



MENMED

**From the adoption of Agriculture to
the Current Landscape: long term
interaction between Men and
Environment in the East
Mediterranean Basin**

European project ICA3-CT-2002-10022

MONOGRAFIES 9

Museu d'Arqueologia de Catalunya **Barcelona**

De l'1 de març de 2003 al 28 de febrer de 2006, es va dur a terme el projecte europeu "From the Adoption of Agriculture to the Current Landscape: long term interaction between Men and Environment in the East Mediterranean Basin (MENMED)" (INCO-MED-ICA3-CT-2002-10022). El seu principal objecte d'estudi ha estat l'interacció entre les comunitats humanes i el medi natural de diferents jaciments arqueològics de la vall mitjana de l'Eufrates i de la vall de l'Orontes associats als orígens de l'agricultura (ara fa uns 10.000 anys), fins a l'anàlisi de les condicions de l'estatus agroecològic i de l'estructura social de la regió que envolta avui dia aquests assentaments.

From 1st March 2003 to 28th February 2006, a research consortium has been created to realise the European Project "From the Adoption of Agriculture to the Current Landscape: long term interaction between Men and Environment in the East Mediterranean Basin (MENMED)" (INCO-MED-ICA3-CT-2002-10022). The project aims to integrate biophysical and historical data of the first settlements to evolve in early agriculture (from 10.000 years ago), and the agricultural and socio-economic processes taking place in present times, from several archaeological sites of the Middle Euphrates and Orontes valleys.



Coberta:

Campament nòmada al nord de Síria, prop de la vall de l'Eufrates. (Fotografia de R. Buxó)

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of agriculture to the current
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Barcelona

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de Catalunya



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MENMED. FROM THE ADOPTION OF AGRICULTURE TO THE CURRENT LANDSCAPE: LONG - TERM INTERACTION BETWEEN MEN AND ENVIRONMENT IN THE EAST MEDITERRANEAN BASIN

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PRESENTACIÓ

De l'1 de març de 2003 al 28 de febrer de 2006, es va dur a terme el projecte europeu "From the Adoption of Agriculture to the Current Landscape long term interaction between Men and Environment in the East Mediterranean Basin (MENMED)" (INCO-MED-ICA3-CT-2002-10022), per part d'un consorci format per investigadors de la Universitat Autònoma de Barcelona, el Museu d'Arqueologia de Catalunya, la Universitat de Lleida, la Universitat de Lió-2 (França), la Direcció General de Antiquitats i Museus de Síria i la Universitat d'Istanbul (Turquia). El seu principal objecte d'estudi era l'interacció entre les comunitats humanes i el medi natural de diferents jaciments arqueològics de la vall mitjana de l'Eufrates i de la vall de l'Orontes associats als orígens de l'agricultura (ara fa uns 10.000 anys), fins a l'anàlisi de les condicions de l'estatus agroecològic i de l'estructura social de la regió que envolta avui dia aquests assentaments. Cobrint un ampli ventall de disciplines (arqueologia, arqueobotànica, geologia, demografia i geografia), el projecte recollia la informació des d'una perspectiva diacrònica, creant eines per a una gestió futura dels paisatges culturals de les dues regions, tot integrant: a. la cooperació científica i tecnològica internacional a nivell de recerca i desenvolupament; b. la gestió del patrimoni cultural; i c. una contribució a l'economia sostenible i al desenvolupament científic dels territoris estudiats.

Pel període antic els objectius específics eren:

- Determinar les condicions ambientals en el context dels orígens de l'agricultura. La incorporació de les anàlisis paleoambientals han estat decisives per formar la base de la reconstrucció del territori natural d'època prehistòrica i històrica.
- Comprendre els principis de l'organització i distribució dels espais de les comunitats humanes de les primeres comunitats agrícoles. Això inclou els estudis demogràfics i antropològics per a la reconstrucció de les estructures dels assentaments, les condicions de l'alimentació i de la salut de les comunitats, i l'organització dels sistemes espacials.
- Descobrir, per la via de diferents metodologies alternatives, les condicions agronòmiques dels orígens de l'agricultura, incluint els canvis en els usos de la terra, els conreus, els rendiments esperats i les condicions de creixement del conreu (en relació a l'aigua i als nutrients del sòl).

Pel període contemporani foren:

- La recollida de dades climàtiques de la regió.
- La caracterització dels diferents tipus d'activitats agrícoles actuals i l'avaluació de la gestió de l'ús de la terra i la distribució demogràfica.
- La recollida de dades des del segle passat per detectar canvis en les estratègies dels usos del sòl. En aquest sentit, això comportava l'anàlisi dels canvis recents en les pràctiques agrícoles derivades de l'orientació urbana de l'agricultura així com també de la introducció de l'irrigació extensiva.
- La recollida d'informació de l'estructura social (organització familiar, activitats secundàries, etc.)

L'integració de les dues informacions en el projecte MENMED ha permès analitzar en profunditat les causes de l'adopció de l'agricultura des d'un punt de vista històric en relació a l'ús de la terra i de la gestió de l'aigua i les seves conseqüències a llarg termini. La utilització de metodologies arqueomètriques ha constituït una contribució científica de gran rellevança per a la valorització de les restes arqueològiques, en vista d'una millor comprensió del desenvolupament dels territoris actuals. De manera secundària, i com a derivada dels objectius principals, el projecte ha incidit en la promoció dels jaciments arqueològics (conjuntament amb la definició potencial de les

estratègies de la museologia) com a museus a l'aire lliure il·lustrant els inicis de les interaccions humanes amb el medi natural.

El fet que aquest llibre es publiqui en aquesta sèrie monogràfica és per a nosaltres un honor i al mateix temps un plaer molt gran. L'ajut d'algunes persones, que han contribuït amb la seva col·laboració a dur a terme el projecte, ha estat també decisiva per aconseguir l'acabament de l'obra. El nostre especial agraïment és per a Nicole Riveill, Pierre Lombard, Tamman Fakouch, Murad Özbasarani i Anna Garrido.

I. INTRODUCTION

1. INTRODUCTION

From 1st March 2003 to 28th February 2006, a research consortium composed by the Autonomous University of Barcelona, the Archaeology Museum of Catalonia and the Lleida University from Spain, the Lyon-2 University from France, the Directorate General of Antiquities and Museums from Syria and the Istanbul University from Turkey, has been created to realise the project "From the Adoption of Agriculture to the Current Landscape long term interaction between Men and Environment in the East Mediterranean Basin (MENMED)". The main objective of the EC project MENMED (INCO-MED-ICA3-CT-2002-10022) is to find out about the environmental and social context in which agriculture emerged and evolved. Covering a wide range of domains (archaeobotany, archaeology, geology, demography and geography), the project aims to integrate archaeological and environmental information in a diachronic approach, and to create useful tools for future management of the cultural landscapes of the Middle Euphrates and Orontes valleys. The interdisciplinary nature of the project MENMED promotes: a. international scientific and technological RTD cooperation; b. management of cultural heritage; and c. a contribution to the sustainable economic and scientific development of the countries studied.

The MENMED project examined detailed information about the biophysical and historical data of the first settlements to evolve in early agriculture (from 10,000 years ago), and the agricultural and socio-economic processes taking place in present times. Related to the early period, the approach to determining palaeoenvironmental conditions is highly suggestive. Archaeobotanical analysis presents a representative view of past forest cover during the Holocene with the presence of species that have since disappeared from the region. Studies of agronomic conditions suggest the cultivation of species of wild cereals along with those of domestic type in early agriculture. Signs of cultivation at the end of the 10th millennium have been demonstrated.

Fieldwork in the Euphrates and Orontes valleys allowed us to complete an approach to the spatial occupation as well as features of the construction techniques in the main areas of the different sites: analyses of variations in patterns and the functional character of spaces, determination of periods of abandonment and changes in the significance of architectural elements in relation to economic and social evolution.

In relation to the contemporary period, our scientific activities involved the available information in the published agricultural and ecological data with documentation on water management. The areas of study coincide with unsuitable climatic conditions and insufficient irrigation with low productivity. Low precipitation and high evaporation cause a decrease in the humidity of the soil, especially in summer, so irrigation becomes an obligation.

A survey of community characterization was prepared in order to understand the historical evolution of the socio-economic conditions and resources used in the study region and applied to the Halula and Akarçay regions. A GIS database was established to implement the geographical characteristics, geological patterns, and resources as well as the archaeological sites along the Euphrates, dating from prehistoric and historic times. Studies in the Middle Euphrates area show that structures of feudal dependency were maintained until the fifties, and they were one of the main causes of conflicts over land use. Livestock, fattening lambs, growing fruit trees, and other uses related to food production such as growing mushrooms and bee keeping are promising solutions for both the landless and landowners in order to increase their income and alleviate poverty. These solutions must be sustained with a related crediting system that avails long and short-term loans to the households.

We should consider the fact that all efforts are made for the purposes of development. These efforts are made in vain if they are not accompanied by the slowing down of population growth.

II. THE PROJECT

2. THE PROJECT

Ramon Buxó, Miquel Molist

The East Mediterranean has been inhabited since the dawn of civilisation. Archaeological evidence in the Fertile Crescent demonstrates that the human settlements played a key role in the Origin of Agriculture. This evidence also contains the clues to answering the question of why these human settlements adopted agriculture from its origins in the Western World and how these early societies interacted with the surrounding environment, shaping the landscape. From these very early times, and for the following 10,000 years, the landscape has evolved to the current steppe conditions dominated by extensive rainfed agriculture and husbandry.

The main aim of the project “From the Adoption of Agriculture to the Current Landscape long term interaction between Men and Environment in the East Mediterranean Basin” is the study of the social and economic context in which agriculture emerged and evolved from the first settlements (10,000 years ago) until modern times. Based on historical sources and archaeological remains, the project integrates archaeological and environmental information using a diachronic approach including:

- a) The biophysical and historical characterisation of the settlements that evolved at the beginning of agriculture.
- b) The agricultural and socio-economic processes taking place in present times.

The project will focus on the study of several archaeological sites dated to the beginning of agriculture as well as the present-day agroecological status and social structure of the region surrounding these sites: Akarçay Tepe, Tell Halula, Jerf el Ahmar, Cheik Hassan and Mureybet. The sites belong to the beginning of the agriculture (9600 BP - 6500 BP): Akarçay Tepe is situated in Turkey, at the Akarçay village, Bireçik (Sanliurfa) on the left bank of the Euphrates. Tell Halula, Jerf el Ahmar, Cheik Hassan and Mureybet are situated in Syria, about 100 km east of Aleppo, in the west and

east bank, a few kilometers from the main Euphrates lie upstream from Lake Assad. The stratigraphical sequence of these sites are formed by the successive construction, utilization and abandonment of houses, and covers three main periods: Middle and Late PPNB, Pre-Halaf and Halaf.

The locations involved are situated in the Middle Euphrates valley (including areas of Syria and Turkey) and Middle Syria (including the Orontes valley), in order to document the phases of urban development and regional organisation to find out about the axis of East-West and North-South communication together with agricultural organisation. Both regions are characterised by a semiarid (rainfall of 250 mm and lower) steppe landscape, where only barley is grown (it is occasionally cultivated in rainfed conditions), while there is a long-standing tradition of pastures being grazed by small ruminants (sheep and goats).

The region surrounding the Turkish site corresponds to a low alluvial plain near the perennial Su Deresi. The region surrounding the Syrian sites corresponds to the Syrian directorates of Membij and Rakka.

Covered by a wide range of domains (archaeobotany, archaeology, geology, demography and geography), the project aims to integrate archaeological and environmental information using a diachronic approach, which is based on the compilation and comparison of available data from the early period and contemporary period, and to create useful tools for future sustainable management of the cultural landscapes of the Middle Euphrates and Orontes valleys. By integrating information from two timeframes (early and contemporary agriculture), the project will add new evidence for the causes leading to the adoption of agriculture in the Eastern Mediterranean Basin, as well as their long-term consequences:

1. for the early period:

- To include the palaeoecological and socio-economic context of the Origins of Agriculture. Specifically, it will include palaeoenvironmental

analyses aimed at forming the basis of prehistoric and historic landscape reconstruction.

- To understand the organising principles behind human spatial distribution during the first agricultural settlement periods. This involves demographic and anthropological studies to reconstruct settlement structures, nutritional and health conditions, systems dynamics and spatial organisation.
- To support information, using several alternative methodologies, about the agronomic conditions of early agriculture, including changes in land use, crops cultivated, breeding performed, yields attained and growing conditions (water and soil nutrients). The role of husbandry in these ancient communities will also be evaluated.

2. for the contemporary period:

- To include the management of the landscape and the present agroecological status and social structure of the region.
- To collect present climatic data from the region.
- To characterise different types of current agricultural activities and to evaluate land use management and demographic distribution.
- To gather information on social structure (e.g. family organisation and secondary activities).
- To collect data from the last century in order to detect changes in land use management strategies. This involves the analysis of recent changes in agricultural practices such as crop and/or land redistribution, derived from urban-oriented agriculture as well as the introduction of extensive irrigation.

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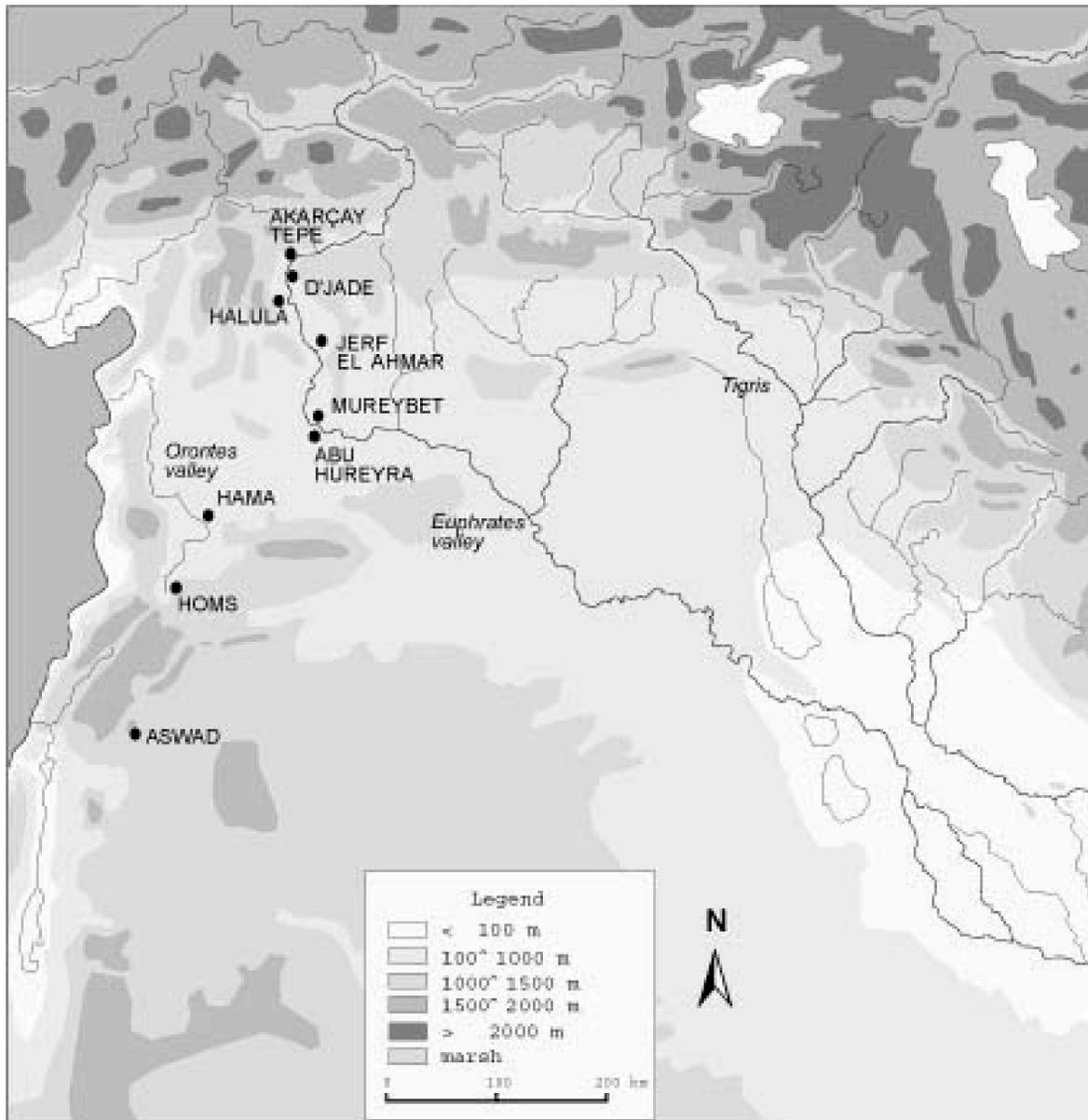


Figure 1. Map of main locations involved in the MENMED project

The project is organised in five parts: the palaeo-environmental characterisation, the reconstruction of agronomic conditions, the socio-economical structure of the sites, the present-day agro-ecological characterisation and the contemporary socio-economical conditions.

The first part is a complete study aimed at the palaeoenvironmental reconstruction (including climatic variables) will be performed using remains from the archaeological sites. This involves the use of the archaeobotanical studies to reconstruct ancient vegetation, as well as the analysis of stable isotopes (^{13}C , ^{18}O) from charred wood remains (charcoals) of forest tree species present in the area (such as *Pinus halepensis* or *Quercus ilex*) to estimate past water availability (rainfall) and temperature regime. In order to reconstruct the vegetation of the past, studies have provided information about the extent of former forest cover and the chronological sequence of changes to vegetation in the Euphrates region. Studies of charcoal and seeds are realised in several sites along Euphrates, from the Natufian at Abu Hureyra to Islamic samples of Tell Shiouk Faouquâni. Early Neolithic sites include Jerf el Ahmar, Mureybet, Dja'de, Akarçay Tepe and Halula. Bronze Age sites include Tell Shioukh Faouquâni, Tilbeshar and Horum Höyük.

The studies can provide us with information about the extent of past forest cover and the chronological sequence of the changes to the vegetation in the Euphrates region. The results have provided evidence of relatively high levels of deciduous oak in the Turkish/Syrian border sites compared to other species, while in the south there are very few of these trees: archaeobotanical evidence suggests that both the *Quercus brantii* forests in Turkey and the *Pistacia atlantica*/*Amygdalus* forest-steppe associations in Syria were much more widespread in the past and it seems that they extended to lower altitudes. Both regions have similar histories of vegetation, similar to what has been found in other parts of the Mediterranean where during the Holocene deciduous oaks were progressively replaced by evergreen oaks.

The ligneous vegetation near the sites nowadays consists of a few spiny shrubs, riverine species and plantations of poplars and various fruit trees. On the other hand, a few species of riverine vegetation are present today on the flood plain (Willow, Poplar and Tamaris).

With respect to the climatic signal stored in stable isotopes, the objectives were to examine relict formations from modern vegetation, and specific forest remnants found at an altitude of between 700 and 900 m along the Euphrates valley (north Syria/south Turkey). Carbon isotope composition in wood was to be tested in the species of greater interest in the middle Euphrates sites (*Quercus* and *Pistacia*).

The wood samples analysed, collected during field trips to Syria (2003) and Turkey (2004), were dated using tree-ring measurements and continued using the

process of quantifying the effect of carbonisation in the stable isotope signature (^{13}C and ^{18}O) through controlled charring conditions.

The results suggest that the variations in $\delta^{13}\text{C}$ are mostly related to climatic constraints. It should be noted that the reference material showed similar or even lower $\delta^{13}\text{C}$ than the archaeological material. This indicates that the water status of trees near the archaeological sites was better in the past than it would be now, if they were still growing in the area.

Concerning the analysis of archaeological samples of wood, the results reveal a significant relationship between the $\delta^{13}\text{C}$ of charcoal from *Pistacia* and *Quercus* samples, suggesting that both species were responding to common environmental factors. Both species also showed considerably higher $\delta^{13}\text{C}$ values than those found in modern samples, and suggest significantly more humid and/or cooler conditions in the past than in present times.

During field work in 2003 and 2004, we were able to examine the forest remnants and collected a large number of samples from archaeological sites in different regions along the Euphrates valley:

- a. In Syria, we examined an important forest remnant found at an altitude of between 700 and 900 masl in northern Syria. This is a forest steppe association (dominated by *Pistacia atlantica* and *Amygdalus* spp.) with very open woodland that only exists today in restricted areas. The best preserved example of this zone is to be found on the Jebal Abdul Aziz in north-east Syria between 700 and 850 masl. Apart from *Amygdalus*, other members of the Rosaceae family are frequent components of both these vegetation zones, and include *Crataegus monogyna*, *C. syriaca*, *Pryus syriaca*, *Prunus spinosa* and *Prunus microcarpa*. These species are difficult to identify precisely from wood charcoal and are not good markers. Below this zone one finds the true steppe dominated by short-lived annuals, and perennials such as *Artemisia*, various chenopods such as *Noae mucronata* and grasses such as *Stipa*.
- b. In Turkey, we found an area of degraded evergreen oaks (*Quercus calliprinos*) situated about 25 kilometres north of Birecik on the slopes of the hills leading down to the Euphrates (near Horum Höyük). This confirms that the history of vegetation in this region is similar to that which has been found in other parts of the Mediterranean where during the Holocene deciduous oaks were progressively replaced by evergreen oaks.

