Ksar Rhilane in the Saharan subzone (Fig. 7.1: site 1; Fig. 7.2); gyttja accumulation in the Rharsa chott in the arid subzone (Ballais, 1992; Fig. 7.1: site 2); and fine alluvium along the watercourses flowing down from the Nemencha Mountains in the semi-arid subzone (Ballais and Benazzouz, 1994).

Today at Ksar Rhilane sands are blown by the wind, and rillwash and sheetwash never occur. In the Rharsa chott, the principal deposit is sodium chloride. In the Nemencha Mountains, the fine alluvium has been organized in continuous beds by slow streams in a large channel. The mean annual accumulation rate was 1.4–2.2 mm, which is very close to the rate calculated for the low prehistoric Holocene terrace (Ballais, 1991b). The few pollen grains taken from those deposits show that a woodland could have colonized the slopes. All these characteristics are compatible with a more positive hydric balance in this phase than either during the previous climatic phase or today, especially in the arid and Saharan subzones. In comparison with the climatic optimum period (Ballais, 1991a), the degradation of climate in the semi-arid subzone is shown by a probable increase in summer evaporation, though winters remained sufficiently cool to permit the growth of *Cedrus* on the summits of Nemencha 1800 m above sea level.

During this period, Roman penetration of the interior seems to have been very limited: no evidence for Roman agricultural works has yet been observed.

An incision period

No deposit has been identified for the period from c.2200 BP to c.1650 BP (the second and third centuries AD), but there is widespread evidence for



Figure 7.2 Flood deposits at Ksar Rhilane (Tunisia): bedded silts and sands (dated to 2380 \pm 155 BP) with ripple-marks in the upper part, with the present-day dunes behind

Photograph: J.-L. Ballais

watercourse downcutting. This period was thus characterized by streams having the capability to incise their channels and to transport their alluvial sediments up to the base levels. It is possible precisely to measure neither the scale of the incision nor its annual rate, owing to the lack of chronological markers. Nevertheless, it should be remembered that the mean annual rate of downcutting of the low prehistoric Holocene terrace was 1.2 mm between 4000/3500 BP and 1700/1600 BP (Ballais, 1991b). Thus, during this period, slopes furnished very few colluvial sediments, indicating either that they were well protected by rather dense vegetation or that the agricultural techniques did not produce soil erosion.

The beginning of this period was marked by the almost continuous expansion of Roman colonization, both westwards and southwards (Février, 1989). Even though they cannot be dated precisely, numerous dams were built at about this time on the watercourses of the Nemencha and Aurès mountains (Ballais, 1976; Birebent, 1964; Leveau, 1974–75) and in southern Tunisia (Ballais, 1990; Trouset, 1974). Sometimes their construction can be shown to be associated with the construction of the Roman frontier works (*limes*) at the boundary of the arid and Saharan subzones (Baradez, 1949; Trouset, 1974). Presumably it was the combination of favourable conditions of climate, vegetation, and soils, and well-organized agricultural activities, that was responsible for such limited soil erosion through the second and third centuries AD.

An aggradation period

Evidence for an aggradation terrace dating to historic times is widespread along most of the watercourses, from the north to the south and from the humid subzone to the upper Saharan subzone. The exception is the lower Saharan subzone: so far, the historic aggradation terrace, unlike the late prehistoric terrace, has not been identified in the far south of Tunisia. As with the late prehistoric terrace, the later feature developed for the most part in those catchments formed in loose, erodible rocks. The sediments are generally fine in texture, beige in colour in the south and greyer in the north. This terrace also has an extensive surface area, particularly in the north, and forms a sediment unit that varies in thickness from 1 m (along small watercourses) to 5–6 m (along major rivers).

On the largest rivers, detailed studies of sedimentation patterns show variations with latitude. Thus in the Wadi Leben terrace at Ksar Rheriss, towards 35°N in the arid subzone (Ballais, 1991b; Fig. 7.1: site 3), desiccation cracks appear in thin beds formed by washed clay and have been filled by sand during later flooding. These patterns, which are characteristic of intermittently-flowing wadis, disappear in the more humid subzones, with the exception of the Kébir-Miliane wadi (Fig. 7.1: site 4), which is today a perennial stream. Conversely, further to the north, the terraced sediments of many watercourses contain dark, hydromorphic, silt-like facies, rich in organic matter or in manganese oxide. In eighteen different cases, it is possible to correlate the presence of these facies with the perennial nature of the watercourse or, inversely, their absence with the intermittent nature of the watercourse. In three other cases, this correlation is not apparent. The sediments nearly always contain fragments of Roman or even earlier pottery (more than twenty recorded examples have been noted) and often charcoal, hearths or other artefacts. They cover the base of Roman bridges or aqueduct piles (Fig. 7.3) or fill in low-volume dams built during the second and third centuries AD. In another case, along the Wadi es Sgniffa, a whole ancient settlement is covered by alluvial sediments. There are still very few isotopic dates for the very low main historic Holocene terrace, but two examples of dated sediments are in the Wadi Chéria-Mezeraa (Fig. 7.1: site 6), which was radiocarbon-dated using samples of land molluscs to 1370 \pm 70 years BP (Fig. 7.4) and in the Wadi el Akarit (Fig. 7.1: site 7), where the terrace is dated to 1470 \pm 190 years BP (Ballais, 1995; Fig. 7.5). The rate at which the low terrace sediments of the historic period were accumulating became considerable: at the eighteen locations examined, the average reached 7.4 mm per year, which is five times the rate of accumulation of the lower (prehistoric) Holocene terrace, suggesting that the geosystems in which the historic terrace formed differed significantly from those when the earlier terrace accumulated.

