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Soil care and water management on Mediterranean slopes: an archaeopedological approach

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Resumen

Todas las regiones mediterráneas están sometidas al mismo régimen de precipitaciones, con frecuencia violentas y estacionales. Cuando este clima se combina con lo que el geógrafo francés René Neboit denominó "la tiranía de la pendiente", los agricultores se enfrentan al problema de la erosión de los suelos y de la gestión de los recursos hídricos. El aterrazamiento constituye una de las respuestas del hombre a estas circunstancias.

En este trabajo se presenta una investigación multidisciplinar, fundamentalmente basada en la Arqueología, la Edafología y la Geografía y con una perspectiva multiescalar espacial y temporal. Los estudios desarrollados en diferentes regiones mediterráneas como el Sur de Francia, la isla griega de Delos y las montañas libanesas y jordanas proporcionan nuevos elementos para una historia de los paisajes agrarios. Ponen de relieve la cuestión de los cambios del paisaje, la historia de las técnicas hidráulicas destinadas al control del suelo y del agua y de los agentes implicados. Los primeros resultados subrayan la complejidad y la interacción de las dinárnicas sociales y "naturales" en la configuración de los actuales paisajes aterrazados.

Abstract

All the Mediterranean regions are subjected to the same regime of rainfall, often violent and much localized in time. When this climate is combined to what the French geographer René Neboit named "la tyrannie de la pente" (slope tyranny), farmers face the problem of soil erosion and management of their water resources. Terracing is one of human responses to these constraints.

A multidisciplinary research mainly based on Archaeology, Soil Science and Geography was engaged according to a multiscalar approach both spatially and temporal. Studies led in different Mediterranean regions such as southern France, the Greek island of Delos and the Lebanese and Jordanian mountains bring new elements for a history of agricultural landscapes. They highlight the questions of landscapes changes, history of hydro-agricultural techniques intended to master soils and water, and their actors. The first results underline the complexity and the interweaving of social and "natural" dynamics in the shaping of current terraced landscapes.

Terraced landscape as an archaeological object

Agricultural terracing is a main feature of Mediterranean landscapes but its temporal dynamics are underestimated. These constructions are often perceived as the result of an intensification of agricultural practices and a population growth entailing a shortage of arable lands, or a support of specialized agriculture. Although they shape the Mediterranean hillsides, from costal hillsides to the slopes of mountainous valleys, these landscapes are generally associated to man's conquest over the mountain. Nevertheless, the common approach of the mountain by History and Archaeology was reduced at first to the study of pastoralism. It is then easy to resort to the notion of physical determinism, tinged with an anachronism which condemns the mountain to be only a marginal zone in the rural economy, at best dedicated to cattle, mining and forestry. All that a cautious eye can embrace is not only the fact of the Nature and human constructions do not always come to fit forms ordered by environmental components. This pastoral aspect is fortunately no longer the only objective of "archaeosciences" which have studied mountains for some years. As such, the international CNRS program on the "Anthropization and history of the environment in the mountains of the Southern Europe" (coord. J.-P. Métailié and D. Galop), in which our works find quite naturally their place, illustrates perfectly this new perspective under which forms, constituents and agro-silvo-pastoral exploitation of mountain landscapes.

In these ecosystems, more specifically in Mediterranean mountainous regions, where a very contrasting climate (strong snow coverage, frost-thaw, violent wind, rainfall often violent and very localized in time) combines to what the French geographer René Neboit named "la tyrannie de la pente" (slope tyranny), farmers face the problem of soil erosion and management of their water resources. Terracing is one their responses to these constraints. Soil is the heart of international debates which are not without influence on the trend of archaeological research. The "soil" directive of the European Community calls for an awareness of the environmental soil functions. The knowledge of these functions and of the impacts of human activities, particularly agricultural practices and their evolution is essential when one wants to appreciate and preserve the qualities of soils and natural waters. It is also why a better knowledge of this support of human activities and of the role of man and\or the climate in its exploitation does not take on only a historic interest. These researches also have a pragmatic interest: they contribute to a durable environmental and agricultural policy, especially in the Mediterranean mountains.

Mediterranean hillsides, generally terraced, are also convenient spaces to study the creation of a cultivated territory. The shaping of landscapes by agro-silvo-pastoral practices is a privileged subject in the study of the history of Mediterranean societies. This approach leads first of all to appreciate the evolution of socialized landscapes, by raising questions about their genesis, their chronology, means by which they were built, their laboring, causes of their transformation and their actors. It leads secondly to consider, through these landscapes, the history of agricultural societies, in a global Mediterranean perspective to define constants and peculiarities in the historic dynamics of Mediterranean agrarian structures according to Lebeau's definition (Lebeau, 1986).

This is the idea behind recent research led on Mediterranean landscapes, in association with P. Poupet (geologist and soil scientist), following a multidisciplinary (Archaeology, History, Ethnology, Geography, Earth and Soil Sciences, CNRS) and multiscalar approach, both spatially and temporal. Aspects of theses researches will be presented here through cases studies.

But, to define finely these modifications and to appreciate their temporal dimension, we need to be able to, first of all, date an agricultural landscape, and then date these changes. These landscapes are generally considered without history or definitely modern. Results obtained from an approach which associates field excavations and the study of soil characteristics preserved behind the terrace walls allow experts to undo the crucial problem of dating them.

A multidisciplinary and multiscalar approach

Dating agricultural terraces

Agricultural terraces were approached from several points of view by numerous geographers, ethnologists and historians. Most of these works concerned landscapes built in the modern and contemporary times. Pre-medieval terrace fields were not the object of a specific research. Many authors were interested in the question of the age of terraces, but they rarely really demonstrated it. Often victims of an immovable conception, these landscapes are considered as the result of age-old technical knowledge. When they are not regarded as such, their existence is for number of writers definitely modern. The most fearless admit that their construction in north-western Mediterranean goes back to Middle Ages, whereas researches carried on in Eastern Mediterranean basin, in Spain and in North Africa already suggested an old age for these constructions (Gibson, 1991; Barker, 1996; Ruiz del Árbol, 1999, 2003).

This lack of researches comes essentially from the difficulty of dating these fields. Before going into the reconstruction of landscapes history it is necessary to be able to put chronological poles. It soon turned out that Archaeology has limited means concerning agricultural features and more particularly terrace systems. How can we get evidence from walls of ancient terrace fields in the landscapes of the current mountain?

The historical and archaeological approach

The answer to this surprising question was brought recently with the opening of by pluridisciplinarity. The joint analysis of these landscapes by Archaeology and Soil Science allowed to demonstrate, in several mountains of the Mediterranean basin, presence of dry stone terrace fields during Antiquity which participate of landscapes still cultivated at present (Harfouche, 2002, 2003a). In some cases they give evidence of a long and recurring social history of farmers' communities which conquered alternately or abandoned the sloping spaces.

It seems so necessary to clarify a crucial and recurring problem of chronology to which no convincing answer was brought again. This need is all the more important as many writers still insist on the difficulty (even the impossibility) to demonstrate the age of agricultural terraces. Let us note that there will not be question here of strip lichets but only terraces with stone walls.

One can not reasonably give credit to architectural studies attempting to define typo-chronologies. These studies are very instructive but do not include the dating of a terrace. It is not a question of appealing to stone-cutters but to farmers who rely on what they have at their disposal. The most important factor is the natural geologic cut of the stone. So different techniques and building materials can coexist at the same time within the framework of the same project. One can see it on the Greek island of Delos and also in the Roman countryside of the city of Béziers (France) where dry stone terraces are built next to earth terraces within the same project. On the contrary, an adapted and so successful technique can be used on the same territory from Neolithic until today. The builders had an opportunist attitude by using the building material present on the spot. They maybe made a sorting among these resources (man consciously chose the stone X to put it in the place Y) but it is difficult to put in evidence.

In numerous works, notably in Greece and in Near East, the dating of terraces still visible in the current landscape lays on a reconstruction of the settlement history. It is based on field walking data and some excavations which deliver then maps of settlement density according to chronological periods. The construction of terraced systems is then attributed (depending on the appreciation of the researcher) to the chronological period the most represented archaeologically. The researcher identifies terracing operations at the most populated and by the same way at the most prestigious historical period (eg: classic time in Greece, Roman time in Italy, Nabateans in the South of Jordan, Phoenicians in Lebanon and Tunisia, Arabs of Al-Andalus). This approach can not obviously be considered as a demonstration, just only because no physical relation is established between terrace fields and archaeological sites. It is simply a hypothesis.

It is not credible either to argue only on the artefacts found on the surface of the terrace field to give the age of the construction. In such small space, it is not because one finds 70 % of Roman sherds on a terrace that this one is roman. A farmer of 18th century could destroy a roman site by ploughing the terrace which he built himself. These artefacts can also be the result of mannuring in a later period to the construction of the terrace.

Another common argument in the archaeological literature to support the demonstration of the age of terraces is the coherence of the terrace system with a dated farm. Even there, this argument alone is fragile because a farm could have been built on a previous terrace system.

Finally, carbon dating on isolated charcoals taken in the soil behind the wall are not good daters of the terrace if the soil was reshaped down to the bedrock as it is often done when the wall is built.

Only three field approaches really allow dating terrace fields.