Archaeobotanical evidence confirms that the most represented species are *Quercus*, *Amygdalus* and *Pistacia*. By comparing the occurrence of these three species in the past with their availability in relation to the sites today and forest remnants it is possible to assess ancient vegetation cover. The more northerly sites occur in what botanists consider to be areas of

potential oak forest in present-day climatic conditions with annual rainfall of more than 400 mm. Charcoal from two Bronze Age sites in southeast Anatolia, Tilbeshar, situated on the Sajour, a western tributary of the Euphrates, and Horum Höyük and Akarçay situated on the banks of the Euphrates has been studied. At both Chalcolithic and Bronze Age sites results indicate that oak charcoal is highly frequent. However, oak is less common at Akarçay, suggesting that between the Neolithic and the Bronze Age the oak forests expanded. These sites occur within an area with less than 350 mm annual rainfall and are at the very limit of the present-day distribution of *Quercus brantii* where relic stands were found at between 800 and 900 masl. Deciduous oak charcoal was found at sites in Syria dated to the Natufian, the Neolithic and the Bronze Age.

Farther south in northern Syria, archaeobotanical analysis of sites situated on the Euphrates have shown that during late Pleistocene and early Holocene the *Amygdalus* and *Pistacia* forest-steppe association was present in this area. Oak charcoal was present at all sites but was not frequent. In Tell Halula, the charcoal assemblage is dominated by riparian taxa: *Tamarix*, *Salicaceae*, *Ulmus*, *Fraxinus*, growing along watercourses; these were probably abundant in the surrounding area due to the proximity of the river. Deciduous vegetation is represented by oak wood, represented by only 1% of the remains.

The second part concerns the reconstruction of agronomic conditions. The research deals with several activities:

- a. The creation of a common database for environmental disciplines.
- b. To record the current distribution of plant taxons identified in the archaeobotanical analysis in the region of Middle Euphrates.
- c. To evaluate the impact of the changes related to the exploitation of the territory and the management of plant resources.

The analyses show the great morphological diversity of the cereal remains, which leads us to consider that the species of wild cereal would have been cultivated together with domestic ones. The archaeobotanical analysis notes the changes in cereal use from 11,000 to 8,500 B.C. cal., and appears to provide evidence of subsistence farming: an increase in weeds, and an augmentation of tools and storage structures related with agronomic activities.

At the end of the 10th millennium, another sign of cultivation was the increased frequency of wild barley in Jerf el Ahmar. This species is absent or rare in the Natufian levels, but is common at the beginning of the 10th millennium and its frequency increased until it became the dominant cereal at the end of this millennium. This barley may have first been cultivated by the human community of Jerf al Ahmar, although they did not necessarily domesticate it.

The archaeobotanical analysis also notes that weed flora increased in the early levels of Jerf el Ahmar, coinciding with an augmentation in the frequencies of tools and storage structures related with agronomic activities. The combined changes appear to provide evidence of subsistence farming. However there are no traces of morphological domestication.

In relation to plants, the weeds identified are associated to steppe and humid vegetation. The low presence of taxa could indicate arid conditions, but others could reflect the existence of humid areas.

In contrast, $\delta^{13}\text{C}$ analysis of charred crop grains found a relatively good agreement between the two genuses: *Triticum* and *Hordeum*. This suggests the incidence of a common environmental factor on grain $\delta^{13}\text{C}$, probably climate-related. $\delta^{13}\text{C}$ values were greater for archaeological grains than for the reference samples collected in the area. This again provides evidence that, around the middle Euphrates, water was generally more available in the past than in present times.

Comparing the results for cultivated crops with those obtained for wood charcoal, we further checked the potential role of climate on the observed isotopic variations in cereal crops. This suggests that most of the variability in crop water availability observed in the past was derived from climatic constraints, rather than from changes in agronomic practices.

The third part is the study of the socio-economical structure of the archaeological sites. It includes all the archaeological studies others than those directly related with the palaeoenvironmental reconstruction, and the assessment of agronomical conditions on early agriculture. Studies were focused:

- A. On the collection of samples in stratigraphical records which were insufficiently represented on a chronological level;
- B. Gathering a database for the territory in process of excavation in the Euphrates and Orontes valleys;
- C. Developing studies related to the palaeoanthropology, with the main emphasis on archaeozoologic studies, in order to determine their potential role in prehistoric economy.

Archaeological work was carried out involving the revision of the stratigraphic sequence of the sites, in order to understand the sequence of events relating to socio-economic evolution, and the significance of architectural elements was examined in relation to changes in the plant economy and social evolution. Analyzed levels continuously provide evidence of human occupations of the sites as shown by variations in the distribution patterns and the character of functional space, which could be related with environmental changes. Periods of abandonment were observed through use of the analyzed podogenic processes.

Anthropological studies have dealt with the relationships between the inhumations of the different houses in the

Tell Halula site (Syria), using both Mitochondrial-DNA and Y-chromosome genetic markers. The results for fauna remains, offer important documentation about economic activities developed in the sites, especially those concerned with animal resource management. The archaeozoological analysis carried out consisted of: 1. specific and anatomical determination of the fauna remains; 2. estimation of the age and sex of represented animals; 3. biometrical analysis of the fauna remains; 4. qualitative analysis of the fauna remains; 5. taphonomical analysis of the fauna remains.

The application of other analytical techniques to the fauna remains considers the hypothesis that the domestication of the different species of animal (goats, sheep, aurochs and wild boar) probably implied significant changes to mobility and feeding systems. The applied methodology consists of the analysis of the stable isotopic composition of animal skeletons, which constitute an average used to determine the palaeoecologic and climatic environments in which the different animal populations lived, becoming an effective instrument in the attempt to document the initial moments of the domestication of these different species.

Studies were made of the **present-day agro-ecological characterisation** and **contemporary socio-economic conditions**, corresponding to the information available in the published agricultural and ecological data, and the institutional documentation of water management with references to land use and socio-economic conditions. In the Halula region and the Orontes valley, the objectives are principally to obtain information on the Middle Euphrates River and the vast plain between 500 to 600 m altitude near Lake Oms and the entrance to the Ghab depression. Meanwhile, in Turkey collected data on the Euphrates valley, restricted to the Urfa region.

Climatic parameters, along with the spatial distribution of other natural resources and systems using them will be studied aiming to an agro-ecological characterisation of the regions surrounding these archaeological sites. The work will include collection and correlation of data on weather, soils, land capability, water resources (including irrigation works), natural vegetation and crop production. Data collection will be gathered from available published agricultural and environmental information, in situ (i.e. field) characterisation performed during the time of the project plus information derived from satellite remote sensing pictures. Moreover of data published by the Turkish and Syrian administrations an important body of available information that has been produced during the last years by the International Centre for Agricultural Research in the Dry Areas (ICARDA) based in Aleppo (North Syria).

The contemporary socio-economical conditions attempts to understand contemporary land use conflicts and the rural/urban dynamics. A thorough and extensive search and review of existing published information related to historical and customary land use patterns found in the

study region will be performed. It is envisaged that this element of the preliminary study will involve visits to Department of Agriculture in Menbij, The French Institute of Arabic Studies, and Assad library of Damascus. This information will be supplemented by interviewing local households, local institutions such as social groups, community based agricultural co-operatives and any other organisations that have been directly influential on the socio-economics of the households. The information collected will be presented as an historical account of livelihood and management trends and landuse patterns within the study area. Collection of supplementary materials such as topographic maps, available satellite images and previously produced thematic maps of resources for the study areas will be decided upon. Additionally, information pertaining to the following issues will also be collected, mapped and included in the spatial database: customary rights governing access to and use of different natural resources; the social groups and sub-groups included and excluded in these arrangements and the basis for their rights, land entitlements, and perceptions of ownership; and the indigenous knowledge of range, water, and livestock conditions upon which livestock breeding decisions are based, income sources, cost and benefit of farming, consumption from their own production, farming techniques are used. Traditional houses, food diet, furniture, kitchen tools, and customary habits in social events will be also recorded.

The economy of the Orontes region depends on agriculture. Despite the existence of the water-rich Euphrates, the unsuitable climatic conditions and insufficient irrigation systems result in low productivity. Low precipitation and high evaporation cause a decrease in the humidity of the soil, especially in summer, when irrigation becomes an obligation. Apart from the Euphrates, which is the main source for irrigation, the small rivers and creeks dry up in summer. Most of these small sources are only able to supply a few village gardens. Apart from the inefficiency of the precipitation, the main reason for the poor conditions lies in the calcareous soils and calcareous formation of the ground which can easily absorb water, thus hindering the formation of rivers on the surface. Rivers fed by groundwater are generally short, narrow and poor.

Such irrigation problems have led to the construction of new dams and irrigation systems in the two regions studied. Analysis of the impact of the construction of large dams (Thsrin in Syria and GAP in Anatolia - Güneymođu Anadolu Projesi-) suggests, on the one hand, the characteristics of the retrieval and distribution network for aquifer resources; and on the other, changes in the organisation of regional intercommunication axes in relation to agricultural production.

Studies along the Halula region demonstrate that in the early 20th century, the new settlers started to

cultivate limited areas of cereal crops in order to satisfy the needs of basic family nutrition. Wide areas of land east of Abu Galgal were classified as vacant and dead until the second half of the 20th century. Vacant land could be bought from the treasury. Dead land could be cultivated free of charge with official permission and following cultivation for five years, ownership could be granted.

During the 1940s, merchants and exploiters from Aleppo and other urban centres guided their capital towards the Euphrates valley for investment in cotton cultivation. This helped to transform the traditional way of life and develop the region. In the early 1950's, a rush for drilling wells and the cultivation of irrigated cotton occurred in all parts of Syria, including the region east of Munboj. In 1963, an agrarian reform law was issued, and the state lands were distributed to the households that had been cultivating them for a long time.

The Halula region is losing its characteristically agricultural system. It is shifting towards more off-farm activities in Syria and abroad, and smallholdings, diminishing the role of small ruminants, and with agriculture having less importance in the livelihood of the people.

With respect to crop production, increasing the yield of rainfed and irrigated crops is attainable by applying proper crop management, which requires an integrated research plan dealing with all the currently used traditional practices. Livestock, lamb fattening, growing fruit trees, and other activities related to food production, such as mushroom growing and bee keeping, are promising solutions to both the landless and landowners that can increase income and alleviate poverty. But these solutions must be sustained by a related crediting system that avails long and short-term loans to the households.

Studies along the Urfa region demonstrate several problems in the GAP area region in terms of land and agricultural activities. The main problem is injustice/inequality in relation to the ownership/distribution of land. The conflict over land-use caused the feudal system to survive in the region and the direct dependence of certain people (living in the countryside) on powerful land owners. Such a social structure originates from historical times, traced back to the Selcuk and Ottoman period. Social clusters such as nomadic tribes and landlords (plus the sheikhs, who are mainly involved in ritual aspects) still dominate in Southeast Anatolia, despite the attempts at economic and social development started in 1950s that aimed to change the system.

'The Southeast Anatolian Project' was not only established as a technical and industrial project but also as a social and economic transformation project where one of its objectives was to minimize such

differences/inequalities between people and to improve the actual situation.

Dam Projects are also very important for the locals and for the region itself. They were planned and established as a solution for hydro-electrical and irrigation problems; however there are technical and economic problems. Some of the issues that have arisen regarding irrigation are the use of chemicals, the lack of sufficient drainage and discharge which causes water pollution, an increase in salinity and aridity etc.

The dams caused environmental problems related to climatic changes. Such changes affected the flora and fauna. It was difficult to improve things, due to factors such as the threat of erosion and high sedimentation, as well as practical issues such as the inundation of the fertile flood plains, lack of financial support to supply equipment to the locals for irrigation, indiscriminate use of fertilisers/chemicals, etc.

A problem arising in Mediterranean countries is that of land use and water management, especially in the context of potential climate changes and increasing desertification. Moreover, extensive irrigation work is being developed in these regions with the expected consequences (soil impoverishment, lowering of water table, changes in social uses, etc).

The beginning of the Holocene brought warmer climatic conditions and villages along the Euphrates became more dependent on farming and less on gathering. The climate was slightly moister than that found in the present-day, and the most favourable climatic conditions for agriculture occurred during the early Neolithic. It was at this time that barley first appeared in the Euphrates sites. The appearance of barley probably resulted from the combined effect of warmer climatic conditions and increased intensity and reliance on cultivation. Barley adapts better to the region's climate than wheat.

The composition of the past vegetation has been highly degraded over the 10,000 years. Degradation of the vegetation led to increased aridity because the removal of plant cover would result in greater evaporation and runoff after rain. It might also have led to higher temperatures. Finally, soil erosion would further intensify the process of aridification.

The situation has aggravated over the last thirty years due to demographic expansion in the area, and it is now time to try to reverse the aridification process. We recommend that the data we obtained on past species be used to reintroduce and restore a more favourable habitat. However these efforts would be totally wasted if grazing were allowed to continue. Given that for the local villagers grazing is an important part of their economy, an efficient alternative to traditional pasture would have to be found and villagers would have to be convinced to use it.

III. RECONSTRUCTION OF ANCIENT VEGETATION AND CLIMATE CONDITIONS

3. AKARÇAY TEPE AND TELL HALULA: PALAEOENVIRONMENTAL RECONSTRUCTION

Raquel Piqué, Carmen Mensua*

The former Neolithic communities in Akarçay Tepe and Halula occupied places not inhabited before. There were new settlements of groups who practiced an incipient agriculture and cattle farming. The open woodland, showed from pollen and other charcoal analysis, had to provide basic resources for human societies. People probably collected not only firewood but fodder, raw material for tools and buildings as well as other plants for food. In the other hand, many other economic activities took place in the forest and steppe surroundings. The livestock farming and the hunting have taken place in them and their viability, without doubt, depended from the forest management.

We have scarce data about forest management in prehistory, usually charcoal constitutes the only remain of forest exploitation. Charred woods from domestic contexts are related mainly with the consumption of firewood. They are residues generated from the consumption of wood collected to be used as fuel or wood used to other function and after recycled as fuel. Charred woods appears in places where took place the combustion (fireplaces, kilns) as well as in rubbish deposits or other contexts where the function is not well known.

The main objective of the charcoal analysis has been to identify the resources consumed as firewood through the time as well as recognize some characteristics of the landscape in the surroundings. Charcoal remains give us significant information about how people used woods and how was the landscape.

AKARÇAY TEPE

We show in this work the results of the analysis of charcoal recovered during the field work from the years 1999, 2000, 2001 and 2002. Charcoal was collected by hand during the excavation process and also by the flotation of sediments. Sampling of soil for flotation was focused in those stratigraphical units with presence of charred organic material, like pits, fireplaces or open

areas. Nevertheless samples from other units were also collected in order to have a better representation of contexts. Samples come from two different sectors of the site: PPNB levels from Trench East and PPNB and LN levels from Trench 20.

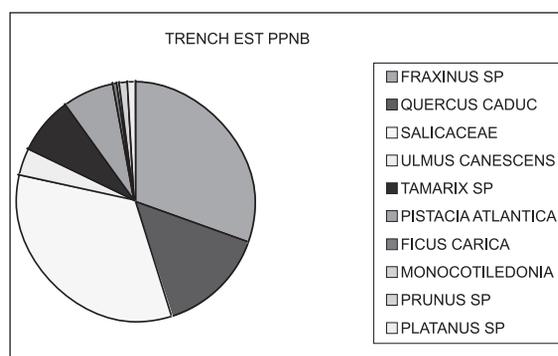


Figure 1. Distribution of taxa in PPNB layers from Trench East in Akarçay Tepe.

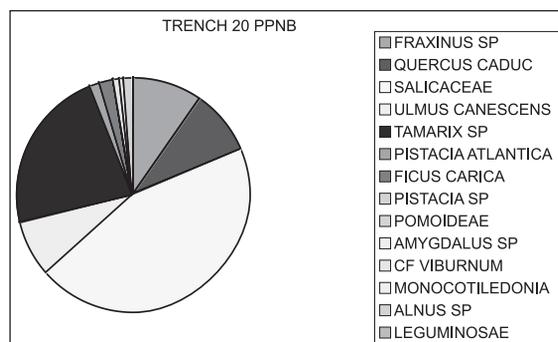


Figure 2. Distribution of taxa in PPNB layers from Trench 20 in Akarçay Tepe.

We have studied 1133 fragments of carbonized wood from 55 stratigraphical units. In general the totality of carbonized wood from the stratigraphical units has been studied. The only exception has been the cases where the remains were abundant; in these cases we have studied a total of 50 fragments for sample.

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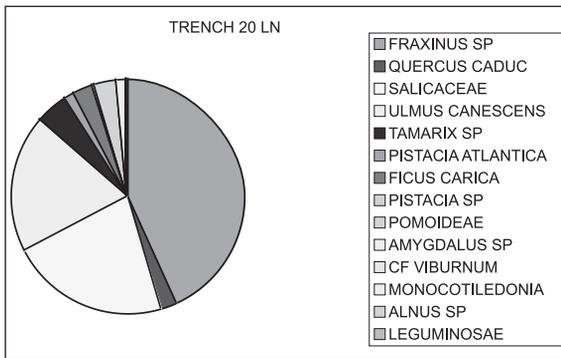


Figure 3. Distribution of taxa in Late Neolithic layers from Trench 20 in Akarçay Tepe.

The analysis of the remains which we present here has permitted to identify the consumption of 16 tree and/or bush taxa which indicate the catchment areas where the firewood gathering took place (Figs. 1, 2 and 3). In

general the better represented species as much from a qualitative (number of samples present) and a quantitative (number of remains) level is those of riparian woods. These vegetal formations, which nowadays are only found along watercourses, are represented in Akarçay by *Fraxinus*, *Ulmus*, *Populus-Salix*, *Alnus* and *Tamarix*.

Taxa from forests steppe and oak woods are also represented, but usually in low frequencies, they are represented by *Amygdalus* and two types of *Pistacia*, *Quercus* deciduous, of *Viburnum*, *Ficus carica*, *Pomoideae*, *Platanus* sp, *Prunus* sp.

The importance of riparian woods among the forest resources exploited in Akarçay with respect to other formations like the oak or steppe woods could be due to a greater accessibility or proximity of the firsts to the settlement. In the other hand the presence of these vegetal formations in all the phases studied indicates a continuous exploitation of this type of vegetation

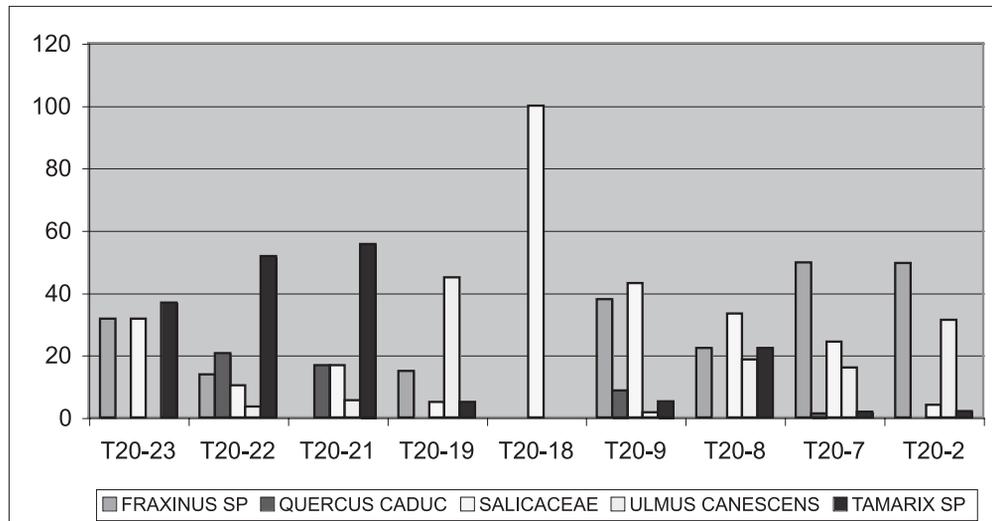


Figure 4. Distribution of main taxa of trench 20 (expressed in relative frequencies (%): Layers 23 to 18 corresponds to PPNB in Akarçay Tepe.