It is of interest to note that this historic aggradation started only when the area in question, with the exception of the Sahara, was occupied by sedentary populations as a result of a lengthy process of political and economic



Figure 7.3 The modern aqueduct crossing Wadi Bou Jbib, Carthage, built on the piles of the Hadrianic aqueduct

Note: The right-hand pile is partly covered by grey silts belonging to the historic-period Holocene terrace

Photograph: J.-L. Ballais

evolution. Generally speaking, the northeast of Tunisia, near Carthage, was cultivated from perhaps the fifth century BC onwards and the cereal plains in the northwest of Tunisia and some parts of eastern Algeria from the third and second centuries BC. The steppes of Algeria, Tunisia and Libya were cultivated from the first and second centuries AD and the borders of the Sahara during the second century AD, at the time of the construction of the Severan *limes* (Troussset, 1986). If the observed variation in alluvial deposits was linked solely to the political and economic development of this vast area, we might expect to find the imbalance of the geosystems resulting from this development occurring at the same time in all places, with the threshold producing the change from incision to aggradation taking place at the same time in the north and south after eight centuries of sedentary settlement in the former region and after a few decades of such settlement in the latter. However, this coincidence, though not impossible, seems highly unlikely, particularly if the tremendous differences in mean annual rainfall between the north and the south are taken into account. In addition, it has now been shown that comparable terrace deposits were deposited throughout the Mediterranean, particularly towards the end of classical antiquity and in the early Middle Ages (Ballais and Crambes, 1992; Brückner, 1986; Vita-Finzi, 1969). The extensive occurrence of this feature can best be explained by an



Figure 7.4 Holocene terrace of Wadi Chéria-Mezeraa (Algeria)

Note: The stratigraphy visible to the left of the standing figure is, from bottom to top: grey silts; bedded pebbles (Early Holocene); beige-grey silts (dated to 1370 \pm 70 BP); and a Roman drainage ditch filled with pebbles

Photograph: J.-L. Ballais

underlying climatic shift across the region. In view of the characteristics of the alluvial deposits, it seems likely that they originated from erosion of soils, particularly those that developed during the Holocene Climatic Optimum and at the beginning of the Roman period.

However, land use systems in classical antiquity probably exacerbated these erosional trends. Presumably the spread of cultivation and ploughing destroyed a large part of the vegetation on the watersheds, reducing the cohesion of soils and superficial formations. It then required only a small change in rainfall characteristics, perhaps in the annual total, or at least in intensity and periodicity, to produce considerable soil erosion and the start, if not the return, of water in the stream channels and increased discharge, though this increase was not enough to carry the large sediment load from the slopes to the base levels.

The absence of the very low historic terrace in the lower Saharan subzone is probably due to the lack of agriculture on the watersheds. For these very recent periods it is difficult to compare the climatic situation with that of Sahara. However, the fact that *Acacia* and *Tamarix* could be found in central Serir Tibesti at around 1700 BP and 1400 BP indicates that, at least in tropical Sahara, the mean annual rainfall was more than the present day rainfall of 5 mm (Pachur, 1974).



Figure 7.5 Holocene terraces in the Wadi el Akarit (Tunisia). A very low terrace of post-Islamic date (610 \pm 110 BP) is fitted into a gypseous terrace of late pre-historic date

Photograph: J.-L. Ballais

THE VANDAL CONQUEST AND OCCUPATION

The Vandals are not one of the beloved peoples of eastern Maghreb history. Too often it seems that their brief passage in the fifth and sixth centuries AD has no longer left traces (Courtois, 1955). In fact, despite new studies (Modéran, 1988), the Vandal period remains badly known for two main reasons. The first one was the lack of interest of French archeologists of the colonial period in the post-Roman civilizations (Février, 1989). The second one is a consequence of the first one: the destruction of the Vandal sites established on top of Roman towns. As a result, neither the limits of Vandal territory (in the present day Constantinois, for example) nor their modes of soil occupation and land use are well known. There is insufficient evidence on which to base any detailed discussion of climate, soils, vegetation and people's possible effects on the landscape at this time. We can note, however, that alluvium continued to accumulate as the very low historic terrace (Table 7.1).