The first is archaeological stratigraphy. It is possible to age a terrace when this one is covered by a dated layer or when the palaeosoil corresponding to the terrace is recognizable and datable. The study of the palaeosoil can also inform about the contemporary environmental conditions. However, the anlysis of ancient terraces by excavations is still rare.

Stratigraphic connections between terrace walls and a dated building still visible in the current landscape suggest also a relative chronology. It is not useless to remember that a link can be established between a field and a farm only if there is a chronological relation between two structures through intersected or superimposed walls.

The third demonstration recovers from Soil Science.

The pedological study

With the evocation of all these limits and pitfalls, it appears extremely difficult to estimate the age of terraces in the current landscape when they did not undergo any covering. A solution is outlined then in the choice of privileged sectors and by appealing to other disciplines as Soil Science. The soil appears today more and more as a recorder of the important modifications which underwent an environment. It is generally neglected in scientific and public debates especially by historians and archaeologists who work on rural spaces and agricultural practices. It is nevertheless a tremendous recorder of evolutions, changes and rhythms of landscapes history. It is also the support of the activities of the agricultural production, the raw material of the farmer. Agropastoral techniques are not independent from soil quality, from their conservation and their improvement and from mastery of superficial waters. Recently, the world congress of Soil Science in Montpelier in 1998 with the symposium "Attitudes to soil care and land use through human history" (coord. P. Poupet and D.Yaalon), and the international colloquium "Autour d'Olivier de Serres" in 2000, reaffirmed the importance of soil knowledge for the understanding of past societies and the necessity of a trans-disciplinary approach (Harfouche, 2002; Poupet, 2001).

A pedological approach of the soil behind the wall authorizes to date the construction of the terrace wall, so that of the terrace, due to the analysis of its pedological characters which inform about its history and its age. So that a soil can develop observable characters and so one can hope to obtain data on the quality of the environment (as the more or less big abundance of water or the existence of a dry or wet atmosphere), it needs time, a lot of time... This time is an essential point because it is the heart of the analytical methods which allow appreciating the dynamics of landscapes and the modalities of their transformation on long-term.

The soil is an organized and structured natural environment in constant evolution. It is so a dynamic middle which possesses a fourth dimension: temporal. The mineral and organic constituents of the soil have behaviour which participates to its transformation. The characterization of their organization within pedological structures allows distinguishing more or less differentiated soils, so more or less developed. During the construction of a terrace maintained with a wall, pedological sediments on the hillside are mixed by man generally until the bedrock on which he bases the first sat of the wall. From this moment which corresponds to the date of the construction of the terrace the "pedological clock" is put back to zero. So, when one is sure that the beginning of pedogenesis and soil horizonation corresponds at the time of the construction of the terrace wall, one can estimate the age of the construction of this terrace. It is so the understanding of soil kinetic which allows localizing this moment on time scale.

The best way to obtain elements of dating for agricultural organizations is so to go where they are, that is in the soil of fields and in the organizations which participate in field systems. Excavations are necessary in well chosen places to reflect the variety of situations and the peculiarities bound to the various landscape units.

Terraced landscapes in their environmental context

The archaeo-pedological approach appears at the moment as the most suited for studying terraced landscapes history. But it is the crossing of sources within the framework of a multidisciplinary approach integrating vegetation and animal sciences, Earth and Soil Sciences, Geography, History and Archaeology, which allows by a game of scales more widely to approach societies through the landscapes they modify, in a way of space socialization. Analyzing human landscape is dealing with rural practices and with durability or changes that they infer in the environment. When the memory of landscapes actors can not feed any more the story of their activities, practices are usually found through objects, implements and tools, as well as constructions. In the best case, they are fed by data coming from Nature Sciences. An approach associating Archaeology and Soil Science allows to speak about soils and fields which are the support and the material of these landscapes (Poupet, 1988, 1998; Poupet and Yaalon, 1998; Poupet and Harfouche, 2000). It is so possible to collect data that directly concern the soil and that inform about the techniques of construction and preparation of the field, as well as about agricultural practices (holes of plantation, lines of irrigation, tracks of fossil ploughings, mannuring...). On another scale, this archaeo-pedological approach with sedimentary archives, palaeobotanical data, and archaeological and historical sources, shines the evolution of these stratified landscapes by putting in light phases of balance, threshold and break. It leads to wonder about mechanisms at the origin of these changes and to appreciate the role of man and\or climate in the shaping of landscapes. It also leads to identify answers and to measure time-answers of societies to environment and again of environment to human practices, according to various landscape units and to different types of space management (Harfouche, 2003a). It is also a matter of understanding techniques of soil and water management and also the transmission of agricultural knowledge. Finally, it is a question of enlightening agricultural practices and agrarian structures.

It appears in many cases that the construction of terraced landscapes goes back up to the beginning of the 2st millennium BC in southern France and to the middle of the 3rd millennium in Cycladic Greece and in the Near East. This demonstrates a space structuralization and a high knowledge of soil and water resources management especially on behalf of Protohistoric societies.

First steps toward a terraced landscapes history on a Mediterranean scale

Researches on terraced landscapes led within the framework of a doctoral thesis from case studies realized in about ten windows on the Mediterranean scale showed the variety of agro-technical solutions used according to the environment and the practices

(Harfouche, 2003a). Cultural terracing is not inevitably bound to a specialized arboriculture. In Mediterranean France, for example, between the 2nd century BC and the 2nd century AD, the extension of vineyards is situated in plains whereas Archaeology demonstrates the presence of terrace fields on hillsides (Harfouche, 2002).

There is however a link between terraced landscapes and water management in particular where water problems arise with most acuteness, in semi-arid climate regions. One hears at the door of the Jordanian desert: "a droplet costs more than a golden coin". This reality is also evident in the heart of the Mediterranean Sea on the Greek island of Delos terraced and irrigated landscape which is built in the middle of the first millennium BC, and also in the circum-Mediterranean regions, as in Neguev or in southern Tunisia where *jessour* is the ultimate technical illustration of this link.

Beyond the demonstration of the age of these landscapes and of their variety in techniques and practices, this work allowed to draw an evolution which is not linear but dynamic on the Mediterranean scale. First, the building of these landscapes towards the 3rd and the beginning of the 1st millennium, then the extension of these fields by the middle of the 1st millennium BC, their construction or their reconstruction (according to different places) between the 1st century BC and the 2nd century, and in some places from the 11th century.

But this rough shape has sense only because it is based on large-scale studies which reveal the spatial and temporal variety of dynamics and the interweaving of environmental and social variables in landscapes genesis and transformation. It shows that the construction of these landscapes is not always undergone in reaction to a population increase or to an expulsion of the native populations towards heights considered hostile by newcomers in a context of colonization for example, but it recovers from choices made by societies.

For example, in Mediterranean France in the same geographic conditions two similar and close hillsides at the top of which settled villages in the 1st millennium BC did not have the same evolution. The population chose to build terraces on some hillsides and not others, the hillsides exposed to the South maybe to set up there particular cultures. These choices were made at least since Protohistory. One even observes important variations in sedimentary deposits at short distances on the foot of the same hillside. In a case, for example, in only 100 metres of distance one passes of a zone where sedimentary coverings goes to 4 m in thickness with post-Roman cycles of sedimentation and of pedogenesis, to another zone where deposits are almost non-existent and where Gallo-roman archaeological structures crop out. The interpretation of these variations on short distances lifts the delicate question of choices operated by societies in the space management and that of the variables which were able to worsen an already difficult situation and to provoke the abandonment of field systems.

This variability from the Neolithic to the current day of landscapes and societies which shape them by agro-silvo-pastoral practices will be illustrated in this contribution through first results of three studies in Mediterranean regions: on the mountain of Enveitg in French Pyrenees, on the island of Delos in Cycladic Greece and on the hillsides of the high valley of Nahr Ibrahim in the Lebanese mountain.

Agricultural landscapes and margins in the Pyrenean region

Defining agrarian landscapes is to wonder about their contents. But one can also appreciate the nature of these spaces by questioning them about their limits, by bending over what is not the agricultural space, what is beyond and what one often assimilates to margins. From this point of view, the mountain offers a privileged place to study the meeting between agrarian landscapes and other spaces (fallow lands, forests and summering).

A Mediterranean mountain

The mountain of Enveitg (Pyrénées-Orientales, France) participates of the intramountainous continental plain of Cerdagne which corresponds to the high valley of Segre a tributary of Ebre river. The plain is surrounded with mainly granite powerful relief in the North as the massif of Carlit which peaks as height as 2800 m and of which the mountain of Enveitg is one of the hillsides. These mountains are cut by numerous valleys. Their streams feed the Segre and are at the origin of the plain sedimentary filling and of the multiple alluvial fans. Geologic conditions and history command the distribution of the villages essentially on the foothills with some exceptions in Spanish Cerdagne, on the banks of the Segre. One also observes a global distribution of production activities according to the height: The plain is the place of cereal and fodder crops, whereas above the villages, the mountain is reserved for the cattle and is organized itself according to vegetation levels and pastoral activities in intermediate pastures, forest of pine and summering grasslands.