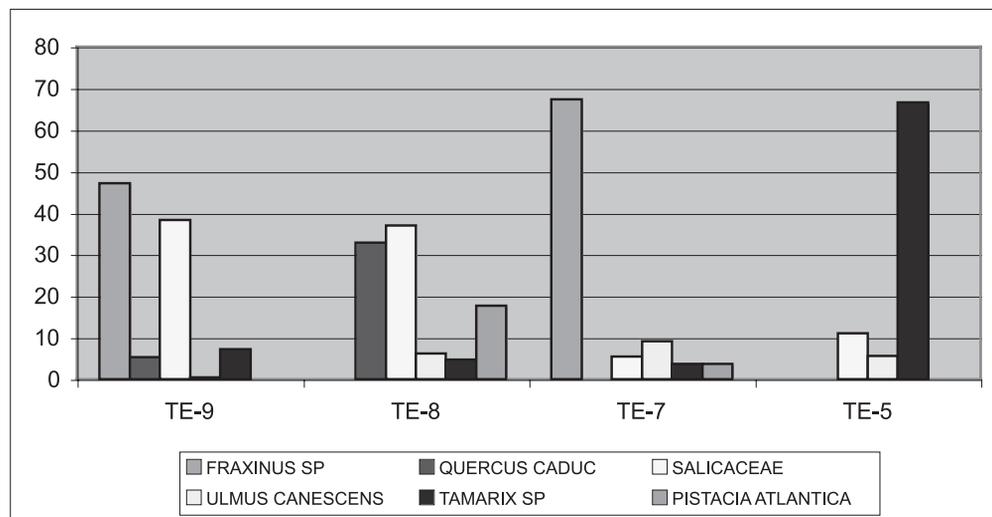


Figure 5. Distribution of main taxa between the layers of trench East (expressed in relative frequencies) in Akarçay Tepe.

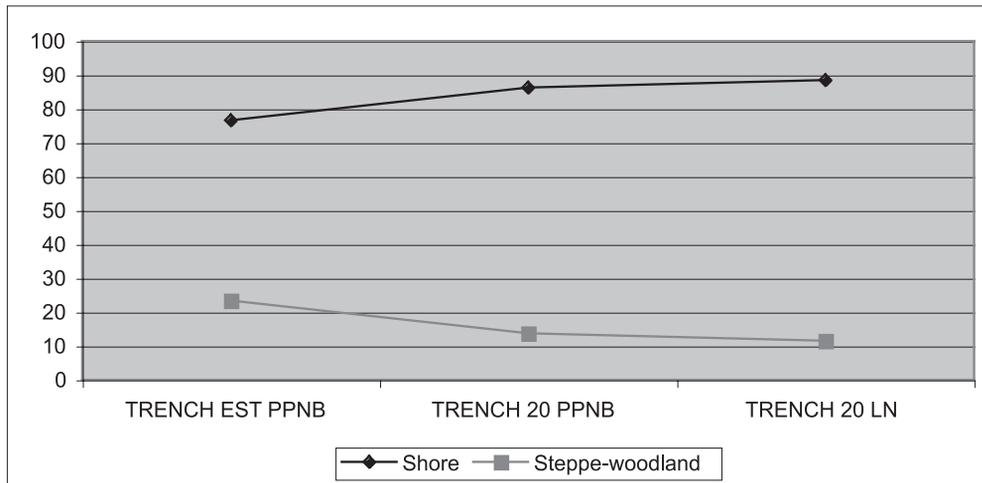


Figure 6. Changes in catchment areas in Akarçay Tepe.

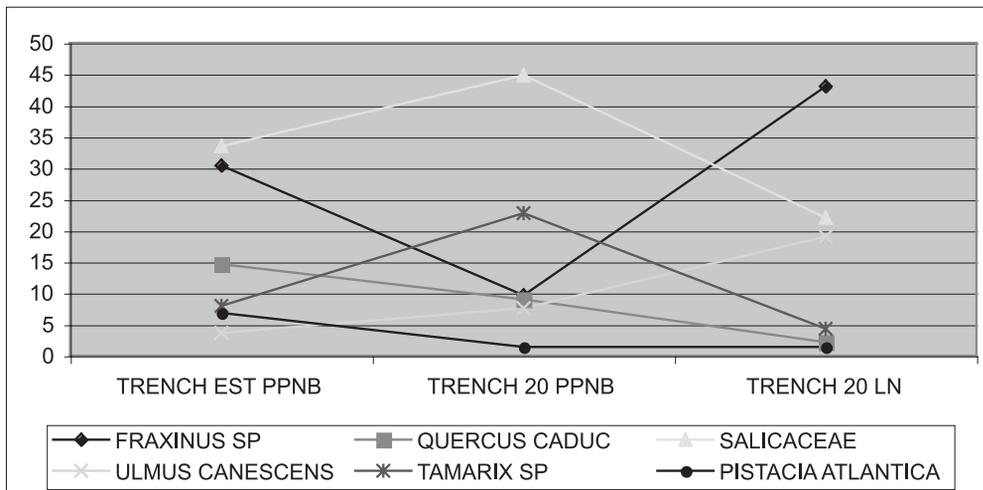


Figure 7. Changes in taxa consumption through the occupations in Akarçay Tepe.

throughout all the sequence of occupation. The exploitation of the riparian woods has been widely documented in various deposits of similar chronologies from the charcoal analysis. Tell Halula in Syria (Helmer *et al.* 1998), Cafer Höyük, Can Hassan III and Tepe Abdul Hosein in Turkey (Willcox 1991; 2002) have supplied data on riverbank exploitation.

Presence of main taxa shows differences among the occupation layers of Akarçay. There are five taxa consumed recurrently: *Fraxinus*, *Quercus* deciduous, *Salicaceae*, *Tamarix* and *Ulmus*. We can emphasize the continuity in the exploitation of these taxa through the time. *Salicaceae* is present in near all the layers, it is only absent in those with very few remains (layers 1 and 6 from Trench 20). *Tamarix* and *Ulmus* are also well represented, appears in 72% of layers. *Fraxinus* is present in 61% of layers and *Quercus* only in the 50%.

The other taxa appear only sporadically. We can consider that these five taxa were the most important in an economical level. Fidelity in the consumption of these five taxa indicates the preferences of population in relation with the firewood consumption. Despite that the offer of taxa in the surroundings was higher only these five taxa were exploited systematically as firewood. The preference for these taxa could be the result of availability, the properties of wood as well as the social value.

These five taxa are the best represented at a quantitative level. In most of layers the sum of remains of these taxa is high than 80%. This high frequency of remains confirms the relevancy of these taxa. Nevertheless through the sequence of layers it is possible to see a high variability in the importance of these taxa. In the figures 4 and 5 it is possible to see the fluctuation of main taxa through the sequence of layers. *Tamarix* is

better represented in PPNB layers, as well as *Quercus* deciduous. In the opposite *Ulmus* is better represented in the recent layers. *Fraxinus* and *Salicaceae* change through the sequence. We don't know the cause of fluctuation between taxa through the sequence. Changes could be the result of the diminution of certain taxa in the surroundings as a result of the human exploitation or other factors. But we have to consider also other explanations like the alternancy of catchment areas or the preservation of certain type of taxa for other economic activities. In the other hand, we have to consider also factors related with the formation processes of the archaeological record. The main concentration of remains of *Quercus* deciduous is in the UE 17 and UE 14 from Trench East Layer 8, both UE correspond to an exterior floor very rich in organic charred remains. Any other layer or sector shows a concentration of *Quercus* deciduous like this. We cannot discard that differences between layers could be the result of the diversity of contexts represented in them. *Quercus* deciduous is abundant in the oldest phases, this taxa is well represented in PPNB layers of trench east as well as in PPNB layers of thrench 20. The consumption of this taxa decreases in LN layers. Also the consumption of *Pistacia atlantica* is more intensive among the oldest layers, in this case is better represented in trench east. In general we can see that consumption of steppe-woodland taxa decrease in recent phase (Figs. 6 and 7). However the consumption of taxa from the forest gallery increases. This tendency can be the result of a diminution of the forest in the surroundings, which would lead to a greater pressure on the forest gallery. The causes of this diminution in the consumption of steppe and oak woods could be related, as we pointed before, with their diminution in the surroundings, nevertheless a further analysis are necessary in order to understand the causes of this tendency. Probably the long term occupation and the continuous exploitations of firewood and other woody resources in Akarçay area had as a consequence the degradation of the surroundings and the scarcity of shrub and tree. Nevertheless it is necessary consider also other factors related with the climatic conditions.

TELL HALULA

Charcoals from archaeological sites are the result of varied work processes, being always residue of firewood consumption. The gathering of firewood take place in the surroundings, and it is organized as a result of social needs and technological capacities. Changes in firewood gathering practice through the time can be a consequence of diverse factors: environmental changes, different wood management, etc. The identification of these changes has been the main goal of the study of carbonized wood from Tell Halula.

The charcoal from Tell Halula comes from several samples from Middle and recent PPNB. It was possible to determine 750 fragments, out of 778 analysed fragments of charcoal from different samples. Problems with determination are mainly caused by small size and bed preservation of analysed charcoals. Even so, the consumption of 11 taxa has been identified. The *Salicaceae* includes *Salix* and *Populus*, whose anatomical similarity don't permit its separation in the majority of cases. In many other cases, the proximity of anatomical features didn't allow the determination beyond the genus level.

A previous analysis was undertaken by Valerie Roitel. Both studies give significant data about firewood management.

Taxon	UE	Fragments
Amygdalus sp	9	64
Chenopodiaceae	1	1
Ficus carica	3	3
Fraxinus sp	3	5
Leguminosae	1	3
Pistacia atlantica	4	5
Pomoideae	1	4
Quercus sp deciduous	1	1
Salicaceae	25	347
Tamarix sp	26	313
Ulmus sp	2	4
Undeterminable	12	27
Inidentifiable	1	1
Total	41	778

Table 1. Results of charcoal analysis from Tell Halula.

From the archaeological charcoal we cannot estimate the importance of these taxa in the surroundings. Taxa frequencies in the archaeological sites are the result of use of resources, taphonomic processes and archaeological sampling strategies. That is the reason why we cannot presume that taxa frequencies represent past vegetation. Nevertheless, ubiquity and recurrence of taxa help us to understand their meaning, especially in terms of consumption.

The charcoal assemblage of Tell Halula is dominated by riparian taxa: *Tamarix*, *Salicaceae*, *Ulmus*, *Fraxinus* (figure 1). Riparian taxa represents 89,2% of fragments determined. However, *Tamarix* and *Salicaceae* together are the best represented taxa in this group, with 88% of remains. Their presence in all the samples studied indicates a continuous exploitation of this type of vegetal formation throughout all the sequence of occupation. Riparian taxa grow following watercourses; probably they were abundant in the surroundings due to the proximity of the river. Riverbank vegetation were exploded

intensively also in other settlements of Syria and Turkey for this period. Previous analyses in Tell Halula in Syria (Helmer *et al.* 1998), Cafer Höyük, Can Hassan III and Tepe Abdul Hosein in Turkey (Willcox 1991) have supplied also data on riverside exploitation, and they confirm the economic importance of these ecosystems.

Firewood was also collected in steppe and oak wood. Deciduous vegetation is represented by *Quercus* subg. deciduous, *Pomoideae* and *Ficus carica*. These taxa were used only sporadically, and they represent only the 1 % of the remains. Steppe taxa were more important (9,73% of remains) and between them the *Amygdalus* is the best represented taxon. Distribution of steppe and oak wood are heterogeneous among the samples. This distribution could be the result of a less intensive exploitation of cited vegetal formation, maybe because its presence in the surroundings of the settlement was

less abundant. However, the presence of deciduous oak and steppe taxa in the assemblage indicate their presence in the surroundings of the settlement. Sample analyzed by Valerie Roitel has provided a more significant evidence of oak woods exploitation. As in Akarçay Tepe oak woods diminish through the sequence.

The use of taxa changes through the sequence. As we can see in table 2 the most significant taxa increases or diminish between phases. Presence of steppe taxa (*Amygdalus* and *Tamarix*) is more important in the most recent levels (figure 2). In the opposite the only fragment of *Quercus* sp deciduous appears in the oldest phase. This tendency could be related to an expansion of steppe taxa, maybe as a consequence of the climatic conditions. Nevertheless the sample studied is still small and we only can suggest this tendency as a hypothesis.

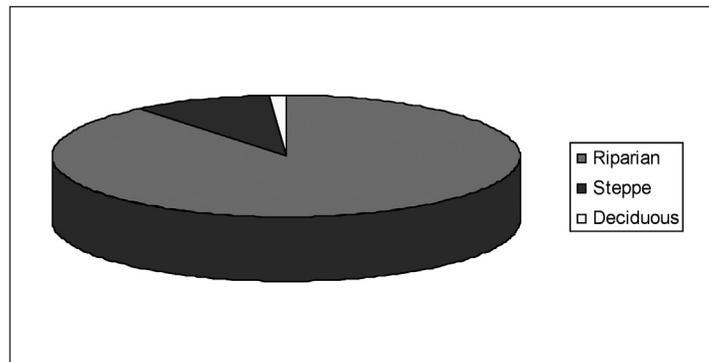


Figure 8. Distribution of relative frequencies in Tell Halula.

TAXA	8500-8300 BP		8000 BP		8000/7900-7300 BP	
	N	%	N	%	N	%
TAMARIX	19	17,3	91	68,9	203	40,0
AMYGDALUS		0,0	13	9,8	51	10,0
SALIX/POPULUS	84	76,4	25	18,9	238	46,9
POMOIDEAE	4	3,6		0,0		0,0
ULMUS		0,0		0,0	4	0,8
QUERCUS SP DECIDUOUS	1	0,9		0,0		0,0
PISTACIA ATLANTICA	1	0,9	2	1,5	2	0,4
FICUS CARICA		0,0	1	0,8	2	0,4
FRAXINUS	1	0,9		0,0	4	0,8
LEGUMINOSAE		0,0		0,0	3	0,6
CHENOPODIACEAE		0,0		0,0	1	0,2
TOTAL	110		132		508	
UNDETERMINABLE	7		7		13	
UNIDENTIFIABLE CF RICINUS					1	

Table 2. Distribution of taxa between phases in Tell Halula.

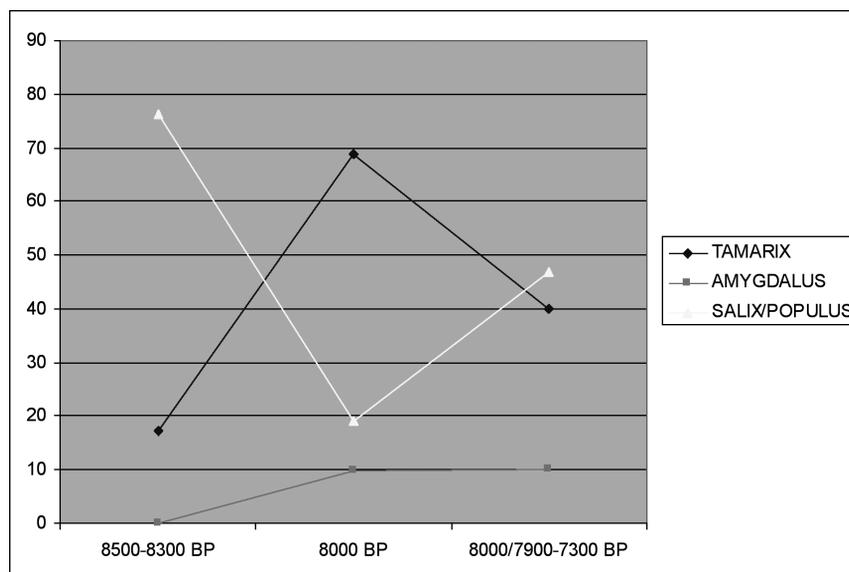


Figure 2. Relative frequencies of *Amygdalus*, *Tamarix* and *Salicaceae*.

CONCLUSION

The main characteristic of firewood management in this two former villages of the Euphrates is the importance of riparian taxa as firewood in all the phases studied. The exploitation of the riparian woods has been also widely documented in various deposits of similar chronologies from the charcoal analysis, as we pointed before. Deposits like Cafer Höyük, Can Hassan III and Tepe Abdul Hosein in Turkey (Willcox 1991) have supplied data on riverside exploitation. Despite that other forest communities grew in the surroundings they prefer to exploit the riparian communities. Availability of riparian taxa due to the proximity of the river could be the main factor to explain the intensity of his consumption. Taxa from steppe and woodlands are represented by *Amygdalus* and *Pistacia*, *Quercus* deciduous, *Pomoideae*, *Viburnum*, *Ficus carica*, *monocotiledoneous*, *Leguminosae*. These forest formations are less represented in these sites. Their low presence could be an indicator of a less intensive and occasional exploitation maybe due to a low presence in the surroundings. In some of the layers these taxa are totally missing; that is to say, in some layers firewood was collected only in the forest gallery. Nevertheless, as we say before, the sample studied is

small and we have to consider that further analysis can modify the firewood consumption pattern.

The presence of *Quercus* deciduous in the charcoal analysis record of Akarçay shows the early expansion of the forest in the zone. *Pistacia*, *Amygdalus* and *Quercus* deciduous are also well represented in pre-pottery and Neolithic levels of other archaeological sites. Their presence has been interpreted as an evidence of forest expansion in South-eastern Anatolia. Remaining of oak forest grow nowadays not far from Akarçay tepe. The consumption of *Quercus* sp deciduous, *Pistacia* and *Amygdalus* has been documented in Abu Hureyra in the occupation of 11500-10000 BP and also in the PPNA occupation from Mureybet and Jerf al Ahmar. All these sites are situated in the North of Syria, in the vicinity of river Euphrates (Willcox/Roitel 1998; Willcox 2002). During the PPNB occupations these taxa were usually consumed, as we can see in the charcoal assemblages of Halula, Dja'de in Syria and Cafer Hoyuk in Turkey. Willcox (2002) consider the presence of these taxa as an indicator of a broad distribution in the past of oak woods and forest-steppe in Turkey and Syria. These formations could also be extended in lowlands. Nowadays the relicts of these forests are limited to higher altitudes. The results obtained for Akarçay Tepe confirm the presence of oak woods and forest-steppe in lowlands.

4. RECONSTRUCTION OF ANCIENT VEGETATION AND OF CLIMATE CONDITIONS ON THE EUPHRATES AT THE END OF THE PLEISTOCENE BEGINNING OF THE HOLOCENE¹

George Willcox, Sandra Fornite, Linda Herveux*

INTRODUCTION

In order to reconstruct past vegetation in the study area we have: 1) been identifying charcoal from several sites along the Euphrates; 2) gathering information from forest remnants in isolated areas. The charcoal results have provided evidence for the presence of tree species in the during the Holocene but which have since disappeared from area. This deforestation appears to be due to a) extensive anthropogenic deforestation and environmental degradation, b) climate change. The forest remnants which we have examined provide direct evidence of the kind of vegetation associations which occurred near the sites. Although up to 20 taxa have been identified from these sites, three characteristic tree taxa, deciduous oak *Quercus* sp, *Pistacia* and *Amygdalus*, are given special attention because they are considered to be good markers.

Degradation of the vegetation in the Euphrates region is particularly severe because regeneration is made difficult due to the aridity and more importantly, constant grazing by sheep and goats, which kills off freshly germinated tree seedlings which means that under present-day conditions regeneration may not occur at all.

The extent of past forest cover and the chronological sequence of the destruction can only be evaluated by interpreting the results from analysis of fossil material. We are carrying out analyses as part of the MENMED project. Charcoal from archaeological sites provides a record of wood exploitation within a chronological framework even if sequences are incomplete. Most charcoal comes from fuel for which there is less selection than for building timber. Fuel is generally collected as near as possible to the settlements, thus the charcoal data reflect the availability within the site catchment area because firewood was collected from the trees or shrubs nearest to the site, regardless of other factors such as combustibility.

The archaeological sites discussed in the MENMED project range from the Natufian at Abu Hureyra in the extreme south to Islamic samples from at Tell Shioukh Faouquâni. Early Neolithic sites include Jerf el Ahmar, Mureybet, Dja'de, and Halula. Bronze age sites include Tell Shioukh Faouquâni, Tilbeshar and Horum Höyük. The area defined by these sites has a climate which forms a gradation from the north-west to the south-east. Thus in the extreme south the average annual rainfall is 200 mm at Abu Hureyra, and in the extreme north it is 450 mm.

The sites in question are found in areas which today are totally denuded and devoid of trees yet the three key taxa (*Quercus*, *Pistacia* sp and *Amygdalus*), have been shown to be present in abundance from charcoal identified at all the sites. The ligneous vegetation near the sites nowadays consists of a few spiny shrubs, riverine species and plantations of poplars and various fruit trees.