BYZANTINE CONQUEST AND COLONIZATION

The Byzantines have been less neglected by French archeologists and historians of the colonial period because they presented themselves as the legitimate

heirs of the Roman emperors (Ducellier, 1988). They occupied the eastern Maghreb from the sixth to the seventh centuries AD. As for the Vandal phase, there is great uncertainty regarding modes of rural settlement and land use. Most information is available for the wars against Berbers (Modéran, 1989). In particular, most of the numerous small forts still visible today were attributed to Byzantine colonization, but it now appears that some are later than the Arab conquest (Mahjoubi, 1978). According to isotopic datings, the end of the aggradation of the very low historic alluvial terrace coincides more or less with the Byzantine period. This can be confirmed at Haïdra (Ammaedara; Fig. 7.1: site 8), where the foundations of a Byzantine bridge constructed at the same time as the sixth-century fort (Baratte and Duval, 1974) were dug into the alluvial deposit (Ballais, 1991c).

ARAB CONQUEST AND COLONIZATION

Seventy years were necessary for successive waves of Arab forces to conquer the eastern Maghreb during the second part of the seventh century AD (Marçais, 1946), presaging the high Islamic period, which was a time of general economic prosperity (Vanacker, 1973). The last wave of Arab invaders, the well-known Hilalian, arrived in the middle of the eleventh century. They are described as nomadic shepherds coming from Upper Egypt, the 'plague of locusts', in Ibn Khaldoun's memorable phrase, who 'pushed their flocks into the middle of the fields, devastated the gardens, stripped and ill-treated the country persons, plundered the hamlets' (Marçais, 1946). In theory, the consequences of such devastation would have been so disastrous that they would have provoked catastrophic and long-lived decline in the Tunisian economy (Al-Idrisi, 1983; Ibn Khaldoun, 1968; Marçais, 1946; Vanacker, 1973).

Following the aggradation of the very low historic terrace, the general trend for watercourses in the study area was vertical incision (Table 7.1), with two to three interruptions. The main interruption can be seen in the very low post-Islamic terrace, which, as far as we know today, is little represented, presumably because of its small size. With only one exception (Wadi Kébir-Miliane), this terrace covers very small areas, in particular in convex meander lobes, and its height above the major bed rarely exceeds 2 m. Occasionally it appears as a rocky terrace that was breached in the previous build-up; elsewhere, the facies can sometimes be compared to that of the previous terrace, though it is sometimes considerably coarser, at least at the base. The age of the terrace is still rather uncertain, because appropriate means of dating are not available, but at Henchir Rayada (Fig. 7.1: site 5) it contains Islamic pottery from the tenth/eleventh centuries and in Wadi el Akarit (Fig. 7.1: site 7) it was dated by radiocarbon using collagen to 610 \pm 110 years BP (Fig. 7.5). This terrace is thus much younger than the period of the presumed Hilalian invasions.

As for the previous terrace, the widespread presence of a terrace of the same age can be seen throughout the Mediterranean basin (Ballais and Crambes, 1992; Vita-Finzi, 1969). Moreover, in contrast to the final years of classical antiquity (the third to the fifth centuries AD), population was probably low at the beginning of the Hafside period in Tunisia during the twelfth century AD. This period marked the end of the medieval climatic optimum and the beginning of the Little Ice Age in Europe (Lamb, 1977; Le Roy-Ladurie, 1967). In Morocco, the existence of a Little Ice Age is controversial (El Bouch and Ballais, 1997; Lamb *et al.*, 1989; Stockton *et al.*, 1985). Once again it seems most likely that such a widespread terrace resulted from climatic causes, but further studies will be required to clarify this point.

This conclusion emphasizes the extreme ideological character of the theories regarding the impact of nomadic shepherds on the landscape at the time of the Arab invasions. Even if those shepherds did in fact cut down trees to any extent, their main effect would have been to substitute pastures for cultivated fields. The consequences would have been as follows: an increase in the rate of vegetation cover over the soil; a consequent decrease in the direct splash impact of rain drops on the soil and thus of pluvial erosion and sheet erosion; and an increase in the 'roughness' of the terrain and thus a diminution in wind erosion. Within such a model it is necessary to moderate the intensity of such processes according to the climatic subzones and different grazing intensities, but it seems realistic to suppose that, in general, such a move from arable to pastoral land use is likely to produce less, rather than more, soil erosion.

CONCLUSION

In the eastern Maghreb during classical antiquity and the Middle Ages, fluctuations in geosystems and, in particular, increases in soil erosion can be seen to have reflected specific combinations of climatic change and human activities. A climatic fluctuation that increases the intensity of rains, or the annual amount of precipitation, affects slopes only if they have been made vulnerable by vegetation degradation or by cultivation systems that have not been designed to counteract erosion. In other words, phases of massive agricultural colonization and phases of extension of the cultivated surface are very favourable to such erosion. This was the case in the study area, as in many parts of the Mediterranean, during the Roman period. On the other hand, periods of conquest generally seem to have been characterized by a contraction of the cultivated surface and a progressive development of 'natural' vegetation or of pastures that limited soil erosion. This may have been the situation in the case of the nomadic Hilalian shepherds of the Arab conquest. However, there were exceptions to these trends, in particular in the irrigated zones and in the terraced mountains.

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