Enveitg is a village in 1200 m height, in border of the plain of Cerdagne and a municipality of 3000 ha of which limits are that of the granite mountainous hillside. Behind the village raises the mountain with in closer the hamlets of the valley of Brangoli surrounded with woody fallow lands and the 2000 ha abandoned to the forest of pines and to grasslands devolved to cattle. These rise among 1600 and 2600 m height. They are punctuated by three horizontal surfaces which correspond to landings or *plas* dedicated to contemporary summer activities ("cattle summering") (towards 1900 m, 2100 m and 2350 m).

It is obviously the most suited spatial scale to the dialogue between the various disciplines which participate in the reconstruction of environmental history and the relations between man and environment. Seen at this scale, can the mountain of Enveitg be considered as an eternal margin, a kind of interval of space between intensely exploited zones close to the village and the limit of the crest of the mountain? Does this suburb enter, as by fate, in a centralized economic logic, the space being approached according to an altitudinal gradient which conditions at the same time territorial status and a unique exploitation system according to a "modèle gravitaire" (gravitary model)?

All these approaches seem bound (in a more or less aware way) to the economic theory of marginalism, appeared in Austria in the end of 19th century. But to identify a margin in the history, far from the modern savings, is not it at first to know the technical-economic laws of moment? It is true that in the model of the Greek town the margins or the *eschatiai* are not organized spaces in a systematic and permanent way. In the

Roman world the modalities of organization of the exploited territory give way also to margins or borders and on the controversies of which they were the object as reported by *agrimensores*. Can the mountain of Enveitg during Antiquity be this kind of space? When one knows that territorial divisions with different spatial logics exists, as non-centralized territorial organization and also a " centralité de complémentarité " (centrality of complementarity), one must be careful when looking at these landscapes, sites and production systems.

The first multidisciplinary researches

Archaeological, ethnological, historical and environmental researches are led on the mountain of Enveig for fifteen years. These multidisciplinary studies allow drawing gradually the evolution of a mountain from Neolithic times to Present day, but by approaching it until now essentially under the point of view of pastoral activities and cattle summering (Rendu, 2003). Almost 120 sites were listed in field-walking among which 20 were excavated. These sites are pastoral constructions: huts of different types, enclosures (pens), draw corridors. This archaeological work led to a typo-chronology of these constructions which goes from current huts to ancient simple or complex units. Their organization changes during time in relation with the technical-economic orientation of cattle-breeding. As in any archaeological research, the documentation coming from excavations and from field walking remains incomplete, but a huge amount of work was realized on a previously unexplored space.

Palynological analysis confronted with the density and the distribution of huts led to propose a first model of evolution of the mountain which underlines the complementarity of the various summering areas (Galop, 1998). Important clearings appear since the middle Neolithic on the forest borders, on foothills as in heights. The Early Bronze Age and the Middle Iron Age sign an opening of the intermediate spaces and the median *plas*. But it is in the Middle Ages that the environmental opening is unprecedented. In this model, Antiquity is a period of reforestation.

Carpological analysis were also realised on a hut situated on the first level of summering area (Ruas, 2003). A burned-out soil delivered several concentrations of carbonized wood of which cereal and wild plants seeds were collected. The rye dominates widely. Some grains of soft wheat and the waste of wild fruiterers are also present. These seeds are constituted with the rests of seavings. Their spatial distribution and the presence of numerous straw as well as associated weed suggest that the cereal was harvested around and transformed on the spot. A carbon date places the fire of this level in the 7th and 9th centuries. The main interest of these works is to ask the question of the existence of an agricultural activity in the mountain, in a space which was approached up to there under the silvo-pastoral point of view.

On the biogeographic ground, these cultures are possible locally and can get organized according to altitudinal levels. But what would be the support of it? What is the archaeological legibility of these fields?

Obviously until 2000 m height among grassland summering areas are also terraces which evoke agriculture (Fig. 1). Today these constructions are situated in the pas-

toral space looking like stone walls which mark platforms slightly oblique covered with grass. When were constructed these terraces? Are they agricultural terraces? Which type of agriculture was practised there? Did they undergo transformations during time concerning construction techniques and cultures they supported? What kind of soils do they protect against erosion? Which place do they occupy in the mountain production system?



Fig. 1. Archaeo-pedological excavation in a terrace on Enveitg mountain (Pyrénées-Orientales, France).

Terraces in a pastoral space

Three zones of terraces are distributed in the valley of Brangoli (1700 m) and on the first *pla* up to 2000 m. The geo-archaeological work having hardly begun in 2003, it is too early to draw up a general picture of the morphodynamic and pedologic evolution of these landscapes and of their agricultural features. We excavated ten terraces. These excavations put in evidence a real stratification of terraced and cultivated landscapes. We shall illustrate it by two examples.

The first terraced space appears under the shape of two big enclosures around terraced field systems on the bank of the torrent of Brangoli. They are today covered by grassy vegetation and small trees notably with brooms and with junipers. Around these enclosures, other groups of terraced fields streak the hillside. These organizations occupy what appears today as a pastoral space, but was it so before?

The excavation realized behind a terrace dry stone wall revealed the presence above the wall of the current terrace a more ancient wall partly destroyed which corresponds to the construction of a previous terrace (Fig. 2).

Archaeological stratification and pedo-sedimentary succession in these terraces reveal three phases of culture of slopes. A radiocarbon dating realized on a lens of charcoal situated on the surface of the palaeosoil of the most ancient terrace indicates that this constructed field was cultivated at least since the Bronze Age. The soil of the visible terrace at present developed on a colluvial deposit. This sedimentation settled in a short time which allowed developed soil to form through all the thickness of the deposit. The

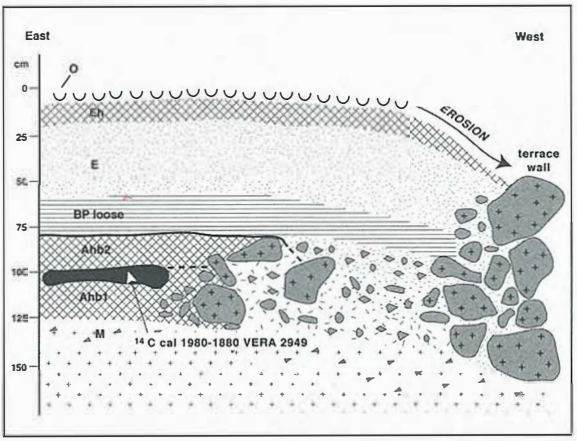


Fig. 2. Complex soil profile behind a terrace wall (Enveitg, Pyrénées-Orientales, France).

degree of evolution of this soil (podzosol) indicates that it involved a long-term constitution. It can be ancient. Generally speaking the pedological analysis shows that the transformations which affect hillsides were long-term changes.

In the light of these data one can revise palaeo-environmental data concerning a reforestation of the mountain during Antiquity. Indeed, one observes in palynologic diagrams during the two centuries BC an increase of the percentages of pine and a decrease of Poacea and pastoral indicators (Galop, 1998). The decrease of the percentages of the spruce and the birch would mean an intensification of activities on foothills. During the Antiquity, the pine reaches its maximal values and the presence of cereal is connected with supposed cultures situated in the plain. The ratio Pine/ Poacea evolves in the same sense of a reforestation during Roman times. Nevertheless, from the end of Iron Age to the early Middle Ages the low mountain supports an occupation demonstrated by Archaeology from the excavation of huts and the study of charcoal exploitation structures dated between the 1st and 3rd century. One knows also the ambiguous value of some indicators as cereal pollens which can have been brought by sheep or can come from very close cultures because they have a reduced dispersal. Anthracological analysis on charcoals coming from a hut occupied during Antiquity also inform about ligneous vegetation in the era (Davasse, 2003). They bring important results concerning the reconstruction of the surrounding vegetation. Carbon dating was made on hearths. Anthracology confirms between the 4th century BC and the 7th century a strong presence of pine but it also shows since the 1st century the increasing presence of the broom and juniper. To be clearer there is a constant progress of the leguminous plants which the anthracologist interprets as a tendency to the opening of the forest.

On the middle mountain the first *pla* forms a large area of lawn on the top of a valley in soft curves. The valley is blocked across by several very light grassy banks. Some are the result of the natural erosion and from the accumulation of arena and pedological sediments behind stone blocks moved on the hillside. Others, of a more important size, are real man-made constructions, terrace walls. Even there, behind the wall of the current terrace we identified the wall of a former terrace. Phases of construction, abandonment and reconstruction of these fields were identified. The ancient terrace and the cultivated soil developed on the granite can be dated at least of the 2nd millennium as it iwas demonstrated below on the mountain. The current terrace is then established with colluvial deposits stratigraphically posterior to the age of the underlying palaeosoil. A radiocarbon date giving a result of the 3rd millennium is there only to prove, if it was necessary, that erosion always transported charcoals on the slope.