THE YOUNGER DRYAS

Analysis of the early sites provides evidence for climatic deterioration seen in the reduction of taxa such as *Stipa*, the wild cereals and *Pistacia* during the Younger Dryas (between 10,700 and 9,600 BC). However it is significant that these three taxa persist, occurring before, during and after the Younger Dryas which appears to indicate that climate change was not as severe as some authorities might suppose. Cereals were less frequent during this period so man relied on plants from the flood plain of the Euphrates such as *Polygonum*, *Rumex* and *Scirpus*. These plants would have been less affected by climate change as they depend on moisture from the river. At the site of Jerf el Ahmar, after identification of the ancient plant assemblage we compared this with present-day associations in order to estimate past rainfall in the region (see Fig. 2). This is interesting to compare

1.- Important note. This chapter is a MENMED activity report which was presented to the European Commission in 2006 and was not originally intended for publication.

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with estimations based on isotopic analyses. The plants have a wide tolerance margin which may explain the differences between the two techniques.

THE HOLOCENE

The earliest levels at Jerf el Ahmar and the period III at Mureybet coincide with the beginning of the Holocene which was a period of climatic amelioration. Pollen diagrams from the Mediterranean zone indicate an expansion of the deciduous oak forests. Barley which was very rare during the Younger Dryas and absent before it increases during the early Holocene in the Euphrates valley. Its increase could be due warmer climatic conditions or that humans started to use it at this date. Tree species such *Pistacia atlantica* and almond identified from both fruit and charcoal are common, deciduous oak continues to be present at low frequencies. This clearly indicates an expansion of the forest species during the Holocene in the study area. By comparing the occurrence of the three species in the past with their availability in relation to the sites today and forest remnants it is possible to assess ancient vegetation cover. The more northerly sites, occur in what botanists consider to be areas of potential oak forest under present-day climatic conditions with a rainfall of more than 400 mm per annum. Charcoal from two Bronze Age sites in southeast Anatolia, Tilbeshar, situated on the Sajour, a western tributary of the Euphrates, and Horum Höyük and Akarçay situated on the banks of the Euphrates

have been studied. At both Chalcolithic and Bronze Age sites results indicate that oak charcoal is present at high frequencies. Whereas at Akarçay the oak is less common suggesting that between the Neolithic and the Bronze Age the oak forests expanded. These sites occur in an area with more than 350 mm of rain per annum. The southern limit of the present-day distribution of *Quercus brantii* where relic stands were found at 650 masl. Charcoal from the site of Tell Shioukh Faouquâni near the Turkish-Syrian border consists mainly of riverine species but some oak is present associated with iron smelting for the Bronze Age. This may have been imported from further north. Thus it would appear that the limit of the oak forest was north of here.

Farther south in northern Syria, the analysis of wood charcoal, charred seeds and fruits at one late Pleistocene and four early Holocene sites situated on the Euphrates have shown that during these periods the *Amygdalus* and *Pistacia* forest steppe association was present in this area. Oak charcoal was present at all sites but at low frequencies and may represent wood which had floated down the river, indeed the isotopic analyses this out. A rich riverine assemblage made up by far the most important proportion of the charcoal from these sites and consists of *Populus euphratica*, *Salix* sp, *Tamarix* sp, *Fraxinus* sp, *Platanus* sp, *Alnus* sp, and *Vitis sylvestris*. Fruits of another riverine taxa, *Vitex agus castae* were found at Jerf el Ahmar. It is striking that all but the first three of these taxa have disappeared from the Syrian Euphrates and that the three forest steppe species have disappeared from the area.

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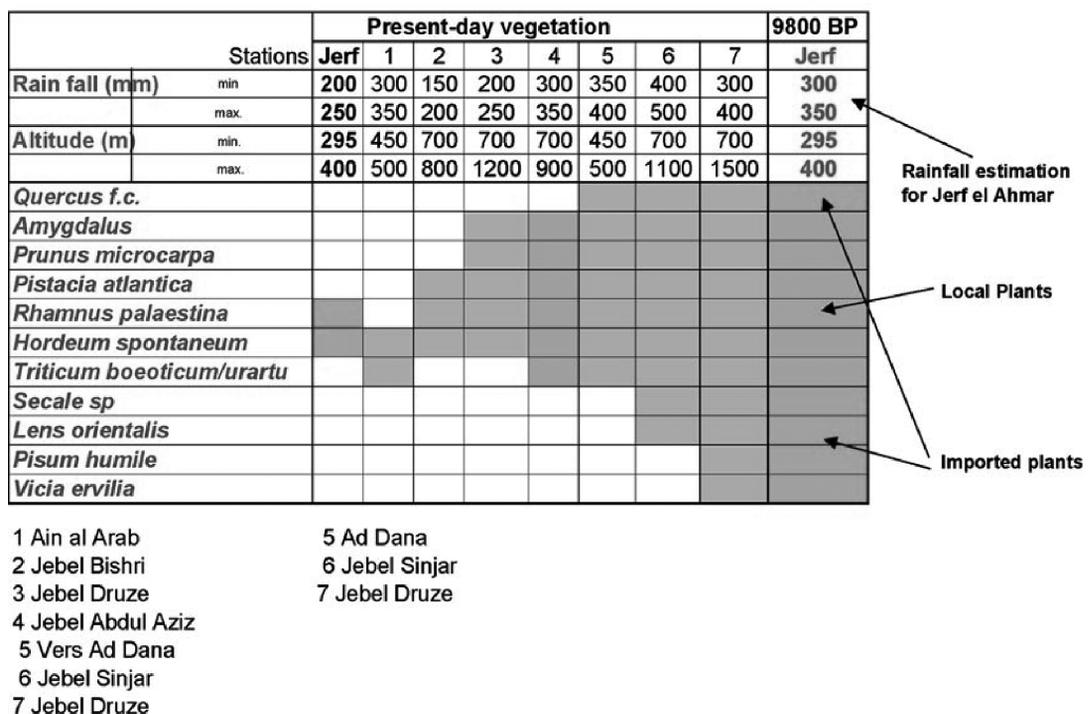


Figure 1. Estimation of rainfall at Jerf el Ahmar at the beginning of the Holocene.

DISTRIBUTION OF KEY CEREAL TAXA AT THE BEGINNING OF THE HOLOCENE

The habitats of some taxa may have been reduced over the last 10000 years by human impact, particularly grazing and perhaps increased aridity. Wild rye has been identified at the four sites: Mureybet, Jerf el Ahmar, Dja'de and Abu Hureyra. Today the nearest stands to the Middle Euphrates occur on Karaça Dag at 1000 masl some 150 kms from the sites. During the Allerod wild ryes may have had a more extensive distribution but the middle Euphrates with its low altitude dry chalk hills seems an improbable wild habitat. But given cooler conditions and a lowering of vegetation zones, the nearest potential habitats for wild rye may have been further south than at present. A potential habitat is the Qara Perguel Dah, which is situated on the left bank of the Euphrates about 15 km south of the Turkish border (see Fig. 2). Given that the natural habitats and distribution of wild ryes is limited, combined with the well attested mobility of societies based along the Euphrates, it is possible that the carbonised rye grains found on these sites originated at some distance from the sites. The fact that chaff is absent from Abu Hureyra suggests that rye may have been imported. Further evidence that the

Euphrates sites are a special case comes from the fact that at the only site away from the Euphrates, that of Qaramel, there is no rye.

The nearest modern wild stands of the einkorn are found just south of the Syrian/Turkish border a few kilometres east of Ain al Arab on basalt soils in an area with 300-350 mm of rain per year. Wild einkorn stands may have extended further south during more humid periods but their habitats would have been limited to areas with appropriate soils. In the reconstruction map (see Fig.2) the einkorn distribution follows approximately the 500 meter contour, but within this distribution soil types would have played an important role.

Wild barley is the most drought-resistant cereal; it is tolerant of poor calcareous soils and is the only cereal today which extends far into the Syrian steppe where it grows on the poor chalk soils of the middle Euphrates. Wild barley is absent at Natufian Abu Hureyra and rare at Natufian Mureybet it becomes progressively more frequent during the mid to late 10th millennium at Mureybet and Jerf el Ahmar, becoming the dominant cereal at Dja'de and Halula. We suggest that on the basis of information obtained in MENMED project that the middle Euphrates was outside the limit of the natural distribution of wild barley at the end of the Pleistocene.

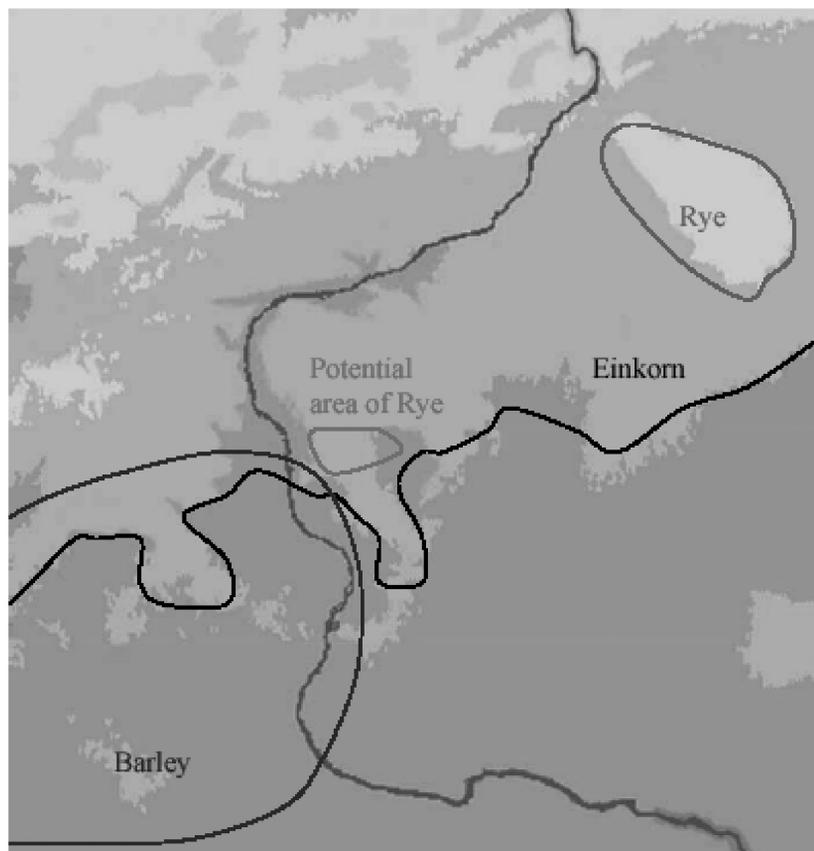


Figure 2. Map of MENMED study area showing a suggested reconstruction of wild cereals distributions at the beginning of the Holocene. A number of early Neolithic sites are outside the area of distribution of the wild wheat and rye.

At the beginning of the Holocene it expanded. But we cannot ascertain whether this was due to climatic amelioration or that its sudden appearance was related to the beginning of agriculture; either it became incorporated as a weed or it was deliberately chosen as a cultivar being better adapted both edaphically and climatically than either wheat or rye to the middle Euphrates region.

DECIDUOUS OAK, A WILD PISTACHIO (*PISTACIA ATLANTICA*) AND WILD ALMOND

During field work in Syria and Turkey under the MENMED project we collected a large number of samples from both archaeological sites and from the modern vegetation. We examined an important forest remnant found at an altitude of between 700 and 900 masl in northern Syria on the Jebal Abdul Aziz in north-east Syria. It is dominated by *Pistacia atlantica* and *Amygdalus* spp. This is a forest steppe association with very open woodlands and today only exists in restricted areas. Apart from *Amygdalus* other members of the Rosaceae family are frequent components of this vegetation zone, and include *Crataegus*, *Pryus syriaca*, *Prunus microcarpa*. These species are difficult to identify precisely from wood charcoal and are not good markers. Below this zone one finds the true steppe dominated by short-lived annuals, and perennials such as *Artemisia*, various chenopods such as *Noae mucronata* and grasses such as *Stipa*.

Tree species were common on the sites but are totally absent in the region today: deciduous oak (*Quercus* sp.),

Pistacia atlantica and wild almond (*Amygdalus cf orientalis*). Our results from the MENMED project show that these species were much more widespread in the past and that these original steppe forests have been destroyed. We have made a tentative reconstruction superimposed on the present-day vegetation map which shows a startling difference between past and present distributions (Fig. 3). However concerning our finds of oak the frequencies vary between sites. Thus the most southerly sites have very low frequencies, while the more northerly sites have much higher frequencies. In addition at the latter sites we also found charred acorns. These two types of evidence indicate the presence of oak trees near to the sites. While at the more southerly sites on the Euphrates we suspect that some of the oak wood may have been gathered from the flood plain of the river having been washed down from much further north during the spring floods. This explains the very high values of the ^{13}C isotopique signatures from the samples at Abu Hureyra compared to those from Qaramel where the oaks were local.

CONCLUSION

We have demonstrated that the climate during the early Holocene was slightly moister than that found under present-day conditions. The area has a climatic gradient and it would appear that at the beginning of the Holocene the isohyets were displaced to the south. On the other hand although we have obtained a good chronological framework for the early Neolithic sites it is not detailed enough to identify any short term abrupt changes in

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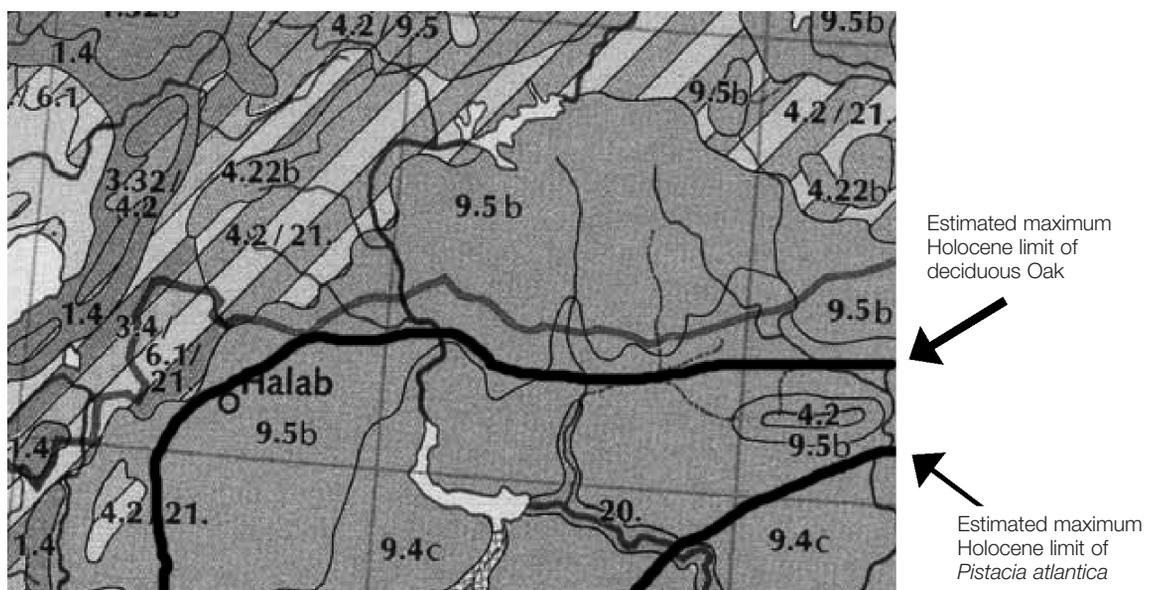


Figure 3. Gives the modern vegetation map (taken from M. Zohary 1973) of the MENMED study area.

climate. The nature of the data only allows us to observe the general climatic trends. The moister climate would have allowed the vegetation zones to descend to a lower altitude and this effect would have been reinforced if temperatures were lower which may well have been the case. The differences compared with the present-day situation undoubtedly made the area more favourable for human occupation than it is at present. But it should be noted that all sites remain close to permanent sources of water which implies that water availability for human use was similar to that of today.

We have been able to establish the composition of the past vegetation and to demonstrate that it has been highly degraded over the last 10,000 years. However we were not able to establish the chronological sequence, of the episodes of the degradation. So we may assume that the degradation occurred most rapidly at times of increased drought and at times of increased population. It is difficult to separate anthropic factors from climatic factors. But given that most of the plants

that we have found can still grow in the area, once human pressure is removed, it would appear that the dominant factor which led to the degradation was human impact rather than climate change. Indeed it is possible that the degradation of the vegetation led to increased aridity because removal of plant cover would result in more evaporation and runoff after rains. It might also have led to higher temperatures. Finally soil erosion would intensify the process of aridification further.

Given that the situation has been aggravated over the last thirty years due to demographic expansion in the area, it is time to try to reverse the process of aridification, before is too late. We recommend that the data we obtained on past species be used in order to reintroduced and restore a more favourable habitat. However this would be totally wasted if grazing were allowed to continue. Given that for the local villagers grazing is an import part of their economy, an efficient alternative to the traditional pasture would have to be found and villagers would have to be convinced to use it.

5. PALAEOENVIRONMENTAL RECONSTRUCTION: THE RESULTS OF CARBON ISOTOPE COMPOSITION ($\delta^{13}\text{C}$) IN CHARRED WOOD

Jordi Voltas*, Juan Pedro Ferrio*, Josep-Lluís Arous**

INTRODUCTION

Carbon isotope composition ($\delta^{13}\text{C}$) in wood has been related to several climatic variables that affect plant water availability, and its analysis on tree-rings offers the possibility of high-resolution climate records. However, vast areas of the world have been largely deforested for a long period, thus precluding extensive tree-ring records. This is the case for the focus area of our study, the Middle Euphrates Valley.

Moreover, palaeoenvironmental data at a local scale is particularly necessary for precipitation, due to its strong spatial variability. In such context, carbon isotope composition ($\delta^{13}\text{C}$) analyses of charred wood (charcoal) from archaeological sites offer the potential to provide a local estimation of precipitation regimes in the past. Within the framework of this project, the data given by charcoal analyses would offer the reference (climatic) background

in order to distinguish between natural and human-derived (e.g. agricultural practices) environmental changes in crops.

ANALYSIS OF WOOD REFERENCE MATERIAL: ASSESSMENT OF THE EFFECT OF CARBONISATION

Previous works on conifer wood (Jones/Chaloner 1991; Ferrio *et al.* 2006) indicate that the impact of carbonization on the $\delta^{13}\text{C}$ of wood can be considerable, and dependent on the temperature of charcoal formation. This remained to be tested, however, in the species of greater interest for the Middle Euphrates sites, most of them from genus *Quercus* and *Pistacia*. Given that these species are angiosperms, they have a distinct wood composition as compared with conifers,

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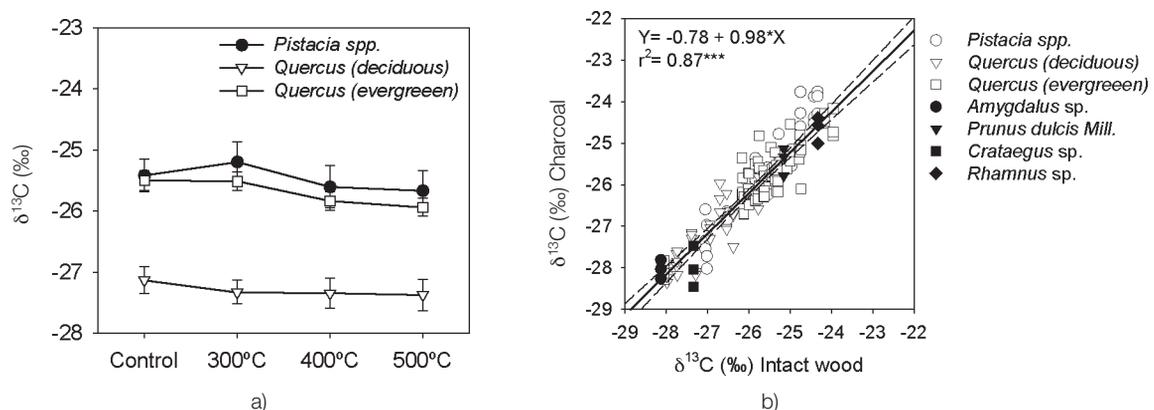


Figure 1. a) Mean values of $\delta^{13}\text{C}$ in wood of *Pistacia* and *Quercus* (both evergreen and deciduous), in control (intact) samples and the three temperatures assayed. No significant differences were found between treatments. b) Strong relationship between $\delta^{13}\text{C}$ of control (intact) samples and their carbonised replicates. The slope and the intercept did not differ significantly from 0 and 1, respectively.

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and thus might behave in a different way regarding the $\delta^{13}\text{C}$ signal recovered in the charred material. We analysed around 50 wood samples from several species of the genus *Quercus* (both evergreen and deciduous) and *Pistacia*, along with some few additional samples of almond (wild and cultivated) and one sample of *Crataegus* and *Rhamnus*, collected during the field trips in Syria and Turkey. All this material was tree-ring dated. Each sampled branch was then divided into four equal portions: one was stored without any treatment, and the other three were carbonised in a muffle furnace at three maximum temperatures (300°C, 400°C and 500°C). Afterwards, each sample was oven-dried at 60°C for 24 hours and milled to fine powder for $\delta^{13}\text{C}$ analyses.

The results indicate that, unlike conifers, carbonisation does not alter significantly the original $\delta^{13}\text{C}$ signature of angiosperm wood (Fig. 1). Indeed, we did not find significant differences between control samples and the different treatments, so the distinct isotopic signature of the three main groups of species (deciduous and evergreen oaks, *Pistacia*) was well preserved (Fig. 1a). On the other hand, a very strong relationship was found when comparing control samples with their carbonised replicates (Fig. 1b). This observation is relevant in order to simplify the inference of climatic data from the analysis of $\delta^{13}\text{C}$ in charcoal, since the $\delta^{13}\text{C}$ signature of both charcoal and intact wood would be directly comparable.

ANALYSIS OF WOOD ARCHAEOLOGICAL SAMPLES

374 samples of fossil charcoal were analysed for $\delta^{13}\text{C}$ (table 1). Because of the carbonate enrichment of

archaeological sediments, each fragment was soaked separately with HCL 6M for 24h to remove carbonate crusts (Deniro/Hastorf 1985). The fragments were then rinsed repeatedly with distilled water. Finally, samples were oven-dried at 60°C and milled to a fine powder for $\delta^{13}\text{C}$ analyses.

SITE	PISTACIA SPP.	QUERCUS SPP.	TOTAL
ABU HUREYRA	10	15	25
AKARÇAY TEPE	27	44	71
DJA'DE	21	10	31
HORUM HÖYÜK	18	25	43
JERF EL AHMAR	31	12	43
SHIOUKH FAOUQANI	2	23	25
TELL HALULA	35	53	88
TELL QARAMEL	28	20	48
Total	172	202	374

Table 1. Wood samples analysed for $\delta^{13}\text{C}$

In order to consider past variations in the $\delta^{13}\text{C}$ of atmospheric CO_2 ($\delta^{13}\text{C}_{\text{air}}$), we calculated carbon isotope discrimination ($\Delta^{13}\text{C}$), as defined by Farquhar *et al.* (1982), which allowed us to compare archaeological and modern data:

$$\Delta^{13}\text{C} = \frac{\delta^{13}\text{C}_{\text{air}} - \delta^{13}\text{C}}{(1 + \delta^{13}\text{C}/1000)}$$

Our results reveal a significant relationship between the $\Delta^{13}\text{C}$ of charcoal from *Pistacia* and *Quercus* samples

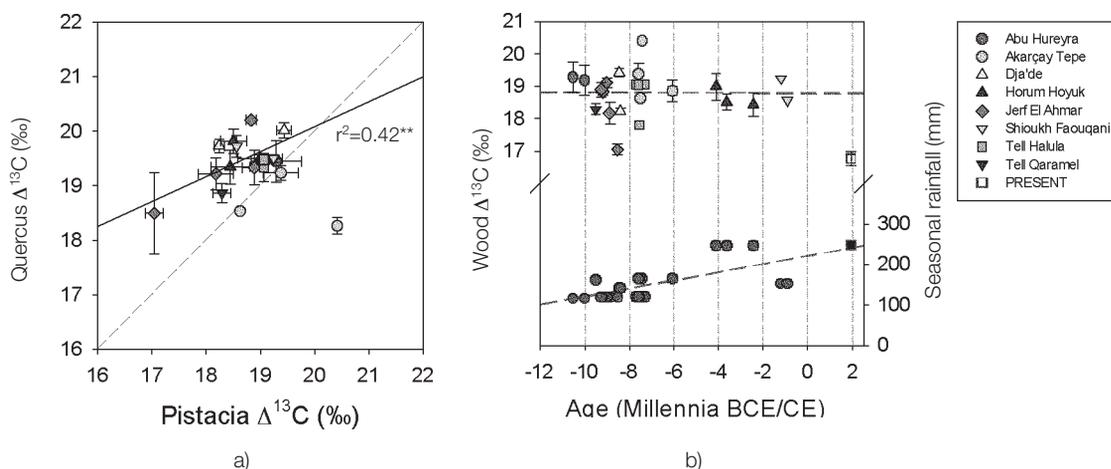


Figure 2. a) Relationship between $\Delta^{13}\text{C}$ in wood charcoal of *Pistacia* and *Quercus* across different archaeological sites and periods; b) Evolution through time of $\Delta^{13}\text{C}$ in wood charcoal of *Pistacia*, compared with the current rainfall gradient across the archaeological sites (secondary Y-axis).

(Fig. 2a), suggesting that both species were responding to common environmental factors. As a rule of thumb, the higher the $\Delta^{13}\text{C}$, the better the water status of trees. As expected, *Pistacia* (a species with greater water use efficiency) showed generally lower values than *Quercus*. Both species also showed considerably higher $\Delta^{13}\text{C}$ values than those found in modern samples (Fig. 2b for *Pistacia*). Although a quantitative model for these species relating $\Delta^{13}\text{C}$ to water availability has not been developed yet, the greater $\Delta^{13}\text{C}$ in archaeological material suggests that the water status of trees near the sites was better in the past than it would be now, if they were still growing in the area. This finding indicates significantly more humid and/or cooler conditions in the past than in present times. On the other hand, despite the existing climatic gradient between older and younger sites (the older ones are located in drier areas, see secondary Y-axis in Fig. 2b), we did not find a significant trend through time for charcoal $\Delta^{13}\text{C}$. This might also be caused by a progressive aridification, already starting in prehistoric times.

We are still working on the inference models to estimate precipitation regimes from $\delta^{13}\text{C}$ data. Nevertheless, we could obtain a qualitative indication of past changes in the water status of trees by looking at $\Delta^{13}\text{C}$ values (Fig. 2). As a rule of thumb, the higher of the $\Delta^{13}\text{C}$, the better the water status of trees. As expected, *Pistacia* (a species with greater water use efficiency) showed generally lower values than *Quercus*, but both showed similar trends through time. Thus, the existence of such a common trend between the two species would suggest that variations in $\Delta^{13}\text{C}$ are mostly related to common (climatic) constraints. On the other hand, it should be noted that the reference material (triangles), despite being collected from areas wetter than the archaeological sites (due to the lack of forest remnants in the vicinity of the sites) showed similar or even lower $\Delta^{13}\text{C}$ than the archaeological material (circles). This indicates that the water status of trees near the sites was better in the past than it would be now, if they were still growing in the area.

IV. RECONSTRUCTION OF AGRONOMIC CONDITIONS

6. CHANGES IN THE USE OF CEREALS ON THE EUPHRATES SITES BETWEEN 11,500 AND 7,800 B.C. CAL¹

George Willcox, Sandra Fornite, Linda Herveux, Ken Ichi Tanno*

The project has shown that the charred plant remains from the Euphrates sites present a wealth of information with regard to the adoption of agriculture. The analyses which we have carried out under the MENMED project have shown that during the occupation of Jerf el Ahmar the inhabitants progressively abandoned gathering in favour of cultivation. Wild cereal species were found further south than where we find them today, with the exception of barley. This can be explained in two ways: 1) the plants were imported/introduced by man, 2) past climates permitted a more southerly distribution of wild cereals. Furthermore refined analyses during the next two years should allow us to understand this phenomenon better.

These results are unique and have never before been obtained from this kind of study. They are of particular importance because they cover the period of transition between gatherers and cultivators. When we compare the frequencies of charred remains at the three sites we can see that there are strong differences in the cereal assemblages (Fig. 1 and 2). Then by looking at the diachronic changes firstly within the sites (see Fig. 3 and 4) then by comparing the sites we see that there are trends which show the changes in cereal use across the whole period of 3500 years. These changes coincide with the transition from gathering to cultivation, the adoption new cultivars and morphological domestication (Fig. 5). These changes result from complex factors such as climate change, human choice, the ecology of populations and natural selection. In the early periods rye einkorn grains were small and cultivation was limited. With the introduction of barley and emmer, with bigger grains, we see the adoption of a more efficient and better adapted set of crops.

At Jerf el Ahmar all spikelet material is of wild type. Grain size was measured for einkorn/rye and for barley. An increase in grain size was observed at Jerf el Ahmar. This

increase in size is not necessarily due to morphological domestication; it may result from cultivation under optimum growing conditions. The introduction of large grain varieties is an alternative but less plausible hypothesis.

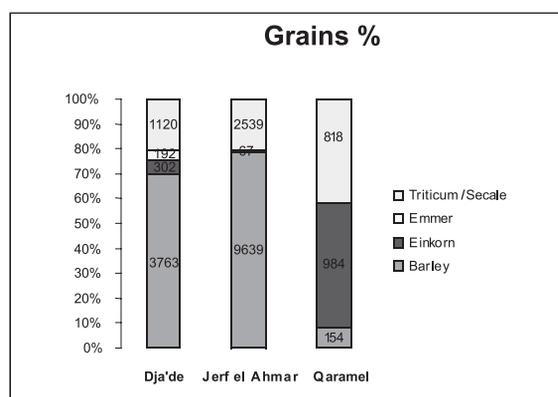


Figure 1. Differences in the proportions of cereal grains between three sites.

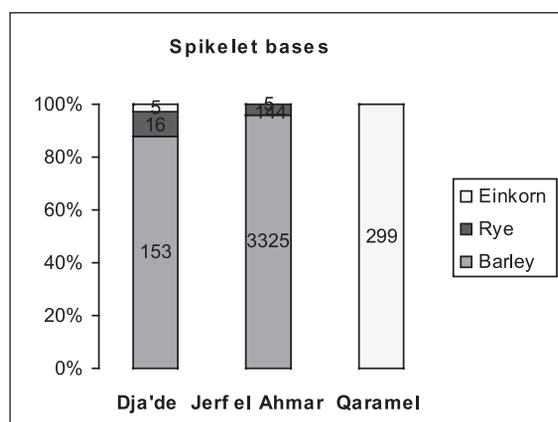


Figure 2. Differences in the proportions of cereal spikelet bases between three sites.

1.- Important note. This chapter is a MENMED activity report which was presented to the European Commission in 2006 and was not originally intended for publication.

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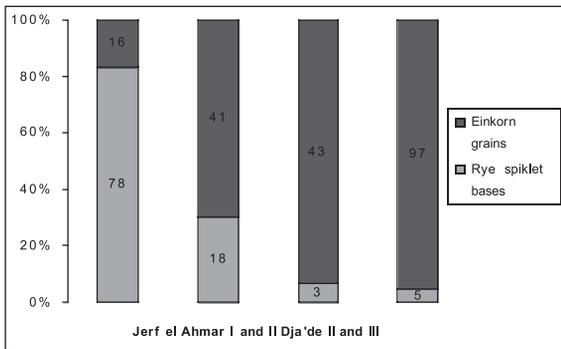


Figure 3. Provides evidence for the increase in einkorn and the diminution of rye.

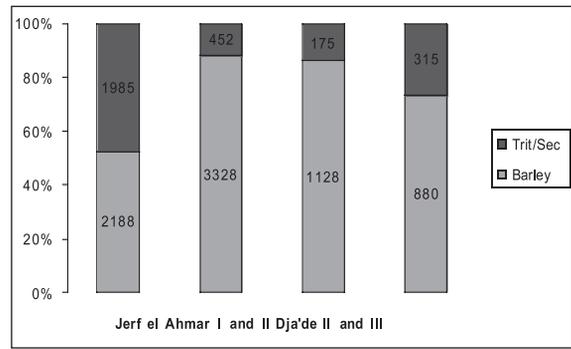


Figure 4. provides evidence for changes in the proportions of barley and einkorn/rye grains.

EVIDENCE FOR AGRICULTURE PRIOR TO THE APPEARANCE OF MORPHOLOGICAL DOMESTICATION (PRE-DOMESTIC AGRICULTURE)

The earliest stages of agriculture developed under special conditions when plants still had all their wild characteristics in terms of morphology and physiology. There was a lapse in time between the beginnings of cultivation and the appearance of new population which had morphological and physiological characters making them better adapted to cultivation.

Taking four lines of evidence for pre-domestic agriculture from early sites on the Euphrates we can see a trend which points towards increasing use of cultivation and less for gathering.

1) The first line of evidence is the reduction in the frequencies of commonly gathered seeds which were never domesticated compared to a relative increase in

the wild progenitors of the founder crops. These changes can be seen if we compare 11th and 10th millennium sites. Thus taxa such as *Polygonum*, *Scirpus*, *Stipa* and the panacoid grasses are common on Natufian sites and become progressively less frequent. At the same time the founder crops such as single-grained einkorn, emmer, barley and lentils become more frequent (see Fig. 6).

2) The second line of evidence is an increase in grain size. Cultivators will tend to choose the best soils producing populations with a higher proportion of well-formed grains.

3) The third line of evidence which could be taken as evidence for pre-domestic cultivation is the introduction of new cultivars. On the Euphrates sites three taxa which are totally absent in earlier levels appear and then gradually increase in frequency. As we have seen the first is barley, totally absent at Abu Hureyra which then appears at Mureybet; it is followed by one

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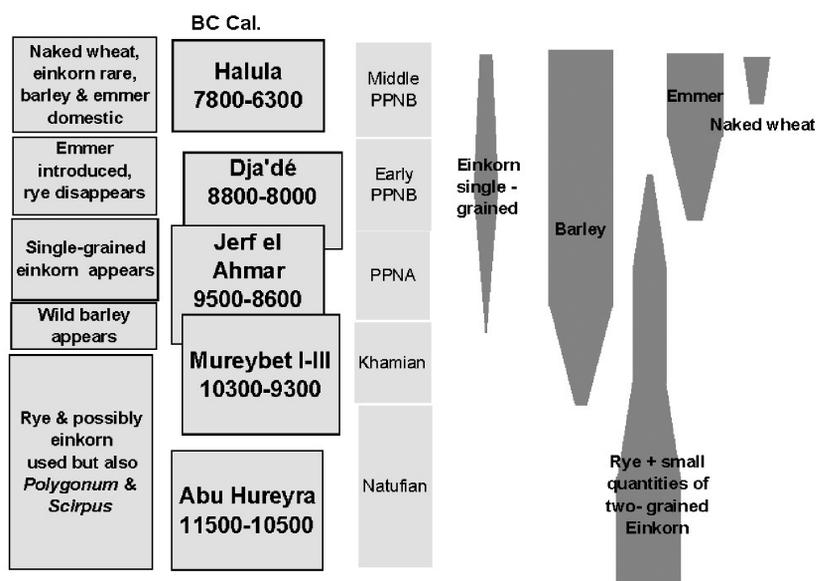


Figure 5. Changes in the use of cereals on the Euphrates sites between 11,500 and 7,800 B.C. cal. Rye/einkorn replaced by emmer and barley.

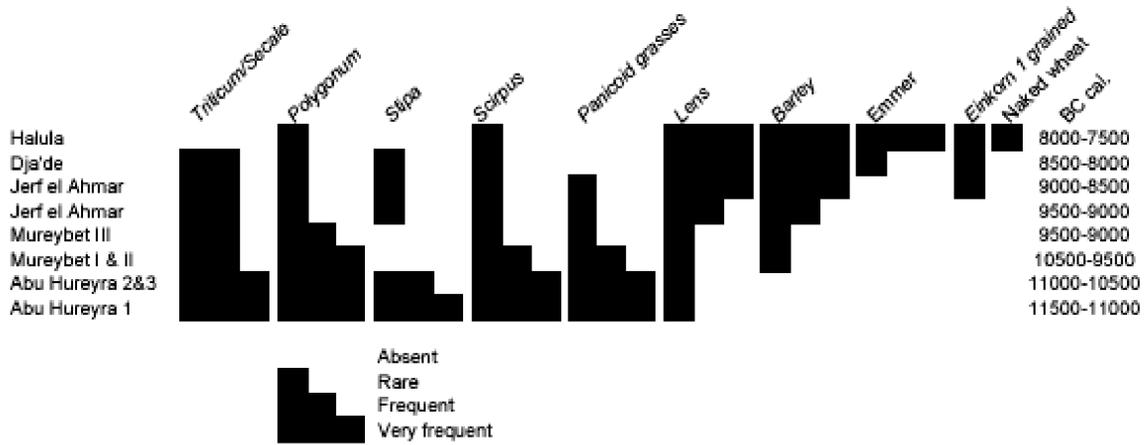


Figure 6. Show a decrease in gathered plants and increase in progenitors.

grain-einkorn and then emmer. These taxa were to become the dominant crops in many parts of the Near East. Thus their first appearance outside their area of natural distribution represents evidence of cultivation (see Fig. 6).

4) The presence of an assemblage of plants which have no obvious economic use and which consist of taxa equivalent to modern-day weeds of cultivation is another sign of cultivation prior to domestication. Cultivation of pulses and cereals would have favoured plants which are adapted to unstable soils. Their presence leads one to the conclusion that they represent evidence for pre-domestic cultivation which would have favoured this group of plants (Fig. 7). Taking all four lines of evidence outlined above they produce a convincing argument suggesting that the

inhabitants of these sites may have started sowing crops on a small scale during the Natufian and that progressively they became more reliant on cultivation. Agriculture developed progressively over two millennia with the addition of better adapted crop and the appearance of weeds. A full production economy allowed the selection of mutant forms which led to the development of morphological domestication where cereal ears retain their seeds after maturity.

CONCLUSION

Given the more favourable climatic conditions during the early Neolithic dry farming would have been possible. The cereals that we have examined that date

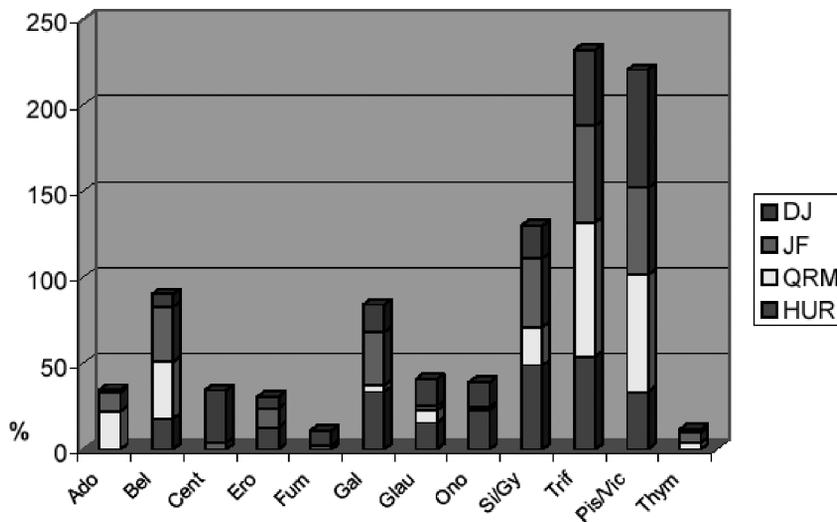


Figure 7. Comparison of weed assemblages from different sites. These results indicate that weeds of cultivation were present at all four sites.

from this period show no signs of having been cultivated under irrigation; indeed at this time it would not have been possible to use the waters of the Euphrates for irrigation. First because the topography of the valley above the flood plain is not adapted. Second because the flood plain itself would have been totally inundated just at the time that the cereals were coming to maturity. These annual floods are brought about by the combination of spring rains and the melting of the snows in the mountains of Eastern Turkey.

Where did these early farmers obtain their cereals? Today large scale wild habitats of einkorn and rye are to be found north of the Syrian/Turkish border. Barley is found throughout the region. Palaeoclimatic evidence suggests wild wheat and rye may have grown further south nearer to the sites than they do at present. However they may not have been growing at a convenient distance to the sites because sites are situated in areas where edaphic and climatic conditions are not suitable. We cannot establish with any certainty at what distance the stands were from the sites. What ever the distance the inconvenience of wild stands being situated not in proximity of the sites created an incentive to cultivate which may have been facilitated by socio-cultural factors. The advantage of having the cultivated fields near the sites would have been enormous. Villagers could protect the potential harvests from grazing animals of which we know there were a great many but also they may have been in competition with other villages for the stands of wild cereals. If they were to plant them near to the site they could not only claim them for themselves but also defend and tend to them.

At the earliest settlements in the region at the end of the Pleistocene inhabitants gathered predominantly rye and some einkorn from areas where it grew, presumed to be further north. Perhaps they used the Euphrates or the Balikh rivers to bring supplies or seed corn further south. For cultivation early farmers would have chosen

areas near to the villages where favourable soil conditions occurred. They probably continued to gather even after they started to cultivate both to renew seed stock and as a backup when crops failed. Crop failure for early farmers may have been quite common resulting from drought, disease or pillage.

The beginning of the Holocene brought warmer climatic conditions and villages on the Euphrates became more dependent on farming and less on gathering. It is at this time that barley first appears on the Euphrates sites. To begin with it was rare then it increases in frequency. The appearance of barley probably results from the combined effect of warmer climatic conditions and increased intensity and reliance on cultivation. Barley is better adapted to the climate of the region than wheat. Progressively the inhabitants abandoned the use of grains of small grasses, *Scirpus* and *Polygonum/Rumex* in favour of cereals and pulses which had bigger grains. Then with time, the diversity of cereals increased with the introduction of one-grained einkorn, emmer and naked wheat. These new crops came from elsewhere.