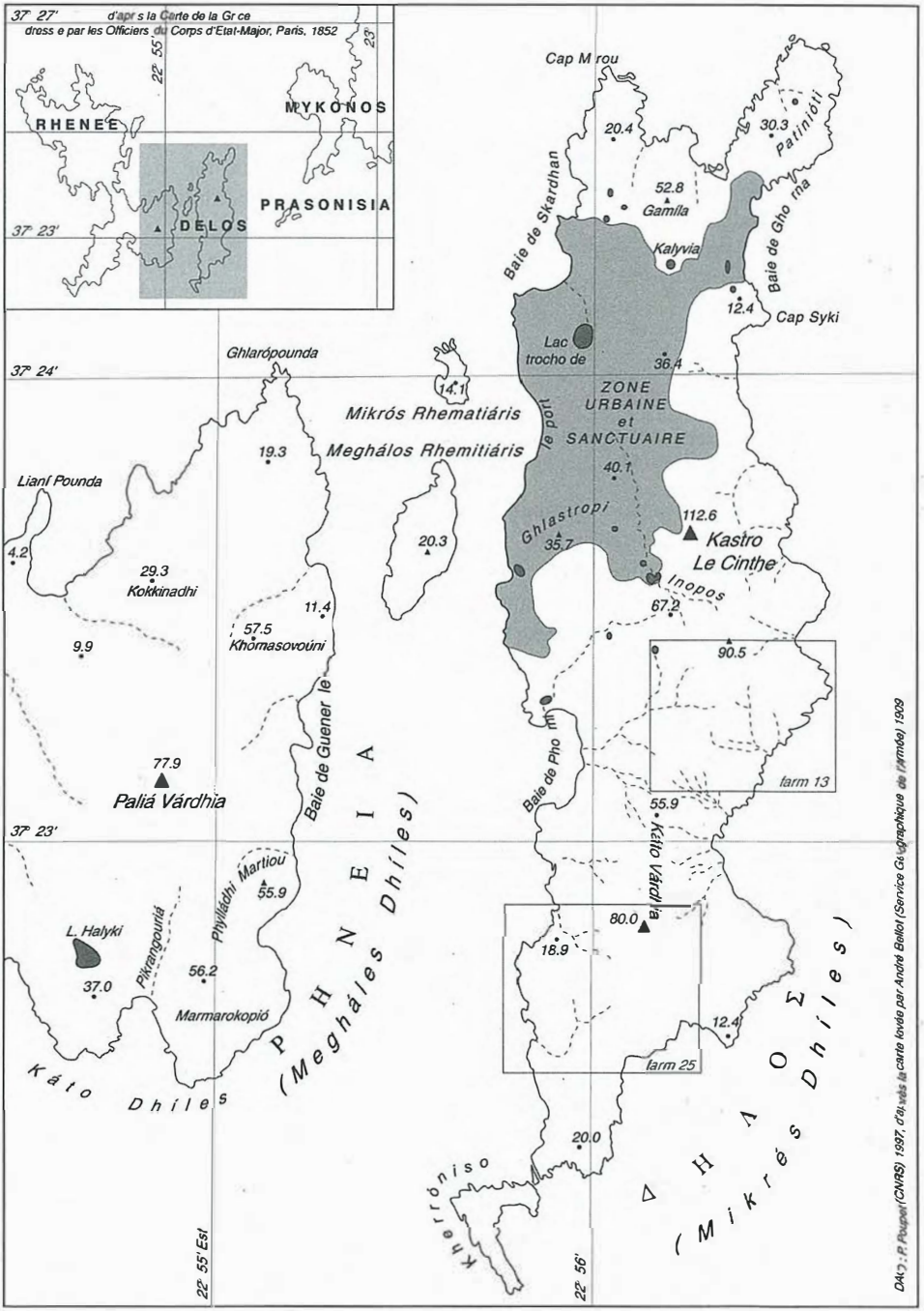


Fig. 3. The island of Delos and the position of farms 25 and 13 (Cyclades, Greece).

All these excavations show a long history of the pedo-sedimentary phenomena which modify hillsides in relation with human activities, in particular agricultural practices. Some organizations could participate of ancient field systems according to soils kinetics. Others are part of the shaping of the mountain agricultural landscape since the 2*nd* millennium. The continuation of the archaeo-pedological work will allow us to understand more about the history of these landscapes. These first investigations have already allowed to study a field construction for agriculture in mountains where one did not expect it, on the ground returned to the forest and to the cattle, and that at least since the Early Bronze Age.

The example of the mountain of Enveitg shows interweaving and coverings of the pastoral and agricultural spaces during time. It illustrates the unstable limits of the agrarian landscapes which fluctuate according to the production systems of peripheral zones.

Farther to the east of the Mediterranean Sea, the island of Delos is a real conservatory of ancient landscapes shaped by agro-pastoral practices.

"Conservatory landscapes": the Delian case study

The Delian landscape

Delos is a small Greek island of Cyclades about 5 km from the North to the South for only 1,3 km in its biggest width (Fig. 3). This size has the advantage to offer a field of search to human dimension which can be intensely investigated because the surface of the island is about only 360 ha.

Except the northern plain occupied by the ancient city and the sanctuaries, the landscape of the island is a succession of granite relief presenting numerous emergences in shape of chaos of enormous stone balls (tors) or rocky paving stones (Fig. 4). The soils of the island form a mosaic where mix the best and the worst in terms of agronomy (lithosols, regosols, fersialsols, brunisols, luvisols). As in most of the Cyclades islands with a semi-arid climate, water resources are a problem for agriculture. Annual precipitation is today between 140 and 656 mm (annual precipitation recorded between 1955 and 1997 on the nearby island of Naxos, situated in about 30 km South of Delos). They are very irregular from one year to the other and concentrated on short periods in autumn and winter. It is necessary to add to it, in a lesser measure, "occult precipitations" and the capacity of keeping water of the much fractured granite rock and of soils sometimes thick. At present the island lacks permanent stream but it is crossed with numerous small brooks and have many springs. The current vegetation is very degraded that is why the island has the reputation of a dry and sterile land lost on the sea, globally unfit for agriculture.

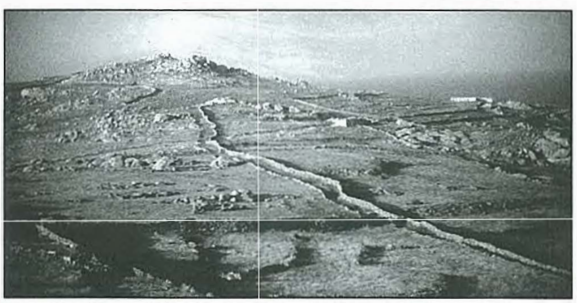


Fig. 4. Landscape of southern Delos (Cyclades, Greece).

An island built for agriculture

Nevertheless, in this very mineral landscape ancient rural constructions were identified since the beginning of the 20th century. Farms and their agricultural fittings are distributed within terraced field systems (Fig. 5). All the surface of the island with the exception of the space occupied by the city and the sanctuaries forms a real ancient not protected rural conservatory. Fields belong for the major part to the ten estates named in registrations engraved in the marble, between the end of the 5th century and the middle of the 2nd century BC by the administrators of Apollo's sanctuary (Fig. 6). They supply information about farms, cultures and leases conditions.

Delos is occupied since the second half of the 3rd millennium until the 7th century AD. It is then totally depopulated. Archaeo-pedological excavations realized in terrace fields supplied the material evidence of the very old age of this agricultural constructed landscape. The pedolog ical characters of the soil behind a terrace wall is those of a very developed soil (eluvic fersialsol), plurimillenary (Fig. 7). The beginning of the evolution of this soil is contemporary of the cons-

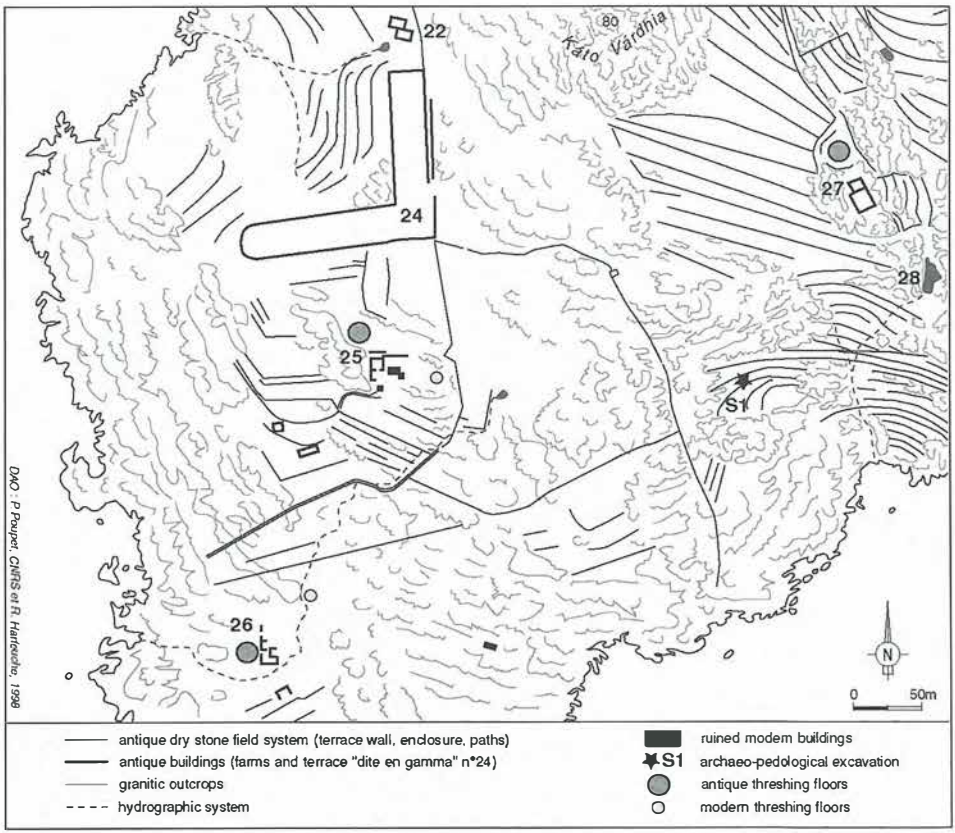


Fig. 5. Map and photo-interpretation in part of Delos southern territory around farm 25 (Cyclades, Greece).