Our data did not allow us to estimate yield. Indeed early farmers would not have been concerned with quantity per hectare for the simple reason the land availability was not a limiting factor as it is in modern societies. They would have been more interested in a high return of the seed corn. They chose varieties with large grains and gradually abandoned small grains. Thus at the earliest sites inhabitants used small grained rye/einkorn. Later they started using single-grained einkorn which has a larger grain followed by emmer and naked wheat which have progressively bigger grains.

Finally data obtained from the MENMED project demonstrates that cultivation started earlier than some scholars had previously proposed and it took thousands of years for the first incipient cultivators to evolve into well-developed farmers who were fully dependent on farming and used fully domesticated cereals and pulses.

7. EVIDENCE FOR PLANT EXPLOITATION FROM PPNB AND PN SITES IN THE MIDDLE EUPHRATES VALLEY: NEW DATA FROM AKARÇAY TEPE (TURKEY)

Ramon Buxó*, Núria Rovira**

INTRODUCTION

The archaeobotanical analyses which we have carried out under the MENMED project have shown from Akarçay Tepe (Turkey). A total of 7760 seeds remains have been studied. In general the remains are so fragmented, the rest are well conserved and we have identified a total of 61 taxons. The volume of the sediment treated is about 2480 liters, and washing by flotation over an exterior column of 1-0, 5 mm. sifting.

Currently, the majority of the analyses are not finished; the first levels of occupation registered in the site could correspond to a mid PPNB. These levels are provisionally the 20 to 23 of the 20 Trench and maybe the most ancient of the East Sector (layers 10 a 12). Next, we documented series of levels from the recent PPNB that correspond to the levels 11 to 19 of the 20 Trench and probably from the 6 to 9 of the East Sector. The total of the occupation not-pottery for the site embraced c. 7600-7000 cal BC.

The pre-Halaf occupation of the site (c. 7000-6100 cal BC), that forms part of the Pottery Neolithic, is registered between the levels 1 and 10 of the 20 Trench, 1 and 5 of the East Sector, as well as the 1 and 7 of the West Sector.

THE CULTIVATED PLANTS

The vegetal taxa identified in Akarçay Tepe embraced the crops plants and the wild plants. In general, we consider that the majority of these species, especially, wheats, barleys, lentils, peas and grass pea are cultivated.

The majority of the seeds remains identified are charred, at the exception of the samples from the boraginaceous family that are mineralised. At the same time, we have registered a series of fossilised remains (drying) that are probably modern contaminations: pips' grape (*Vitis vinifera*), medick fruits (*Medicago minima*), fumitoy seeds

(*Fumaria* sp.) and a seed of pear/apple (*Pyrus/Malus*). Take into account the high level of fragmentation of these remains, we will carry out the interpretative analysis focused in the ubiquity of each taxon per sample (figs. 1 and 2) but not in the absolute number of the remains in order to minimize the possible distortions produced for the fragmentation and to evaluate in a correct way the importance of each taxon.

CEREALS

The number of taxa from this group is no so much but it embraces the main crops species in the South-West Asiatic. In general, barleys and wheats are well represented, in the same way for the hulled and naked forms, although the first ones seem more important. Two-rolled hulled barley (*Hordeum distichum*) is more difficult to distinguish of its wild ancestor (*Hordeum spontaneum*) if we just have the seeds, this is the case that in general we have observed in Akarçay Tepe. Due to the mentioned before as well as the fact that many samples of this species were fragmented, we have decided to join in the same category of *Hordeum distichum/spontaneum*. Just in one case we have registered one rachis internodes (sample 28U 15) that we able to identify as *H. distichum* thanks to the presence of a rough abscission scar (Hillman *et al.* 2001). In general, we have observed that the seeds of two-rowed hulled barley increase in a light way their size once they correspond to early phases of occupation. This could be in relation with the fact that these seeds are better conserved than the elder. In fact, the argue about the increase of the size for the domesticated seeds are now for review because we think that the differences concerning the size observed between the more ancient and the more recent period are due to the existence of different populations of cereals but not to an effect of the domestication (Willcox 2004).

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Gathering of the wild barley is dated in the South-West Asiatic since 17.000 B.C., its cultivation could produce since mid 9th millennium BC. The area of natural dispersion of wild barley is so wide but specially focused around the Mediterranean, the Central-South of Anatolia, north of Iraq and the West of Iran (Zohary/Hopf 2000, 66), for that at the beginning of the occupation of the Akarçay' site both documentation of domesticated and wild forms is understanding. The two-rowed hulled barley (*H. distichum/spontaneum*) is one of the main species of cereals, just behind the emmer wheat (fig. 3). Six-rowed hulled barley (*Hordeum vulgare*) has been identified from the grains using the criterion of the deformation of the ventral furrow. Regarding the naked barley (*Hordeum vulgare* var. *nudum*), its presence has been able fixed thanks to the particular morphology of the grains which not present the marks of the glumes on the surface, they have a more round form and the ventral furrow more closed.

The introduction of six-rowed hulled barley is so early, since the end of PPNB, coinciding with the presence of naked barley (Nesbitt 2002). In Akarçay Tepe, their presence from layer 11 of the 20 Trench and layer 10 of the East Sector coincide with this chronology, although traditionally the researches confirmed that they are not wee fixed in Anatolia until the 6th millennium BC (Zohary/Hopf 2000). In a general level, both species of barley have a concrete presence during the phases of pre-pottery occupation. On the other hand, we point a light increase of their frequency and abundance on the pre-Halaf phases without to equal the proportions of the two-rowed hulled barley and the emmer wheat.

Between the hulled wheats, we may point the presence of the emmer wheat (*Triticum dicoccum*). In Anatolia, emmer wheat is documented for the first time in a domesticated form dated on mid of the 8th millennium BC at Nevali Çori (Zohary/Hopf 2000), becoming the main cultivated cereal in the major part of the pre-pottery sites of the South-West Asiatic. In Akarçay Tepe, this abundance of the emmer wheat is clear evident during all the sequence of the occupation of the site. Its abundance and frequency are so similar than the *Hordeum distichum/spontaneum*.

Inside this group we have also documented grains of einkorn wheat which belong to the forms of one-grained einkorn. The current distribution of the wild species of one-grained einkorn wheat (*T. boeoticum* ssp. *aegilopoides*) embraces the Central-West of Anatolia (Willcox 2005) that corresponds with the discoveries realised in Akarçay Tepe. Few seeds of little size have been identified as a *Triticum boeoticum/monococcum*, being possible to identify with seeds both of wild species and subdeveloped cropped species. At the same time, we have collected some spikelet forks that have been determined, in the majority of the cases, like *T. dicoccum/monococcum* due to their fragmented state and the difficult to distinguish both species.

Originally, the einkorn wheat seems to be developed in the Anatolia Peninsula, north of Iraq and West of Iran, probably since the beginning of the PPNB. From here it was spreading out to other oriental regions (Zohary/Hopf 2000). The crop of one-grained einkorn wheat could be specific for Anatolia like seems to confirm the whole of Nevali Cori (Willcox 2002b). In Akarçay Tepe, the presence of one-grained einkorn wheat is so concrete during the different phases of pre-pottery occupation, but it is well collected since the (layer 23 de la 20 Trench) which could confirm the hypothesis above mentioned. However, it seems a secondary crop like the six-rowed hulled barley or the naked barley. The fact that practically we do not register morphologically wild forms can indicate a well developed agriculture.

In relation to the naked wheat, we have collected grains of free-threshing wheat (*Triticum aestivum/durum*). The presence of hexaploid free-threshing wheat is developed so quickly once the agriculture of the emmer wheat is developed in the regions where the goat face grass (*Aegilops*) growing, for example the Anatolia Peninsula. The documentation of these species of naked wheat is dated in this region on 7000-6500 BC for example at Asikli Hüyük, but not in Çayönü or Nevali Çori (Zeist/Roller 1995; Nesbitt 2002). In Akarçay Tepe are collected form the beginning of the occupation of the site, being the third specie of cultivated cereal both phases of PPNB and pre-Halaf, especially with respect to their frequency of presence. Finally, different grains of goat face grass (*Aegilops*) have been collected, as well as two bases of, so big and strong, being identified like *Aegilops crassa* (Zeist/Baker-Heeres 1982). These species are not considered like cultivated plants but a part non-selected of the harvest. The number and frequency of presence of this taxa in Akarçay Tepe, more important than another species of cultivated cereals like the naked barley, six-rowed hulled barley or einkorn wheat, indicate the great dispersion of this plant in this region, maybe they could also show their exploitation.

LEGUMINOUS

Lentils have, in general, a rather small measure and in spite of being its number relatively abundant all seem indicate that had been cultivated and has been determined as *Lens orientalis/culinaris*. The cultivation of lentil seem to be one of the ancient produced in the south-west of Asia, probably from the VIII-VII millennium B.C., as it seems to show its wide distribution in the wild form and the groups documented in many sites of this region (Zohary/Hopf 2000).

Field-peas, show, at first sight, different biometric characteristics. There have been determined bigger samples like *Pisum sativum* and smaller like *Pisum* sp., even though there cannot have been observed the characteristics of the seed coat, the unique sure criteria of domestication, we believe that in both cases are cultivated. The main criterion utilized to differentiate from the rounded

forms of *Vicia* has been the morphology of the hilum which is oval and short. Nevertheless, we can say that the cases where hilum was preserved were scarce. So, that we have decided to determine these doubtful samples like *Vicia/Pisum*. The cultivation of peas seems to be documented from the VIII millennium, even though there have not been identified fully domestic forms till the end of the VII-beginning of VI millenniums in sites like Çayönü, Çatal Höyük or Can Hasan I (Zohary/Hopf 2000).

Grass peas (*Lathyrus* sp.) present a more squared form as peas, having, in main time, a rather triangular section. The hilum is also short but lanceolate. The distribution of the wild species of this race embraces a large area of the Mediterranean basin and the South-west of Asia, having been documented the first indices of its cultivation in Anatolian sites to the end of the VIII milenium like Nevali Çori and after during the VII millennium at Çayönü (Zohary/Hopf 2000).

We differentiate bitter vetch (*Vicia ervilia*) from the other species of *Vicia* for its pyramidal form with a triangular base and the rounded apex. The distribution of wild progenitor of bitter vetch is situated in the area of Anatolia, north of Iraq and Anti-Lebanon, having been documented its cultivation in the Anatolian aceramics sites from the VII-VI millennium B.C. (Zohary/Hopf 2000). It is believed that its cultivation could have started precisely in the Anatolian area (Zeist/Roller 1995).

Chick peas (*Cicer* sp.) present a rather angular and convex form with a rounded basis. They have a prominent radicle and rounded hilum clearly visible, situated in the centre of the seed. It cannot be precise whether the unique sample documented at Akarçay belongs to the cultivated species (*Cicer arietinum*) dew to the exception of the founding, and of its rather small measures which are more similar to the wild forms from pre-pottery sites like Çayönü or Ghoraifé (Zeist/Baker-Heeres 1982, 209) Nevertheless, the region were we are is that which fit with the distribution area of the wild progenitor (*C. arietinum* ssp. *reticulatum*) of cultivated chick-peas (Zohary/Hopf 2000, 110).

There have documented, to finish, a fragment of a big leguminous, half of cotyledon, which could belong to a broad bean (*Vicia faba*-type), even though its bad state of conservation prevent us to make it for sure. The wild progenitor of the broad bean still remains unknown, at the same time that the certitude of evidences of a cultivation of *Vicia faba* is documented both in the east and west of the Mediterranean in a rather late moment.

THE CULTIVATED FLAX

From the beginning of the occupation sequence of Akarçay Tepe, there have been preserved remains of flax (*Linum* sp.), which have been identified under this term mainly dew to its fragmented state. This fact impelled to measure the seeds and join to the cultivated species, which can be generally differentiate because

the measure of the seeds surpasses the 3 mm of lengthy (Zohary/Hopf 2000, 130).

The beginnings of flax cultivation are not very precise, so they are only based on the biometry of the seeds and there exist wild species with similar measures (i.e. *Linum bienne*) or bigger (i.e. *Linum perenne*) Another utilized criteria is the abundance of seeds remains of this specie in the archaeological sites, fact which together with the previous, point that the cultivation of flax could be initiate in the south-west of Asia before the 6000 B.C. (*op. cit.*, 132). The obtained data at Akarçay, show that flax is a common plant from the beginning of the occupation and that can be confirmed with security that its cultivation at least from the layer 8 (27V 12) of the East sector which can be dated approximatively before 7040 cal B.C.

COLLECTED FRUITS

Archaeological remains of fruits are not very abundant at Akarçay Tepe, but there have been documented at least three species.

One of the most frequented identified fruits is the fig (*Ficus* sp), its grains can be found from layer 10 (27Y 33) from East Sector; situating the chronological fork between the 7450 and the 7200 cal B.C. During the pre-pottery occupation, this specie generally appears in a dispersal way (fig. 2), and it increases considerably its importance during the pre-Halaf Neolithic phases, fact which could indicate its cultivation at least during this late period.

Another fruit which was exploited by Akarçay communities is the wild pistachio (*Pistacia atlantica*), even though its presence is very punctual during all the occupation sequence. The identification of fruits of this species is produced from the Late Palaeolithic, for example at Halan Çemi (Nesbitt 1995), and is very common in other Anatolian sites from PPNB like Asikli Hüyük (Zeist/Roller 1995, 183).

Finally we have to point the punctual presence of a sloe stone (*Prunus spinosa*-type), which has been identified thanks to the rough form which presents on the surface, which is clearly different from the other species of the cherries group (*P. cerasus* i *P. Avium*) or from the plums (*P. domestica* ssp. *insititia*). There have not been found any reference of the identification of this species in the South-West of Asia, even though the period from which this remain has been identified (layer 4 de la 20 Trench), dated c. 6450-6200 B.C., it belonged to the more or less near vegetation.

THE WILD PLANT REMAINS

The number of wild species which form part of the adventice vegetation around d'Akarçay Tepe is high. In fact, the high number of certain species typical of calcareous soils of steppe humid areas like small-seeded legumes (*Trigonella*, *Medicago*, *Trifolium*), small-seeded grasses (*Hordeum bulbosum*, *Eremopyrum*, *Hordeum*

murinum) or the stony-seeded gromwells (*Arnebia*, *Buglossoides*), is related to the opening of cultivation areas and the elimination of the competing vegetation (Willcox 1996, 149-151; Hillman *et al.* 2001, 388). Nevertheless, even though it cannot be proved why there have not been documented closed conjoint in Akarçay could be that these species, specially would have been exploited for its consummation.

The conjoint small-seeded legumes and small-seeded grasses are the most abundant in the site. In the first group stands up specially the presence of *Astragalus*, *Trifolium* i *Trigonella* (*astroites*), and in a more modest form the *Melilotus*, during both big periods of the site occupation. Up to pre-Halaf levels, they appear and reach a big extension *Coronilla* and *Medicago* (*radiata*) punctually during the first period is documented *Onobrychis*. We can also note the presence of concentrations of *Astragalus* (28U 15 i 21O 35), *Trifolium* (28U 7) and *Trigonella* (28U 7, 21O34 i 21O 35), although the general percentages of these species remain fairly balanced across all the sequence (about 20-30%).

In the second group we have to underline the important presence of *Lolium* across all the sequence; in fact the most abundant and frequent taxon of this category of plants. Afterwords *Bromus* is the the gramineous with a higher frequency, meanwhile the rest of species of this group appear in a more reduced proportion *Avena*, *Echinaria*-type, *Echinochloa*, *Eremopyrum*, *Hordeum murinum*-type, *Phalaris* i *Poa*-type. The percentages of the different species of this group, remain quite balanced during the sequence of occupation of the site, like in the previous group (c. 40-50% per *Lolium* i 20-30% per *Bromus*) being, perhaps, representative, the decrease and almost disparition of 'Avena in the levels pre-Halaf. The seeds remains from the Boraginaceous family is also very important, specially *Arnebia decumbens*-type, *Lithospermum arvense*-type and *Lithospermum tenuiflorum*, which seem to increase its apparition frequency in the pre-pottery and pottery levels (fig. x) Other taxons of this family which appear more sporadic are *Alkanna* i *Heliotropium*.

The rest of wild species of Akarçay Tepe are related also with the cultivation of cereals and leguminous, being the most representatives *Ajuga*, *Amaranthus*, *Androsace maxima*, *Atriplex*, *Bellevalia*, *Centaurea*, *Chenopodium*, *Galium aparine*, *Fumaria*, *Glaucium aleppicum*-type, *Gypsophila*, *Helianthemum*, *Malva*, *Plantago*, *Silene*, *Stellaria*, *Teucrium*, *Thymelaea*, *Valerianella* y *Ziziphora*-type. Most of these species are typical of the aridest steppe areas. In this sense we have to emphasize the presence of a species related to humid environments the rush (*Juncus*).

CONCLUSIONS

The study of archaeobotanical remains of Akarçay Tepe clearly shows the cultivation of different species of cereals, leguminous and flax. Two species are predominant: the

emmer wheat and the two-rolled hulled, followed by naked wheat and punctually by six-rowed hulled barley and einkorn. The role played by the goat face grass remains undetermined, can be either an exploited species or a wild plant of wheat crops. There cannot be observed in the ancient levels of occupation (PPNB) or in the more recent any important variation related to the main cultivations, but an increase of the frequency of hulled and naked hexaploid barleys.

Cereal crops seem to combine with leguminous, in special lentils, peas, and grass pea. It is possible that also chick peas were cultivated, even though its rare presence prevents to make it sure, especially in the first case.

Related to flax, its presence is observed up to the initial occupation of the site, but with recent dates, we cannot make for sure its cultivation at least till the end of medium PPNB.

In parallel, Akarçay Tepe human communities completed their vegetal diet with the consummation of different fruits like figs, wild pistachios or sloes stones. It is not clear whether the fig tree is cultivated, as the number of remains seems not high. Nevertheless it is possible to be as a consequence of the tafonomic processes which incise in the differential conservation of plant remains in relation of its culinary manipulation. At the same time it is important to confirm that not only have been identified plant remains of cultivated plants or fruit trees, but also has been observed the presence of many weeds species, between them, small-seeded legumes and small-seeded grasses between others. These species show that agriculture is a practice totally developed. The crop or volunteer exploitation of some of these species, meanly of most important wild leguminous (*Astragalus*, *Trifolium* or *Trigonella*) cannot be established, even thought it cannot be ignored.

Referred to the realized agricultural practices, very little information has been found, dew to the absence almost generalized of sub-products like chaff remains. We do not believe that this absence is the result of an exhaustive cleaning of vegetal products once realized the crop, because the number of weed seeds is very high. On the other hand this situation can reflect: (a) a bad conservation of these elements; (b) as the first sifts coarse in external spaces of the habitat; (c) or its systematic utilization with some concrete finality. A unique concentration of this kind of remains has been documented (28U 15, layer 5).

Related to the environmental context, the identified species are typical of the aridest steppe vegetation. On one hand, the presence of *Arnebia decumbens* could indicate arid conditions, but on the other hand the presence of species like *Rumex pulcher* or *Juncus* could reflect the existence of humid areas. In this sense, the abundance of *Lolium* seem to suggest that the environmental conditions of Akarçay Tepe were more humid than sites situated more in the south, like Jerf al Ahmar o D'jade. Also it is possible the existence of these two kinds of species indicates a territory wide management tapping both Euphrates banks and also remote and drier areas.

8. RECONSTRUCTION OF AGRONOMIC CONDITIONS: THE RESULTS OF CARBON ISOTOPE COMPOSITION ($\delta^{13}\text{C}$) IN CHARRED CROP GRAINS

Juan Pedro Ferrio*, Jordi Voltas*, Josep-Lluís Araus**

INTRODUCTION

The use of $\delta^{13}\text{C}$ analysis in charred crop grains to estimate water availability in early agriculture was already proposed in the early 90s by Araus and Buxó (1993). This approach provides indirect information on the period in which the seed is formed (grain filling). The $\delta^{13}\text{C}$ values of crops may be affected not only by climatic variations, but also by changes in crop management practices. Nevertheless, provided that data from reference, non-cultivated material (e.g. charcoal) is available, it is possible to determine, in principle, to what extent the observed variations are due to climatic or anthropogenic factors (Ferrio *et al.* 2005).

TAXONOMIC DETERMINATION OF ANCIENT CROPS

416 samples of archaeological cereal grains were analysed for $\delta^{13}\text{C}$ and nitrogen isotope composition

($\delta^{15}\text{N}$), and the main dimensions (length, breadth and thickness) were measured for grain weight estimations (table 1). As for charcoals, each grain was soaked separately with HCl 6M for isotope analyses. Finally, $\Delta^{13}\text{C}$ was calculated from $\delta^{13}\text{C}$ in grains and the estimated $\delta^{13}\text{C}_{\text{AIR}}$, as described above.

APPLICATION OF WATER INPUTS AND GRAIN YIELD MODELS TO CEREAL GRAINS

In order to quantify the differences, in terms of water availability, between past and present conditions, we estimated water inputs (WI) during grain filling from the $\Delta^{13}\text{C}$ of charred grains, following the models previously defined by Araus *et al.* (1997; 1999a, as modified in Ferrio *et al.* (2005)):

FOR WHEAT:

$$WI = 0.175 \times e^{(0.376 \times \Delta^{13}\text{C})}$$

FOR BARLEY:

$$WI = 0.225 \times e^{(0.364 \times \Delta^{13}\text{C})}$$

Site Location	Barley	Rye/Wheat	Naked Wheat	Emmer	Einkorn	Total
Abu Hureyra	–	9	–	–	–	9
Akarçay Tepe	69	–	28	29	–	126
Dja'de	33	59	–	–	–	92
Horum Höyük	4	–	3	–	–	7
Jerf el Ahmar	34	23	–	–	–	57
Kosak Shamali	6	–	–	–	5	11
Shioukh Faouqani	25	–	–	–	–	25
Tell Halula	3	–	9	–	–	12
Tell Karamel	–	–	–	–	20	20
Tilbeshar	–	–	52	–	–	52
Tell Ab'r 3	–	5	–	–	–	5
Total	174	96	92	29	25	416

Table 1. Seed samples analysed for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ and measured for grain dimensions.

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Finally, we divided the estimated values by the current average precipitation during grain filling (April + mid May) for each site (interpolated from the climatic data of several meteorological stations). This allowed us to correct the differences between sites due to their geographic situation, thus providing a more reliable outcome of the environmental evolution through time in the area. In a similar way, grain yield was estimated from $\Delta^{13}\text{C}$ of charred grains, using the models developed by Araus *et al.* (1999b; 2001; 2003).

EVOLUTION OF WATER AVAILABILITY AND GRAIN YIELD

As shown in Fig. 1a, estimated water availability in the past was consistently higher than in present-times (1.5-3 folds higher in barley, 2-4 folds higher in wheat). In some cases (e.g. around 9000 BP), particularly for *Triticum* spp., the resulting values were clearly above the expected values for rainfed cereal farming. This coincides with a relatively wet period, according to charcoal data (Fig. 2b, chapter 5), thus indicating a relative improvement of climate conditions. We should bear in mind, however, that in rainfed Mediterranean conditions, the earlier phenology of barley derives into wetter conditions during grain filling and, thus, barley usually benefits from greater water inputs (and $\Delta^{13}\text{C}$) than wheat. In contrast, during this wet period, we found far greater water availability in wheat than in barley, which might be an evidence of some kind of specific water management, addressed to increase water availability in this crop. As barley is less drought-sensitive than wheat, it is a common practice in dry areas to keep barley as a rainfed crop, reserving any additional water supply, or the moister soils (e.g. closer to a water stream) for wheat, due to its added value for

human consumption. Thus, we have found evidences of water and soil management practices during early agriculture that resemble those currently found in the area. This could be of interest as a way to evaluate the potential long-term impact of current practices, looking at their consequences in the past.

On the other hand, grain yield estimations in the archaeological context were similar or even higher than those found in present crops in the area, despite recent agronomic and genetic advances (Fig. 1b). Nevertheless, we found generally higher yields among the older sites (from 10th to 6th millennia BCE) than in the younger ones. Overall, our results suggest that current crops are grown under harsher environmental conditions than in the past. This might be the result of a synergistic effect of climate change and agricultural expansion, which forced ancient farmers to cultivate poorer soils.

NITROGEN STATUS AND GRAIN WEIGHT

Moreover to the evolution of $\Delta^{13}\text{C}$ for cereal species, we studied the changes through time in the $\delta^{15}\text{N}$ of grains (Fig. 2a). Although a quantitative calibration with modern material is under development, $\delta^{15}\text{N}$ values can be used as rough indicators of the nutritional status of plant species. Generally, $\delta^{15}\text{N}$ tend to be higher in soils rich in organic matter. Our results reflect a consistent depletion in the $\delta^{15}\text{N}$ of cereal grains through time, which might be caused by a progressive soil degradation, associated to the expansion (and intensification) of agricultural practices.

During this project, we also were able to develop calibration models to estimate the original weight of cereal grains from their dimensions after carbonisation (Ferrio *et al.* 2004). Using these models, we were able to track the evolution of grain weight in ancient crops,

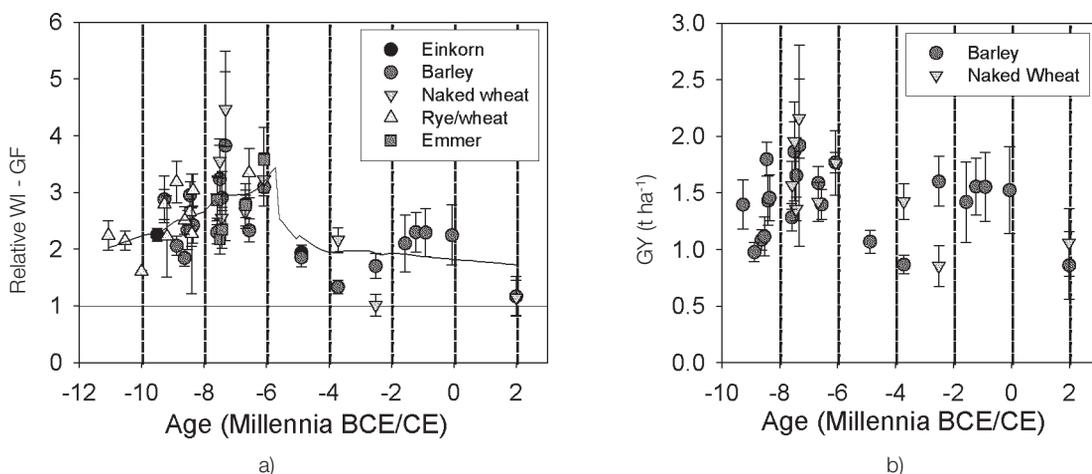


Figure 1. a) Estimation of water inputs during grain filling for cereal crops, as derived from $\Delta^{13}\text{C}$ values of archaeological grains, and expressed in relative terms respect current precipitation (April + mid May) for each site. b) Estimation of grain yield for barley and naked wheat, as derived from $\Delta^{13}\text{C}$ values of archaeological grains.

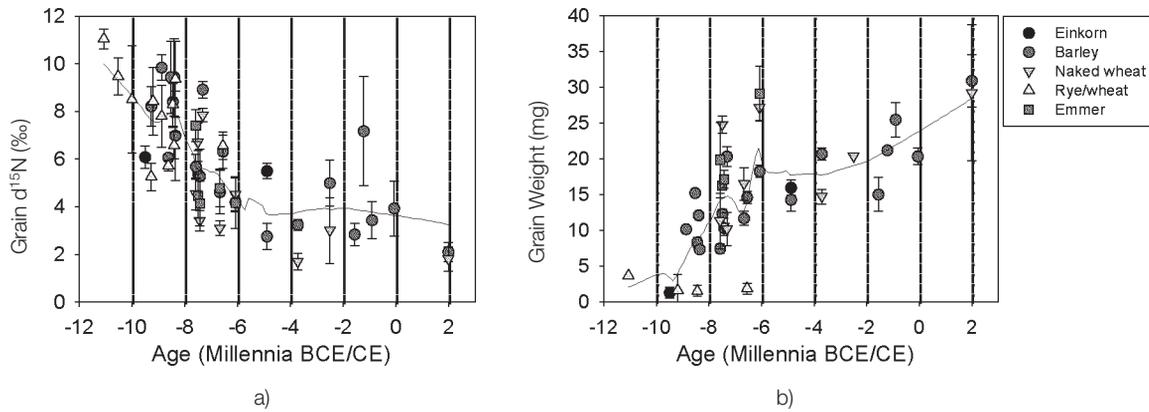


Figure 2. Evolution of $\delta^{15}\text{N}$ (a) and estimated grain weight (b) in charred grains of cereal crops.

and to compare them directly with those of modern crops (Fig. 2b). We found a trend towards increasingly larger grain weight through time (especially for barley), and grain sizes below 10 mg are not observed from the 6th millennium BP onwards. This suggests some kind of (conscious) selection for bigger grains during the domestication process, in agreement with the findings of Partner 2 (Willcox 2004).

CONCLUSIONS

Overall, our results show that the environmental conditions at the beginnings of agriculture in the area were more favourable than in present times. Nevertheless,

we found evidences of a progressive climatic degradation which, together with an intensification of agriculture, caused a significant depletion in crop yields from 6th to 4th millennia BCE. Moreover, the analysis of nitrogen isotopes also suggests progressive soil degradation in terms of nutrient availability. This process might be comparable with the current land degradation in the area, evidencing the long-term effects of agriculture expansion. Nevertheless, the climatic context associated to the expansion of agriculture should be refined in order to understand its causes and consequences. In this regard, one relevant topic is the effect of seasonality, which has a strong effect on the water availability of crops and might have changed through time in the studied period.

V. SOCIO-ECONOMICAL STRUCTURE OF THE SITES

9. A PRIVILEG AREA TO KNOW THE FIRST FARMING SOCIETIES: THE NEOLITHIC IN THE EUPHRATES VALLEY

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The middle valley of the Euphrates River, between the southern slopes of the Taurus and the semi-desert steppe of classic Mesopotamia, is one of the regions where the shift from the last hunter and gatherer societies to the first farmers and herders can be studied more detailed and rigorously (Fig. 1). The

excavation and research projects in this area have renewed our available knowledge from the pioneer studies of the 70's, especially from data provided by some archaeological sites as emblematic as Tell Mureybet (Cauvin 1977) or Abu Hureyra (Moore *et al.* 1975; Moore 2000).



Figure 1. View of the Euphrates River near Tell Halula.

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Indeed, during the last decades a significant amount of research works have been developed, mainly from different rescue projects all along the alluvial plains of the Euphrates, in the two countries (Syria and Turkey) which share this part of the river. The aim of this brief paper is to present the updated historical background of the region, including the most recently discovered and analyzed archaeological sites, in a diachronic vision that, although it must be synthetic, it will emphasize the information available from the sites that have been analyzed under the MENMED project framework. The text of this presentation will be organized following the different historical periods defined in the chronological and cultural proposal from "la Maison de l'Orient" (Hours *et al.* 1996). The chronological datations will be presented in BC (calibrated).

THE LAST HUNTER AND GATHERERS: THE NATUFIAN (12.000-9.500 CAL BC)

Overall, our knowledge about the last groups of hunter and gatherers has been, in recent decades, one of the most important keys to understand the origins of agriculture. Establishing their relationship with the environment, and approaching to define their cultural, economical and technological stage, are keys to establish the following development. The role of these societies has been reinforced by the assumptions, surrounded by controversy, which raised the possibility of farming practices since this phase. The greater or lesser importance for the exploitation of plant resources, especially of cereals, and their level of sedentary are some of the main variables involved in the debate around the role exercised by these societies in the economical transformations to agriculture.

In the area of the Euphrates Valley, there aren't so many settlements which coincide with the beginning of the warming climate phase, and, therefore, belong to the chronological frame between 12.000-9.500 B.C. (calibrated); and they all are documented from the 70's in the area of the middle course of the river: Nash Horm, Mureybet, Abu Hureyra. Any new site has been added recently, despite the extensive surveys conducted from the rescue projects. The archaeological record, both from within the valley and, more generally, the northern Levant, doesn't present therefore neither the wealth nor the exuberance of the archaeological sites from the southern Levant.

The knowledge from these settlements, and their features, are integrated, however, in those defined for the whole of the natufian culture. That is, these settlements can be considered base camps, as demonstrated by the evidences of both Mureybet and Abu Hureyra, where they were found the remains of huts or pits excavated on the subsoils, and of oval or round plans, and hearths and post-holes undoubtedly linked to some kind of

vegetable coverings. Although the evidences from Mureybet for the Natufian period are limited only to some hearths, for the immediately following period, that is the transition period to the PPNA and so-called Khiamian (Mureybet II), round plan and semiexcavated huts are already found. The level of sedentary acquired by these groups is high, and even in some areas and settlements they are real sedentary populations, with a diversified and intensified exploitation of natural resources based primarily on hunting and gathering.

THE FIRST MANIPULATIONS OF THE VEGETABLE RESOURCES: THE PPNA PERIOD (9.500- 8.700 CAL BC)

The historical period known as the PPNA (Pre-Pottery Neolithic A) (Phase 2 from "la Maison de l'Orient") is an innovative period in continuity with the previous phase, especially in certain regions among which stands out the Euphrates valley. At this phase, and in the whole Near East, there are clear evidences of manipulation of vegetable resources which can be classified as the beginning of the first agricultural practices, although the morphological shift that gives to the species the status of "domesticated" will not be done since later periods. In fact, these activities are documented in a general framework of continuity in hunting and gathering practices. To this economical novelty, other innovations are also added regarding to architectural development, as the technical and conceptual improvement of the domestic habitat, on one hand, and an incipient development of collective works at the settlement level, on the other.

The documentation in the Euphrates valley is rich. So, this phase was first identified in Mureybet (phase III), being also recognized later in the site of Cheikh Hassan, which is located 15 km. further in the north, and, more recently, in the site of Jerf el Ahmar, located 40 km. further in the north (Stordeur 2000; Stordeur/Abbes 2002). This cluster of settlements, in such a concentrated geographical space, has allowed us to know well the features among which will emphasize the constructive techniques and the spatial planning of the sites. One of the most significant contributions is the documentation of the shift from round plan buildings, both semi-excavated or not, and in use since some millennia ago, to rectangular plan and completely built buildings that will be the most common model in the future. This shift, previously observed in sites like Mureybet and Cheikh Hassan from partial remains, has been detailed from the more recent documentations from Jerf el Ahmar, where this evolution can be followed from an extensive excavation and with a large number of houses recovered. This site has also allowed, on the other hand, observing another novelty, this time concerning spatial organization. That is, the previous preparation, through a large terracing, of the space where the different buildings will

be build and the location of those buildings in a semicircle opened area to an open space, forming a kind of square where a collective use building was recovered (Stordeur *et al.* 2000; Stordeur 2003).

Indeed, the existence of collective use buildings, with a strong symbolic content, has also been found at Tell 'Abr 3 site, where collective buildings with similar features have been documented (Yartah 2004). This aspect, together with the wealthy symbolic remains documented in these settlements, has helped to emphasize their cultural unity. Moreover, in recent years have been documented (near the Euphrates valley area), some settlements that also share cultural and technological features, considering the possibility, for this chronological period, of the existence of an area with a strong cultural characterization which would extend to south-eastern Anatolia and the Euphrates valley itself (Stordeur 2003). The morphology and quality of the archaeological record in this area has contributed to the designation of the "golden triangle" (Aurenche/Kozłowski 1999). It should be cited, therefore, important sites all over this area like Tell Qaramel, near Aleppo, and Çayönü and maybe the earlier phases of Göbekli Tepe, in Anatolia (Schmidt 2002).

THE DEVELOPMENT OF THE SETTLEMENTS (8.700-7.000 CAL BC)

From 8.700 cal BC, the innovations from the previous phase will achieve a period of consolidation and expansion in the entire Levant. This phase is traditionally so-called "Pre Pottery Neolithic B" (PPNB) and it covers a wide chronologically time span, establishing an internal evolution that allows us to distinguish 3 phases: the Early PPNB 8.700-8.200 cal BC, the Middle PPNB 8.200-7.500 cal BC, and the Late PPNB 7.500-7.000 cal BC (Hours *et al.* 1996). Despite the long duration of this phase and the regional differences, it is still considered a phase of certain unity, and characterized as a pre-ceramic culture but with a real knowledge of the economy of production, that is, the agricultural pces and the beginning and the first development of the animal domestication will be clearly documented during this phase. These economic changes will occur in a context of better structured and with an increasingly investment of work settlements, that leads to a more complex structure, both in the planning space level and in the buildings themselves. The technical activities and work processes related to the manufacture of tools also show this increasingly investment of work; at the same time, the exchange of raw materials, and any general sign of exchange as well, increases sharply.

THE EARLIEST PPNB PHASE (8.700-8.200 CAL BC)

This first phase comprises a small number of settlements, which show some transformations with

regard to the previous one. The continuity of some settlements like Jerf el Ahmar, Cheik Hassan and, maybe even, the earliest phases of Dja'de el Mughara show the keys to an innovative evolution *in situ*. This phase is well documented in the Euphrates valley and in Anatolia, while, in the other Levant regions, PPNA cultures seem to extend within this time span and without obvious changes.

In the Euphrates valley, the archaeological sites of Mureybet and Cheik Hassan had provided the first features of this phase (Cauvin 1977; 1994). Currently, the site of Dja'de is providing a set of new and very significant information. The continuity with regard to the earlier phases can be observed in some architectural elements (materials used, building techniques,...), but, nevertheless, it can be also observed the full consolidation of the rectangular plan architecture, with the starting development of the models tested in the previous phase and the innovation of new types of buildings, like the platforms so-called *grill plan* (Coqueugniot 1999; 2000). The more ancient remains, although the excavation is still in progress, have documented some kind of collective architecture with important bichrome paintings (Coqueugniot, pers. com.).

In the area of Turkish Euphrates valley, two settlements show the originality of the Anatolian remains for this phase: Nevali Çori and the earliest phases of Çafar Höyük. Their contemporaneity with other archaeological sites as Göbekli Tepe and Çayönü (Grill Building phase) indicates the strong development documented in the area of south-eastern Anatolia on the whole, confirming both the presence of original, innovative and high complex technical architectural remains, and the importance of this area in the innovation process concerning the practices of subsistence. In fact, both the Euphrates valley area and the whole south-eastern Anatolia, present economic practices where the gathering and hunting are still important, but where an incipient agriculture, well documented in some archaeological sites as Dja'de el Mughara and Nevali Çori (Willcox *et al.* this volume), and an incipient animal domestication as well, are given (Saña/Tornero this volume).

THE STABILIZATION OF THE SETTLEMENTS AND THE BEGINNING OF THE HUSBANDRY PRACTICES (THE MIDDLE PPNB: 8.200-7.500 CAL BC)

In this phase, a meaningful development of the space planning and of the architectural techniques, following and developing the models defined in the earlier phases, are documented. So, there are evidences, for the first time, of the emergence of large settlements, which can extend in an area of more than 3 hectares. The growth of this kind of population agglomerations has to be related to the consolidation of the production techniques of subsistence, that is, the spreading of the agricultural



Figure 2. General view of Tell Halula.

practices which are supplemented with an important contribution of meat, at the first time, from the hunting and, then, from the first documented husbandry practices on the ovicaprins, first, and suddenly followed on the cattle and suids.

The data from the Euphrates valley come from a small number of archaeological sites: the latest phases of Mureybet (BVI), the reoccupation of Abu Hureyra (Phase 2A) and the earliest phases of Halula. The latter two sites present a big area (6-8 ha), and, considering their respective distance, it can be suggested a regional role for each one. The archaeological record from tell Halula is showing a clear structure of the building space, which is almost agglutinative, dense, and where the houses are well-organized distributed. The plans of the houses, which can have a surface area of almost 70m², are similar, with a complex, rectangular and multicellular plan, and with a clear differentiated use of each of the rooms (Molist 1996; 1998; 2001). The domestic activities are documented both in the main room of the houses and, especially, in the outdoor areas where ovens, hearths, platforms for drying, etc. indicate the use of those spaces for domestic and techniques activities. In the northern area of the valley, it's documented the continuity of some of the settlements already founded in earlier phases like Nevalı Çori (Phase III-IV), Çafar Höyük (XIII-IX), Göbekli, and probably we have to include the

earliest phases of the settlement of Akarçay Tepe at the latest stages of this phase. As it will be more clearly shown all along the next phase, the cultural unity (in archaeological terms) between the Euphrates valley world and the whole south-eastern Anatolia, attested in the previous phase, wouldn't exist, tending to differentiate, depending on the areas, between a more Anatolian tradition and a more southern one. These differences are not generic, since it has also been documented some overall socio-economic characteristics including, among others, the establishment of the real farming of both cereals and pulses (Buxó/Rovira; Willcox *et al.* this volume), or the emergence and consolidation of a new system for managing animal resources from the husbandry practices (Saña/Torero this volume). Moreover, it's also documented an important increase in the exchange of products, especially of obsidian; regarding to that, the supply sources tend to diversify during this phase, exchanging obsidian not only from the Cappadocia, as in previous periods, but also from eastern Anatolia (Delerue 2007).

THE CONTINUITY OF THE LATE PPNB PHASE (7.500-7.000 CAL BC)

This chronological phase shows, on the one hand, a full continuity with regard to the consolidation of the agricultural practices, already documented in the previous



Figure 3. PPNB House of Tell Halula.

phase, just with the addition of some new vegetable species and, especially, the increasingly importance of the husbandry practices. On the other hand, it also shows a significant growth not only in the number of the well-known settlements, but also of their surface on the whole. The population growth is, undoubtedly, one of the best documented components throughout the process of neolithisation, as it has been shown from a demographic analysis using the anthropological data available so far (Guerrero 2006).