Fig. 6. Agricultural terraces in southern Delos (Cyclades, Greece).

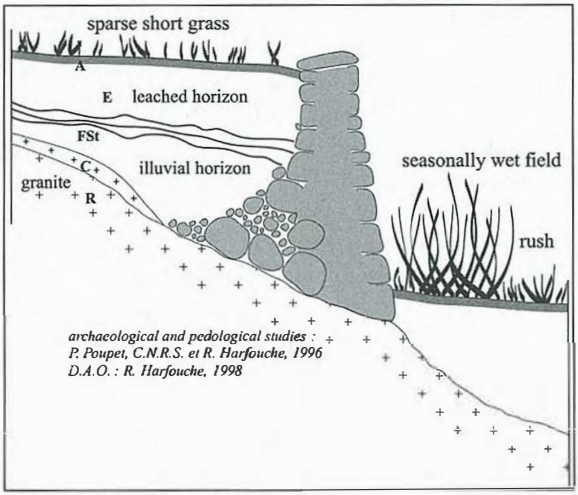


Fig. 7. Profile of a developed soil behind a terrace wall on the island of Delos (Cyclades, Greece).

truction of the wall of the field as the archaeological stratification shows it. The construction of the wall of the terrace required the reorganization of the pre-existent soil on all its height to set up the base of the facing and of a heap of stones to insure drainage behind the wall. So the "pedological clock" was "put back to zero" at the time of the construction of the terrace. Very comparable results were obtained thanks to multidisciplinary investigations led in Methana's peninsula, in Argolid (James *et alii*, 1994). Besides the practice of irrigation demonstrated by Archaeology vineyard and fruit trees were cultivated on terraces and were registered in leases. Anthracological and carpological analysis tend to show that the olive growing existed on the island. Classical threshing floors give evidence of the important part of cereal and leguminous plants in alimentation. The very developed soil found behind the terrace grew in a Mediterranean climate very close to the current. Climatological and geomorphological studies conclude also that current climatic conditions were those of Antiquity. This soil gives evidence also of a long history with a balance in relations between man and environment.

An agro-pastoral exploitation

In this small ancient landscape built for agriculture, did cattle have a place? Was there a competition between the world of cultures and that of breeding as underlines it P. Brun or complementarity (Brun, 1996: 102) ? A deep debate was committed in the end of 1980's among the supporters of a specialization of the breeding and the opposition between the breeders (often considered as nomads) and farmers in the economy of the Greek town (Skydsgaard, 1988) and the supporters of an exploitation integrating agro-pastoral resources (Hodkinson, 1988). Actually, if one goes through the epigraphic archives relative to the breeding in ancient Greece (Chandezon, 2003), the registrations which are interpreted as testimonies of conflicts between farmers and breeders are too rare and ambiguous. Also, archaeozoological studies and archaeological excavations in rural contexts miss to the debate especially for historic periods.

On Delos an archaeozoological study on the bones discovered in the excavation of a classical farm showed the predominance of sheep and goats (77 % of the rests) with regard to the pigs (19 %) and the weak proportion of the oxen (2 %) (Leguilloux, 2000). Delian registrations also state sheepfolds and cowsheds in farms and a rule which punishes damages made on vineyards by the small cattle. It led historians to see on the island as on all small Cyclades a cattle management exclusively based on the stalling. These conclusions lean also on extrapolations on other laws promulgated in the Greek world notably on the islands of Amorgos (*IG* XII 7, 62 l. 35) and of Ios (*IG* XII, 5 , 1-2), who forbid the wandering of cattle on the lands of the gods. Now, these sources make references to fields of the sacred estates. What was the management of the farmlands which did not possess a religious status? Furthermore, penalties of the Delian rule indicate indirectly that the cattle left its space of stalling during the year.

The farmers exploited a landscape essentially built for the agriculture but in which the cattle has a place that one can approach from the morphological analysis and soil analysis. The example of the farm 13 is an illustration of it (Fig. 8). This farm is built on the southeast hillside of the island in limit of granite rocks and cultivated soils. A classical threshing floor is built near as well as other buildings. The function of these structures is still unknown (agricultural, pastoral?). The Greek texts and the Latin agronomists mention oxen for ploughing and threshing (Harfouche and Poupet, 2003). Around this farm terrace systems occupy all slopes, including in the beds of the temporary rivers where terrace-dams like North African jessour are built. The semi-arid climate of the island imposes to farmers to take the best part of water resources. During rainfall sediments accumulate behind the walls of terraces. This temporary water allows also to maintain much longer humidity necessary for cultures in the soil and even to irrigate them. To the north of the farm, the excavation and the study of an ancient reservoir and its irrigation system indicates that irrigated cultures were practiced on the island during Antiquity (Poupet, 2000). The meteoric waters were collected in this pond built against a vast rocky *impluvium* like in the systems of water supply in the predesertic regions in East and in North Africa (Harfouche, 2003a). The storage capacity of this pond is 2000 m^3 what makes it the most important water reservoir of the island.

The morphological analysis of enclosures and paths informs also about cattle management in terraced landscapes. The field systems get organized on both sides of a

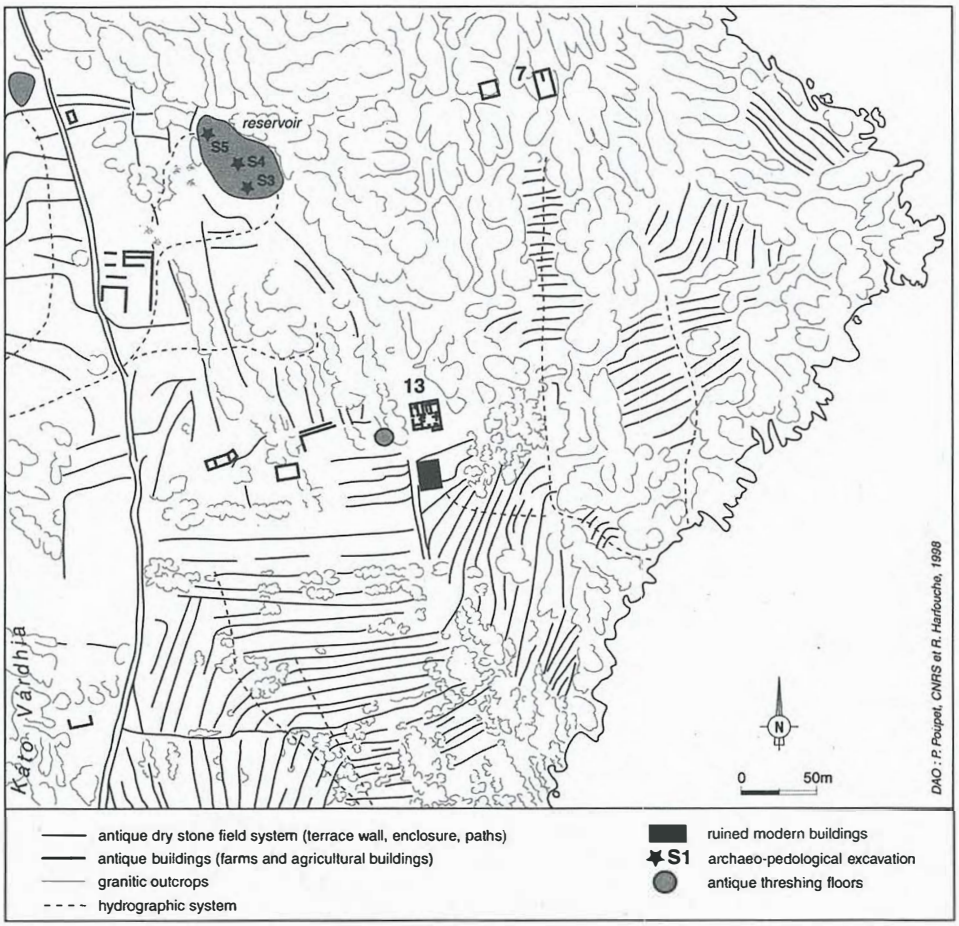


Fig. 8. Map and photo-interpretation in part of Delos southern territory around farm 13 (Cyclades, Greece).

long path of north-south direction. This major axis forms the backbone of the island from the city to the rural estates. It is limited by dry stone walls which protect fields situated on both sides from cattle ramblings. A terrace wall acting also as enclosing wall east-west leans on this road. Two different terrace systems get organized on both sides of this wall which forms a limit between two properties. The cattle run for food does not limit itself to the uncultivated spaces present on the island. The farmers had to protect their fields but they also had the possibility of cattle grazing on the field after the harvest. This practice was used on the island in May 1864 when L. Terrier visited it. This testimony also underlines the importance (underestimated by modern historians) of vegetation reconquest in the evolution of the environment of the island. The pasture after the harvest could also be made on an orchard. On the Cycladic island of Ceos a custom in the 18th century gives for one person the right of pasture on the field cultivated by the other one after the fruits harvest (Doukellis, 1998). Even today, in Cyclades, crowds of sheep graze in orchards. As P. Doukellis writes, there is no opposition in the terraced space between

cattle and cultures, there is only a separation in time. Also the straw left after threshing is a substantial food complement.

We must not forget that Delos soils are a mosaic where mix the best and the worst in terms of agronomy. Vegetation plays an important role in the production of biomass which will be integrated into minerals in soils to constitute its structure. Altogether the granite cultivated soils on the island call fallow (the rest of the soil recommended by Xenophon, Latin agronomists and O. de Serres in the 16*th* century) which allows to reconstitute a reserve of humidity by ploughing and the reconstruction of feeder principles (Varro, I, 29; Columella II, 4 and XI , 12; Palladius II in IX; Pliny XVIII, 181; O. de Serres II, 2). But these soils require also a fertilization to substitute takings made by plants because if fertilization is not sufficient soils become less productive. The contribution of organic matter is then essential and the only solution is to favour breeding. Greeks were aware of the utility to leave on the field vegetation to fight erosion and for the enrichment of soil. In Delos, fields could be amended with the manuring coming from sheepfolds and cowsheds of farms.

The Delian landscape gives evidence of these rare ancient landscapes preserved without sedimentary coverings where agricultural and pastoral practices contributed to shape topography and to soil and water management. The oriental Mediterranean Sea counts other types of landscapes, stratified, where one practices a non mechanical agriculture, non destructive, as in the Lebanese mountain.

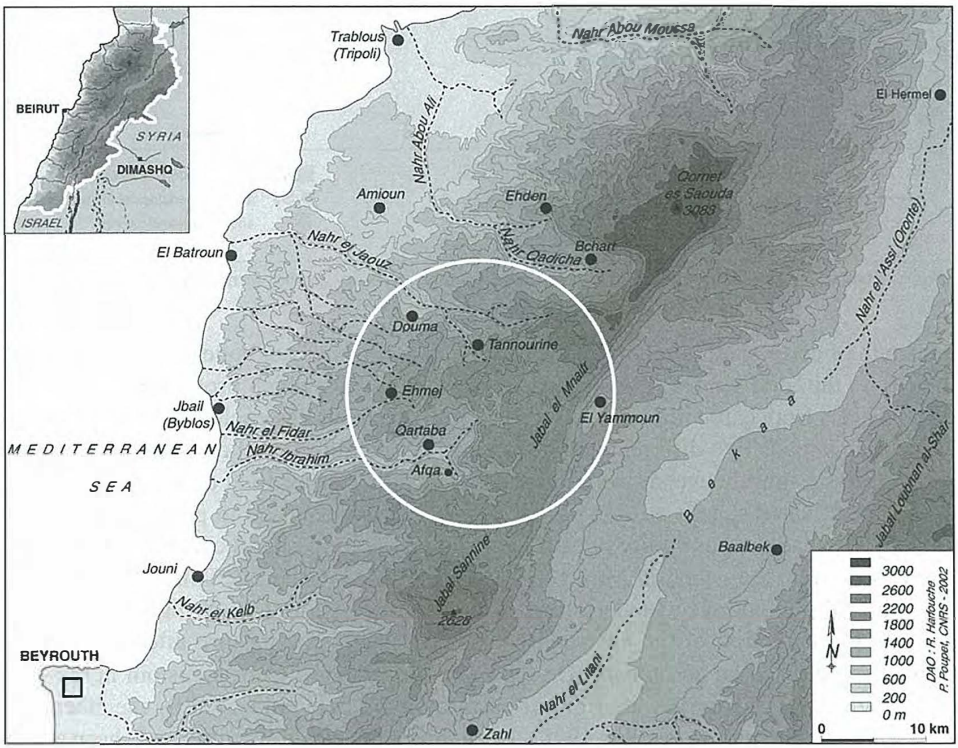


Fig. 9. The high valley of Nahr Ibrahim in Jabal Loubnan (Lebanon).

The shaping of slopes in the Lebanese mountain

Staged spaces or pervious borders?

Let us leave the small island relief for the Mediterranean hillsides of the Lebanese mountain, on the roots of the Nahr Ibrahim river, also named Nahr Adonis in Antiquity, in the back-country of Jbail (ancient Byblos), 20 km far from the coastal city (Fig. 9). In this region, constructions for soil protection against erosion reached their paroxysm. The sub-current exploitation of the environment means an intimate link between breeding, agriculture and fruits culture. We discover (especially since 2001) the rich documentation of this preserved country concerning fields, orchards and the cattle, on long-term as in Enveitg and without a big break in the settlement as in Delos.

The high valley of Nahr Ibrahim is a deep valley with essentially soils developed on limestone and sandstone. Structural history and erosion cycles shaped horizontal surfaces on hillsides slightly tilted towards the valley on which settled farmers' villages. The rest of the hillside is a succession of cliffs and slopes punctuated with rocky emergences. The pedological cover is mainly composed of fersialsols next to much less interesting soils for agriculture (peyrosols and lithosols). Unlike the island of Delos water resources do not miss. Under a rather dry aspect in summer Mount Lebanon is the rainiest mountain in the Near East. It receives on average between 1000 and 1500 mm of rain a year. Numerous and powerful springs at the foot of height tablelands feed permanent torrents. The summits covered with snow contribute also to hydraulic resources. The morphology of the landscape and the hydrogeology favour the altitudinal distribution of field systems and activities which are bound to this natural context (Fig. 10). This altitudinal distribution is clearly present from South to

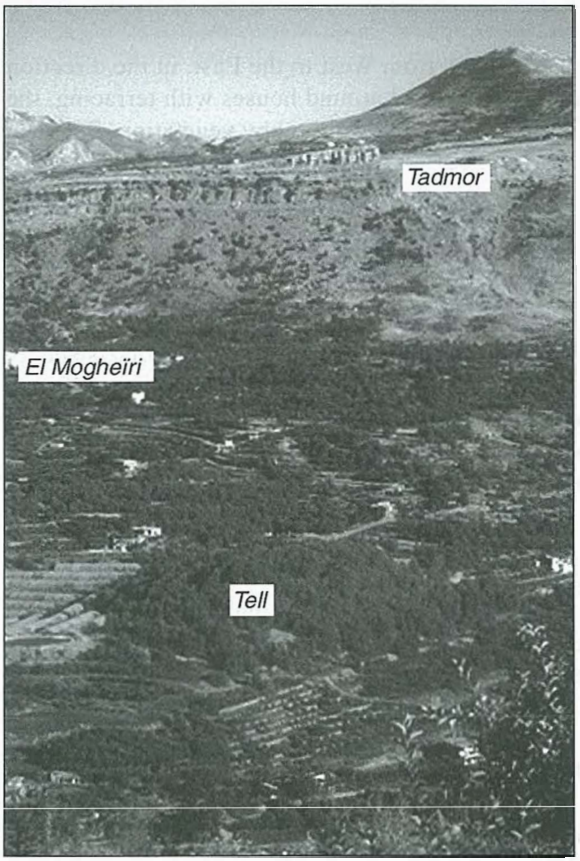


Fig. 10. Landscape, field systems and ruined village (Tell) at El Mogheiri (Qaza of Jbail, Mount Lebanon, Lebanon).

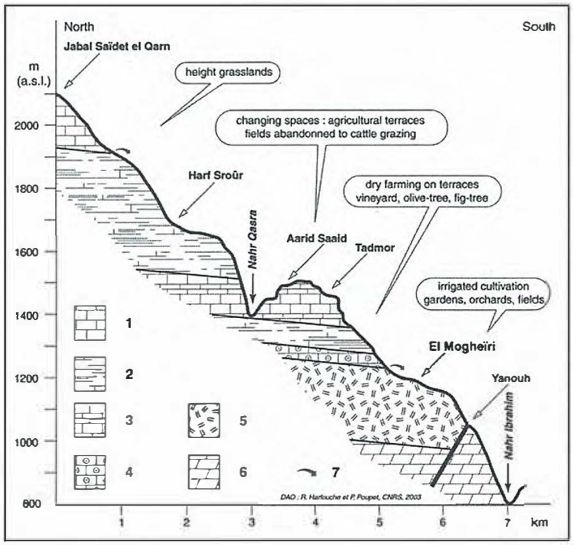


Fig. 11. Topographic and geologic section of the northern hillside of the high Nahr Ibrahim valley at El Mogheiri (Qaza of Jbail, Mount Lebanon, Lebanon).

1- Limestone, Marley-limestone, Dolomite and Dolomitic limestone of Cretaceous and Cenomanian.
2- Sandstone, Clays, Marley and volcanic material of lower Cretaceous and Albian.
3- Limestone of the "Falaise de Blanche" (Aptian).
4- Oolithic limestone and Biocalcarenite of Jurassic.
5- Volcanic breccia, Basalt and Marley of Oxfordian.
7- Permanent sources. The distribution of soil exploitation patterns seems to be linked to height and hydrology.

North, perpendicularly to the river, as well as from West to the East, in the direction of the valley (Fig. 11). Except hillsides cultivated around houses with terracing, the current landscape (often mineral) is covered with a thin shrubby vegetation. Between 1500 m and 2000 m height appear the spruce and fragments of the primitive *Cedrus* forest.

The precious contribution of Ethnology

In this mountain where men practise another kind of agriculture, a non mechanized and pre-industrial agriculture, Ethnology brings its contribution to the understanding of the history of landscape exploitation, to that of practices and techniques as well as to all the stages of the agricultural production, from ploughing with the traditional plough and the hoe to the harvest with sickles and to the threshing. There is a close link between breeding and terracing. On these soils devolved to agriculture, the cattle of the farm is generally made of two oxen or cows for the hitched work in fields and for the domestic milk and cheese production. A mule completes sometimes this livestock. Some farmers possess also a small breeding of sheep and goats which are in stalling during the long winter months. After the snow melting they are led on the high tablelands, in these zones exclusively dedicated to breeding and where landscape was affected by this activity: outcrop substratum, rocky substratum and very degraded thin vegetation on mainly lithosols. At a lower level, changes in soil exploitation make these spaces formerly devolved to agriculture become privileged places for cattle.

Rural landscape is finally shared between lands for cattle on one side, fields on the other one, with however a certain accessibility of these last ones for cattle after the harvest. Fersialsols maintained on hillsides by terrace walls count among the most fertile soils of the planet. To maintain their productivity, farmers practise fallowing, but the most common process is the manure (*zibl*) transported from the cowshed on fields after



Fig. 12. Herd of goats grazing on abandoned terraces on Tadmor's plateau (El Mogheiri, Lebanon).

the harvest. The proportion of the cattle with regard to the surface of soils is too weak so that the stalling produces the sufficient quantities of manure. So, the residues of the threshing are partially buried in the field after the straw (teben) was collected for the cob-construction, the litter and the feed.

On Tabmor's cliff (Palmyre in Arabic) occupied by a settlement from Antiquity to the Middle Ages, a still visible threshing floor is built on the limestone substratum. The border is made with a simple pile of rubble stones and blocks. Whereas on the irrigable hillsides below Tadmor's plateau no threshing floor is visible. During the harvest with sickles, and only in this stage of mountain (between 1000 and 1200 m) the circular threshing floor is built on the most windy terrace field, with a well smoothed and adobe-like cob. A strip of cob is built to form a border around the threshing floor. This short-lived area will be destroyed after the threshing, the cob materials being integrated into the soil of the field by ploughings. In fact, the only visible track of the threshing activity is the threshing implement itself: the *maouraj* which is the ancient *tribulum*. This is one of several examples in which Ethnology in this preserved traditional mountain throws a light on the silences of Archaeology to understand agricultural practises.

Actually, farmers and breeders exploit the mountain according to an altitudinal division of production activities but in a non compartmentalized space. Borders between cultivated soils and lands of pastures are pervious. The cattle moves according to agreements and demands among the farmers and the owners of the animals. One exchanges the right of pasture on a terrace field for some milk or some cheese or against loads of manure (Fig. 12). The stony field system made of fenced terraces and paths lined with walls limit the ramblings of animals. The course of the cattle does not limit itself to the fields of harvested cereal. In this mountain, one lets also graze sheep in orchards for the invaluable manure.

In recent past and even today in Lebanese mountain agriculture, breeding and forestry participate in an integrated economy which expresses itself through the aspect of field systems and through rural practices. Current landscape takes also its roots in Antiquity.

The burden of the historiography

Even recently, historians together with architects specializing in ancient monuments and with some archaeologists who ventured into the high valley of Nahr Ibrahim saw in this mountain only a way through between the farnous Phoenician coastal cities and the plain of Bekaa. They contemplated this mountain with its numerous Hellenistic and Roman temples and its rock-graves. Some discoveries of Bronze Age artifacts in

caves are interpreted without convincing arguments as testimonies of temporary activities (Baroudi and Ghaouch and Kallab, 1991; Salame-Sarkis, 1991). Modern writers even see in the artefacts collected in different places of the mountain the signature of men devoted to the wood exploitation and crime (Chevallier, 1971: 4-8). The legibility of the agricultural and pastoral exploitation of the Lebanese mountain is nevertheless directly approachable to whom search for it. Rural history is written in the stone. The stones of the press-bed, the cutted rock to crush grapes and the rock tank are attributed to a modern exploitation, in best medieval, without any element of dating to support such assertions. This so-called uninhabited mountain carries also Roman forestry registrations engraved on order of the emperor Hadrian (117-138) (Breton, 1980; Abdul-Nur, 2001). These registrations inform us about the ancient forest and its management. This Lebanese forest was famous for its cedars so desired as shown in the frieze of the wood naval transport in Sargon II's palace (8th century) in Khorsabad (Assyria). Basing themselves on the interpretation of this exceptional documentation as well as on schemes taken out of their imagination, modern authors asserted that the agricultural development of the Lebanese mountain begins only at instigation of the first Christian villages (Alpi, 1998: 204). Before this civilizing effort the mountain is described as a space crossed by marginal populations of hunters and woodcutters and stays so during all Antiquity and Byzantine times a huge forest (Planhol, 1993: 158-159). Recent excavations led on the Chhîm's Roman and Byzantine village (back-country of the ancient city of Sidon) by the Polish team of the Varsovi University allows today to question (if it was still necessary) these primitivist assertions. However, these researches concern the settlement in the first coastal hillsides and not the mountain *stricto sensu* (Waliszewski, 2002).

Toward a history of a mountain system

Therefore, the settlement history of the mountain is still widely underestimated. The first archaeological works on rural space we led recently showed that this mountain where men come, according to the historians, epigraphists and architects, only to pray and to die in rock cut graves, was in fact inhabited since Bronze Age (Harfouche and Poupet, 2001). It was not only inhabited but also already built with terraces. A real Tell remained invisible to the eyes of former researchers who focused on the monumental temples and churches and on the epigraphic archives was easily discovered on a hill which dominates the valley in the locality " el Khrayeb " that is the ruins in Arabic (Fig. 10). One had recognized in it (under this revealing place-name) the ruins of some buildings identified with Maronite chapels (Assaker, 1990). In fact, this ancient village probably surrounded with a wall is occupied since the Early Bronze Age (2500-2000) until medieval times. It proves that the mountain was not only a place devoted to religious activities, a vast space for a controlled silvicultural activity and a set of graves. Archaeopedological excavations realized in agricultural terraces nearby the tell and the Byzantine basilica allowed us to put in evidence a real stratification of the rural landscape as in the mountain of Enveitg (Harfouche and Poupet, 2002) (Fig. 13a).

Four phases of construction of hillsides were put in evidence (Fig. 13b). The most unexpected result is the discovery of levels of permanent occupation and of landscape organizations older than the Hellenistic period, one dated of 10-6th century BC and

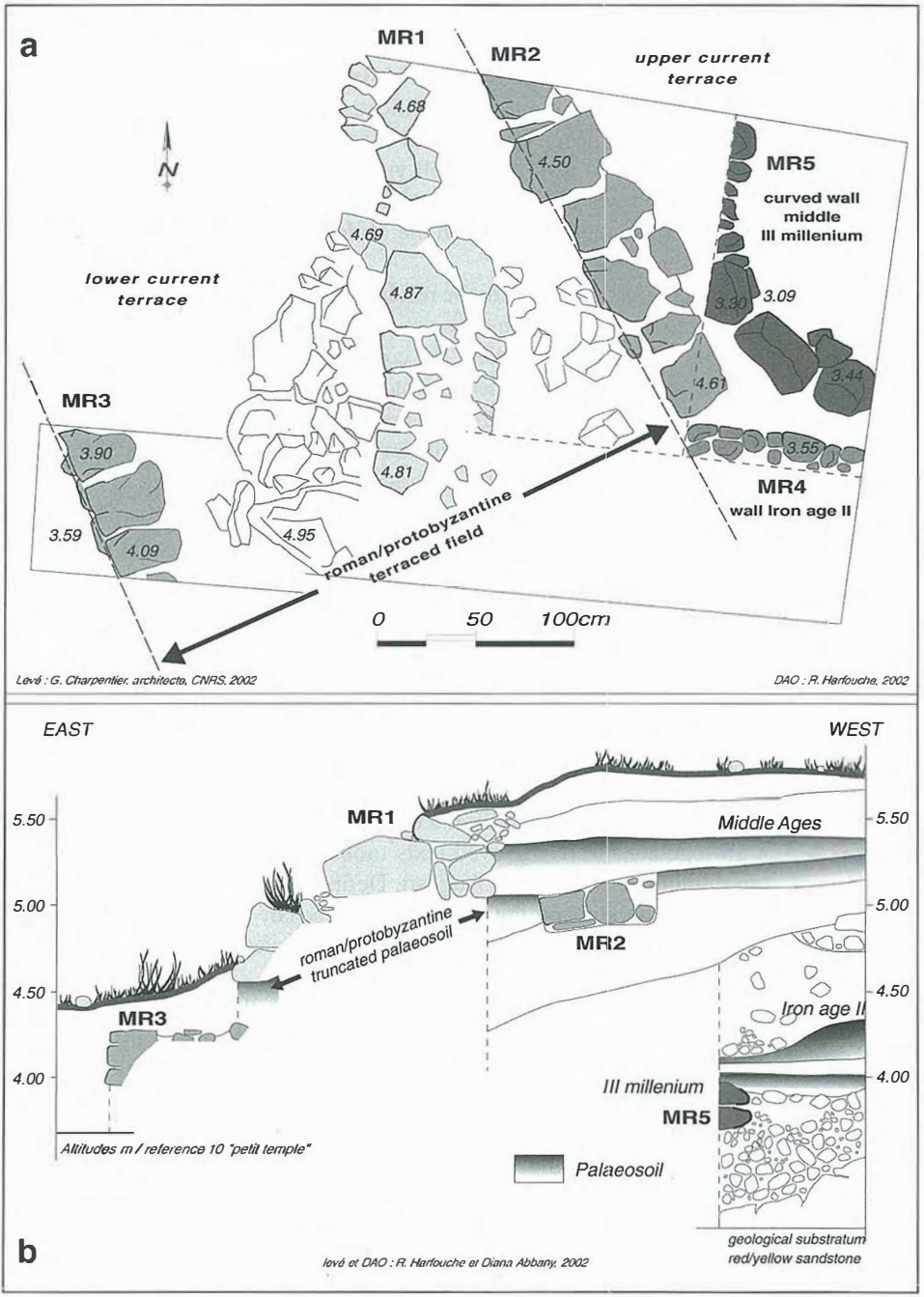


Fig. 13. Plan and section of an excavation behind a terrace wall in the High valley of Nahr Ibrahim (Mount Lebanon, Lebanon).

the other one of the 2nd and\or the 3rd millennium (MR5). An agricultural terrace system previous to the current fields was also discovered. Two parallel walls (MR2 and MR3) staged on the hillside participate of a terrace field dated of roman to proto-Byzantine times. Stratigraphy demonstrates a cut in the stratification corresponding to a reorganization of the hillside posterior to the terraces walls. It consisted of a cleaning of part of sediments present on the slope. The wall of the still visible terrace (MR1) is in connection with two post-Byzantine phases of cultivation. Another excavation put in evidence two phases of agricultural terrace on the hillside in the Middle Ages, the most ancient going back up to the 12-13th centuries.

The confrontation of these data with the results of archaeological excavations realized on the ancient sanctuary and with the observations on soils outside the site reveals bit by bit the history of the hillsides of the valley. The construction of terraces requiring elaborated techniques and a lot of coordinated men to protect soils on slopes and to master superficial water, it is striking to notice that these works are probably already made since the IIIrd millennium. Since the 1st millennium BC the human occupation of hillsides appears more acute. It will last till the end of 7th century. During Roman times the pressure of agricultural and silvicultural practices on the environment is evident. The emperor Hadrian tries to regulate the exploitation of the forest by rock registrations, engraved along the valley between 250 and 2000 m of height (example of the registration n° 5001):

IMP [ERATORIS] HAD [RIANI] AV
G [VSTI] DEFINITIO
SILVARVM
(Demarcation of the forests of the emperor Hadrian August)

However, in the current state of researches on the landscape, nothing allows to assert that these registrations are used to limit a big movement of clearing (Gatier et alii, 2001: 113). Put all together, these engraved texts (about 250 registrations) deliver the following message: Imperatoris Hadriani Augusti, Definitio silvarum, Arborum Genera Quatuor cetera privata, numbers and the sigla VIG (On behalf of the emperor Hadrian August; Demarcation of forests; Four kinds of trees [are reserved for him], the others to the private individuals).

We ignore which were the four essences reserved for the use of the emperor. Considering that these woods were cut for the naval architecture and considering the current vegetation, historians and geographers identified these four essences to *Cedrus libani, Abies cilicica, Juniperus exelsa* and *Quercus sp* (Vaumas, 1954).

Which place occupied the cattle in this forest controlled by the emperor? Two types of registrations inform about the use of forests within the framework of the *definitio sylvarum*. This forest regulation distinguishes two types of woods subjected to two different managements: the *sylvae caeduae* that historians identify to forests intended to be cut on regular periods and the *sylvae pascuae* which correspond to woody meadow or pastured (Breton, 1980: 28). The registrations of the Lebanese mountain, particularly those of the high valley of Nahr Ibrahim which contain in their formula the only abbreviations DFS meaning *D(e)f(initio) s(iluarum)* (IMP HAD AVG DFS) are considered as boundary-stones which assert the imperial property of soil and trees, whereas the only

abbreviations AGIVCP, meaning *a(rborum) g(enera) IV c(etera) p(riuata)* (IMP HAD AVG DFS AGIVCP), indicates a right of usufruct on soils in particular for the pasture, to water the cattle, for the wood cutting (excepted the four forbidden essences), for the collect of acorns etc. (Breton, 1980: 29).

At least in 2nd century cattle management was linked to the forestry as it is still today. The legibility of these practices for the former periods is limited to what is engraved since archaeological works on pastoral structures and archaeozoological studies are lacking. However, archaeological and pedological studies inform about the link between the cattle and agricultural terraces. Indeed, soil analysis on an ancient terrace field discovered in the excavations below the Tell put in evidence the use of manuring techniques from the 3rd millennium under the shape of very small considerably split up shards and multiple organic waste integrated into the cultivated soils which were also probably grazed.

After 7th century, the pedogenesis recovers naturally its rights including in the zone of the sanctuary. That would indicate then a reduction of the human pressure on the ecosystem or a different management of the space (reorganization of field systems, more important part of the breeding?). Maybe is it necessary to ascribe to this period the abandonment of pre-medieval terraces found close to the ancient village? In 12-13th centuries a new burst of organization (and reorganization) of the agricultural landscape takes place. However, many current terraces walls are much more recent. This agricultural water and soil management is less developed today. The photographs of the beginning of 20th century show terrace systems partially abandoned. Their soils (peyrosols and lithosols) are destroyed by erosion and on which thin vegetation tries to give way when it does not disappear under the tooth of sheep and especially goats (Harfouche, 2003b).

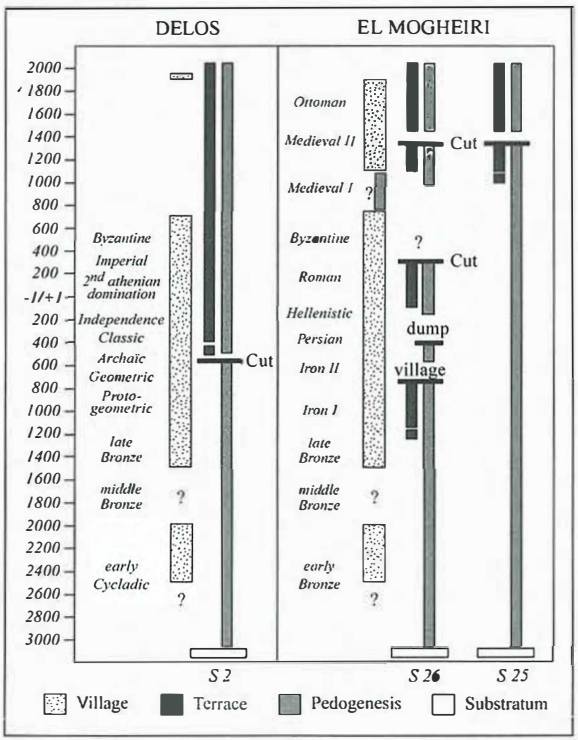


Fig. 14: Synthetic table of hill-slopes evolution on the island of Delos (Cyclades, Greece) and at El Mogheiri in the high valley of Nahr Ibrahim (Mount Lebanon, Lebanon).

The high valley of Nahr Ibrahim as Delos is a conservatory of landscapes and practices where everything remains to discover and to study by crossing sources and disciplines. But unlike Delos the Lebanese mountain offers a long-term history of agricultural societies from Neolithic to present day (Fig. 14). It is so necessary to carry on this study to better understand the meaning of breaks and balances in the evolution of these fields towards agro-silvo-pastoral practices.

New questions for new objects

Knowledge acquired during these researches, methods and problems which they contributed to develop, also the hypotheses which they aroused make of these conservatories of Mediterranean landscapes a privileged laboratory for the study of the evolution of agrarian structures. The most interesting in these landscapes strongly humanized is that they are at the same moment records of changes in the environment under the influence of natural variable (mainly topographical and climatic), at local and global scale, and an expression of techniques of field construction and agricultural activities.

These works show, especially in southern France, in Greece and in Near East, the variety of " soil times ". Social activities and " natural " phenomena are written in it on the long-term, in the short time (event) and in changes (field expansion and contraction). It seems so essential to take into account soils and their evolution, notably to understand and to date the construction of agricultural spaces.

The study of landscapes led according to a multidisciplinary approach is a relevant way to get into light the notion and reality of the technical innovation, the transmission of agricultural knowledge, hydro-agricultural systems in their technical and social dimension, to understand what makes the Mediterranean mountain and its specificities and finally to help in the fight against the irreversible landscapes degradation by understanding the mechanism of their evolution in particular soil and water management.

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