In the southern part of the Euphrates valley, the sites of Halula and Abu Hureyra are still occupied, increasing their surface, and showing, on the other hand, a great continuity both in the technical features of the buildings and the space planning (Fig. 2). The picture of a complex village can also be seen, in a greater detail, in the site of Tell Bouqras (Akkermans *et al.* 1983). Indeed, this site, located at the lower part of the Euphrates valley and dated to the end of that phase, clearly shows the image of both the space planning and the domestic architecture complexity in sedentary and agricultural village. The arrangement of the different domestic buildings is generally very tight, with some wider open spaces, probably of a collective use, distributed throughout the houses mesh. This picture is similar to what we are getting into tell Halula. In this site, we also

have discovered some built structure with a collective use. The discovery of a large terracing wall (wall E101), with a length of 25m recovered so far, and a height between 3,20 and 3,80 m., constitutes a significant example of the collective works made by these communities.

In the northern part of the Euphrates valley, the number of settlements recovered is significantly higher than in the previous phases. All of them are located in the river valley itself, as it's demonstrated by the most famous sites: Gritille, Hayaz and Gurcutepe (Voigth 1985; Roodenberg 1989). It is necessary to highlight the recent works in two of the settlements: Akarçay Tepe and Mezraa Teleilat. The occupations in the west mound of Akarçay Tepe show, for this phase, an exceptional richness of the archaeological record and a wide range of architectural solutions (Ozbasaran/Molist 2006; Ozbasaran *et al.* 2004; Arimura *et al.* 2000). The features, currently in progress, are at several points closer to the settlements in the southern part of the valley (as for example, the location of the houses, etc.); but, on the other hand, some of them are closer to the south-eastern Anatolian world (as for example, the massive use of stone, the complex rectangular and multicellular plan: so-called "cell-plan", etc.). The location of the site between two strong cultural areas

has also been demonstrated in the studies concerning the lithic resources management for the manufacturing of tools (Borrell 2006). The contemporary levels of Mezraa have been little analyzed, because of the wealth of the most recent occupations recovered in the lower levels of the site (Ozdogan 2003a; 2003b).

THE DIVERSITY OF THE LATE NEOLITHIC: THE PRE-HALAF PHASE: 7.000-6.100 BC (CALIBRATED)

In the area of Anatolia and northern Levant, and more exactly in the Euphrates valley, this period was poorly documented until the beginning of the 90's. Thus, in the area of the Euphrates no one archaeological site had been excavated, and the few documented sites were badly known from irregular surveys. This picture led to interpretations that suggested a loss of influence of this region compared to the previous periods or, even, a movement of the population to other neighbouring regions, such as the coastal region or the Djezireh (Hours/Copeland 1984).

In recent years, research has allowed us to recognize a dense human occupation, being the main features of the human groups are starting to be known. Currently in the Euphrates valley, the available archaeological information available for this period comes from the following sites: on the one hand, from some sites already known in the previous phases, like Abu Hureyra (Phase 2C) and Bouqras (recent levels), which show a continuity without breaking with the previous phase; although both of them are occupied during the first half of the VIIth millennium, just before they were abandoned. On the other hand, the excavations carried out in the framework of the rescue archaeological works during the construction of the Tichrine dam have shown significant novelties as the reoccupation of the site of Dja'de el Mughara, with several levels of buildings, currently in progress of excavation and study, an earlier installation, with no remains of built habitats, in the Obeid site of Kosak Chemali, (Nishiaki/Matsutani 2001), and a long occupation at the site of Halula, where it has been able to establish a stratigraphical sequence (levels 20-34) that covers most of this period. It must be added to those sites, other only known by surface surveys like Hamman Seguir, Hamman Kebir, and even maybe Molla Assad.

In the northern part of the valley, the data recovered is equally innovative and important. The site of Akarçay Tepe shows a continuity of occupation, with a rich sequence that covers most of the VIIth millennium, and in particular, with one of the best documented "pre-pottery vs. pottery" "transitions" in the area. The data from Mezraa-Teleilat (Phase II) is also new and its definitive publication will be essential to know this

evolution. The carrying out of the excavation in extension has provided a significant body of documentation of both the architecture and the archaeological record on the whole. Additionally, Gritille would continue occupied and a new occupation in Kumartepe would also be documented (Hauptmann 1999).

This rich scene of settlements hasn't had yet a correlation with the data that has been extracted from them, since most of them they are still in progress of excavation and study. So, for this brief exposition we will take as a reference the sequence and the information from sites like Tell Halula and Akarçay Tepe, which present a high level of continuity. From an architectural point of view, the distribution of the habitats at Akarçay Tepe is scattered, so, the different domestic buildings are distributed randomly, and separated by wide open spaces where some domestic structures (like hearths, ovens, pits, etc.) and, especially, a large accumulation of domestic rubbish (combustion and faunal remains, etc.) as well, are recovered. The domestic habitats, in the most ancient levels, continue with the tradition of rectangular plan pattern, although with an increasingly use of the stone, as a building material, as well as beaten floors.

The scattered distribution and the less investment of work of the domestic buildings contrast with the care given to the collective buildings in Tell Halula. The first of them is a big wall, built in stone, with a width of 1,20 m, and with a preserved height of 1,10 m., which defines the limits of the settlement on the eastern part of the tell. The second one is a sort of water conduction, made up for a pit with a careful treatment of its walls and bottom, and with a length of 16 m. in its best preserved part. But one of the great innovations of this phase, in the southern part of the Tell, is the presence of circular buildings or *tholoi* traditionally associated with the Halaf phase. In Tell Halula and in the most recent levels of the Pre-Halaf phase, this kind of buildings is always documented in association with rectangular plan houses. The use of these two types of plans for the domestic buildings is documented in the Euphrates valley, as well as in the Balikh valley, especially at the transitional levels (Balikh IIIA) of the site of Sabi Abyad (Akkermans/Schwartz 2003). These findings confirm the apparition of a new type of building from the middle of the VIIth millennium in the whole area of the northern Syria and, in particular, of the Euphrates valley.

The appearance of the pottery is one of the most significant technological developments of this phase. The Euphrates Valley, and the archaeological sites mentioned above, allow to document in detail the emergence and development of the first pottery productions. At this level, the evolution of the first productions at Tell Halula and Akarçay Tepe is characterized by three different phases; the first one defined as "black series is mainly represented



Figure 4. General view of Akarçay Tepe East Sector (ES), from Northwest.

by a very small number of pots of simple forms (vertical wall bowls, ...) and characterized by a well purified clay paste where the inclusion of crushed calcite is predominant. Their surfaces wear a dark colour and are well polished, with complete absence of any kind of decoration. In the second phase, number of sherds recovered and variability of compositions increases, and the most represented productions are the simple pots with vegetable temper (*coarse simple ware*), some of which present a polished surface treatment (*burnished coarse simple ware*) or incipient decorations (*coarse impressed and incised ware, red-slipped coarse ware*). The productions of a higher quality, absent in those two earliest phases, are developed in the third one and they show the use of a more fine kind of paste, with mineral temper and more elaborated surface treatments, and even sometimes painted (*Dark Faced Burnished Ware, red painted ware*) (Faura 1996; Faura/Le Miere 1999; Le Miere/Picon 1999; Cruells pers. com.). The lithic industries indicate a significant variation regarding to the earlier phases. These are variations that affect both the supply of raw materials and their management and the final products. So, the flintknapping techniques have a more active role rather than other techniques more diversified. The final

artefacts are characterized by their most banal aspect, and, basically, they are arrowheads, retouched blades, flakes retouched flakes, burins, scrapers, etc. which have lost, on the whole, the investment of work and the beauty of the artefacts from previous phases (Borrell 2006; Ferrer 2000). The lack of characterization of the lithic record, nevertheless, does not prevent that the use and the activities carried out with these kinds of artefacts remains still high and with a level of efficiency equal to the previous phase. This technological change must be interpreted, not as a change in the artefacts functionality, but as a change in overall socio-economic production processes.

THE HALAF PHASE AND THE COMPLETE CONSOLIDATION OF THE FARMING AND HUSBANDRY PRACTICES: 6.100-5.400 BC (CALIBRATED)

In the Euphrates valley, this chronological period was, until some years ago, one of the worst known and only the available data from the site of Shams ed Din had some entity (Gustarson-Gaube 1981). Nevertheless, in recent years, new data recovered from new sites have

been substantially increased. So, one of the most important has been the discovery, at the site of Tell Halula, of the link in between the Pre-Halaf world and the traditional Early Halaf phase, defining a new transitional phase so-called Proto-Halaf. Recent studies have illustrated that Halaf origins were polygenist and this new phase actually permits to define the middle Euphrates as an area belonging to the emerging centres for the Halaf culture. At the same time, data coming from different sites belonging to this period has been largely increased, and the archaeological works carried out have allowed us to better understand the characteristics of their settlements. So, Tell Halula has provided an extensive stratigraphical sequence, from Proto-Halaf to the Middle and Late Halaf phases (Cruells/Nieuwenhuys 2004; Cruells 2005; Gómez 2006). Moreover, in the same part of the valley, excavations at Tell Amarna carried out during the 90's

provided data from an interesting site belonging to the Middle Halaf phase, which considerably extended the sequence for this phase (Cruells 1998; Tunca/Molist 2004). Finally, and concerning to the northern part of the valley already in Turkey, the recent excavations at Fistikli Höyük have provided an interesting and small agricultural settlement from the Early Halaf phase (Bernbeck/Pollock 2003).

DISCUSSION

The brief and introductory historical background set out, just reveals the population evolution in the area of the Euphrates valley all along five thousand years, a period of time in which the process of neolithisation occurs. An evolution of which we would like to highlight some significant points: First of all, the continuity of the

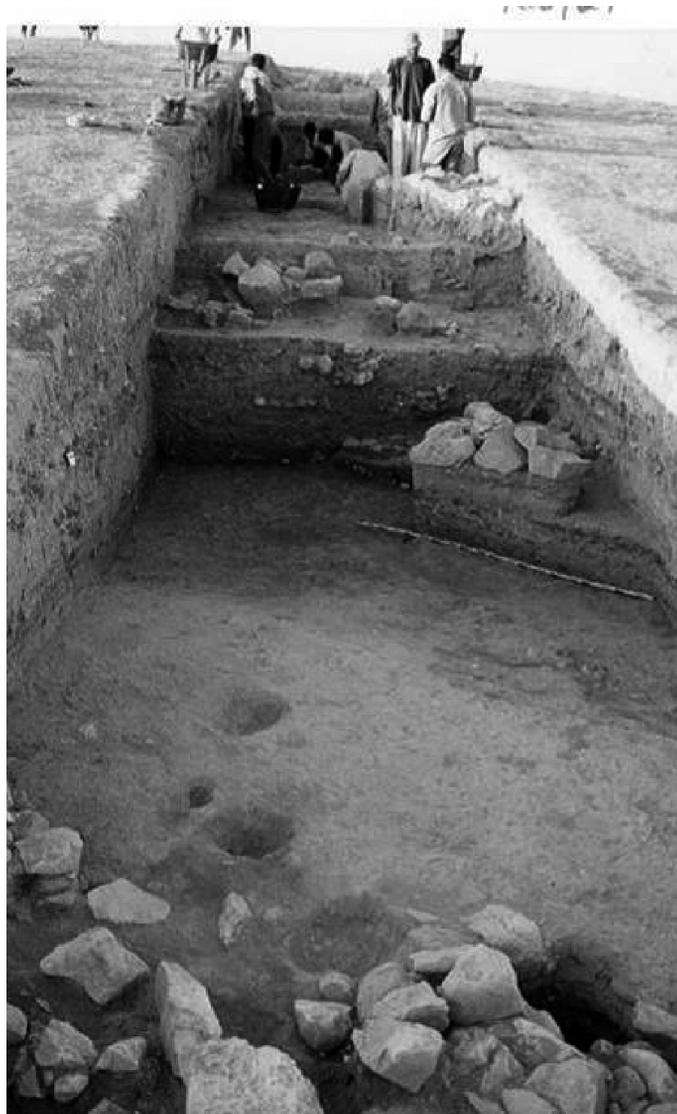


Figure 5. View of Akarçay Tepe, trench with the layers from PN to PPN and the virgin soil.

occupation in the middle valley of the Euphrates during all the periods analyzed, that is, from the Natufian to the Halaf phases. The available data is not equal and many elements are still in progress of final study, but, in our current state of knowledge, it's clear to dismiss the existence of a large hiatus or a movement of the population out of this rich valley. This continuity of the occupation in the region is reflected by an original evolution of a dynamic and innovative cultural tradition, recognizable by some specific characteristics developed in this region in an autochthonous manner. This doesn't mean that this tradition is enclosed in itself, on the contrary, the privileged geographical position of the Euphrates valley area, which it's a great net of communication and exchange, permits to have a distribution and receiver role with all its neighbouring regions and, even, with more distant regions (the southern and the Mediterranean coast in Syria, Anatolia, Iraq).

Concerning the habitat and the architectural evolution, the most important stages in the evolution of the built spaces are documented: sedentary lifestyle, the evolution in settlement patterns from circular to rectangular plan buildings, the development of the villages, etc. Although some of these phenomena are also documented in other areas, as the Jordan valley, documents recovered show such a wealth of variations and solutions that they place the Euphrates valley as the region where this transformation is best evidenced. The "reappearance" of the circular plan buildings as *tholoi* for the domestic habitats, during the Pre-Halaf period,

constitutes a further significant development apported by the Euphrates valley area. To this brief resum we would have to add too the architectural findings that must be attributed to a collective planning and carrying out works like large terracings (Halula, Jerf el Ahmar), or systems of water pipe (Halula) (Molist/Stordeur 1999). In that way, we also observe some of the main technical transformations, like changes in the management systems of lithic industries concerning food production. Innovations concerning pottery productions and the main novelties defined during the VIIIth millennium, due to the new research and archaeological works carried out, are renewing the available knowledge so far. Indeed, the recent findings allow placing the Euphrates valley in the central part of the geographic region where the specific changes will provide the basis for the further development of large prehistoric civilizations like the Halaf.

Finally, regarding to the socio-economic innovations and the relationships with the environment, the research programme that we have carried out and that is set out in this book, provides a very interesting picture. Indeed, the results obtained help to establish the main characteristics of the emergence and consolidation of the early agricultural and husbandry practices (see the contributions in this volume of Buxó/Rovira; Willcox *et al.*; Voltas *et al.*). At this level, the Euphrates valley area is shown as an original and indigenous centre of this transformation, while there is a greater complexity and interrelation with some near regions.

10. LITHIC TOOLS AND AGRICULTURE IN THE MIDDLE-EUPHRATES VALLEY DURING THE SECOND HALF OF THE VIIIth MILLENNIUM CAL. B.C.: NEW DATA FROM TELL HALULA (SYRIA) AND AKARÇAY TEPE (TURKEY)

Ferran Borrell*

INTRODUCTION

The different agricultural tasks can partly¹ be known through the study of the chipped stone assemblages. An approach to these activities has been done by different scholars who study the Lithic tools as a way to better understand the origin, consolidation and intensification of agriculture for the first farm communities who settled in the middle Euphrates valley (Cauvin 1983; Anderson-Gerfaud 1988; Anderson 1999, 2003; Ibáñez *et al.* 1999; Hole 2001; Borrell/Molist 2007).

There are three main agricultural tasks that can be documented with the lithic tools: sowing, harvesting and threshing. In this paper, which focuses on the harvest, a brief evaluation of the development and organization of these tasks in the middle Euphrates valley during the second half of the VIIIth millennium is performed. This evaluation is done by means of a study of the chipped stone assemblage of Akarçay Tepe (Arimura *et al.* 2000; Ozbasaran/Molist 2006) and Tell Halula (Molist 2000; SAPPO², 2007; Molist *et al.* in press), located on the left and the right bank of the middle Euphrates valley, respectively.

At Akarçay Tepe there is no evidence of any hoe or plow, nor has the presence of “tribulum” been attested to. On the other bank, at Tell Halula, the presence of hoes has been detected (Ibáñez *et al.* 1999). These tools, with a

shape similar to an axe or adze, are made of limestone and have an active edge at one end. This edge often still has betume remains, a feature which could be interpreted as a way of strengthening the edge of the tool. The traces identified in the tools suggest that they were used for working the fields. The use of “tribulum” has also been noted at Tell Halula in previous work developed by P. Anderson. This particular proposal has been done according to the use-wear analysis of flint tools, and dates the presence of “tribulum” towards the very end of the PPNB period (Anderson 1999; 2003).

Though scarce knowledge exists about the sowing and threshing tasks, the lithic tools that seem to have been related with the harvest of cereals and other plants are abundant and allow close investigation of the task.

The presence of glossed³ tools is clear in Halula and Akarçay, as it is in most of the Neolithic sites of the Levant. The Lithic assemblage present here is composed of 225 glossed tools from Akarçay Tepe, belonging to Lithic Phases⁴ 5 to 2, whose chronology spans from the mid-VIIIth millennium to the first half of the VIIth millennium cal. B.C. The total number of glossed tools studied from Tell Halula reaches 222, belonging to Occupational Phases⁵ 8 to 14, dated around the third quarter of the VIIIth millennium cal. B.C. This way, the assemblage seems large enough to characterize the blanks, the raw materials and the morphology and shape of the sickles at both sites.

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1.- Our research group has also developed a method to estimate ancient cereal yields from the analysis of carbon isotope discrimination in archaeological grains. The estimations are similar to or even higher than present yields under rainfed conditions. Thus, despite the recent agronomic and genetic advances, the better growing conditions prevailing during the Neolithic allowed ancient farmers to obtain relatively high yields (Araus *et al.* 1999; 2001; Ferrio *et al.* 2007).

2.- SAPPO is a Research Group of the Universitat Autònoma de Barcelona, focused on the study of the Neolithic period in the Near East. The group is coordinated by Professor Miquel Molist and composed by the following research affiliates: J. Anfruns, J. Bosch, F. Borrell, R. Buxó, X. Clop, W. Cruells, J. M. Faura, A. Ferrer, A. Gómez, M. González, E. Guerrero, M. Saña, C. Tornero and O. Vicente.

3.- We assume the possibility, as some researchers have documented before, that the gloss observed in some flint tools can be the result of harvesting cereals or other plants such as pasture grasses, reeds, rushes and sedges (Anderson-Gerfaud 1988).

4.- Five Lithic Phases have been established after the study of the chipped stone assemblage of the whole sequence. Lithic Phases 5 to 3 belong to Middle and Late PPNB, while Lithic Phases 2 and 1 to PN. For more detailed data see the previous works (Borrell, 2005, 2006, 2007a, 2007b).

5.- To know more about Tell Halula lithic assemblage see the previous works (Molist *et al.* 2001; Borrell 2006).

THE SICKLES

Glossed tools are quite abundant at both sites and are made of flint. In Tell Halula, nearly half of the glossed tools are made on dark-brown flint, whose primary outcrops would have been located in the limestone formations of Maksar, 25 km south of Halula. The rest of the glossed tools are made of local flint gathered from the Euphrates terraces. In Akarçay, local flint procured from the banks of the river is present in mass quantities. Only 10 % of the glossed tools are made of non-local flint (dark brown).

Almost all of the glossed tools at Tell Halula are blades, most of them showing bi-directional scars. The size of the complete blades is quite remarkable (between 5 and 9 cm). The use of blades tends to change to favor flakes at the end of the Late PPNB, so when comparing the lithic assemblage studied in this paper with the PN glossed tools (Ferrer 2000), important differences can be attested to. At Akarçay Tepe, the same chronological evolution is documented. Besides that, in Akarçay, most of the blades, which are mostly fragmented, are knapped from single-platform cores, probably using the pressure technique or indirect percussion (Borrell 2006, 2007). In spite of the clear differences between the blanks used at both sites, a common chronological evolution is documented, with blades gradually being substituted⁶ by flakes to produce sickles.

Bitumen was the substance used to fix the blade/flake to the shaft. The use of this substance as a type of adhesive is well documented both at Halula⁷ and Akarçay.

The overwhelming presence of blades with parallel gloss would confirm that the blades were inserted parallel into the handle. Only a few number of the sickle blades studied display the gloss and the bitumen remains oblique to the edge. The presence of the curved sickle with a denticulated edge becomes generalized in Tell Halula at the beginning of the VIIth millennium cal. B.C. (Molist *et al.* 2001). North of Halula, in Akarçay Tepe, the presence of flakes/blades with parallel gloss predominates during the Lithic Phases 5 to 3. The oblique gloss appears during the Lithic Phase 4 and becomes widespread during the Lithic Phases 2 and 1, during the first half of the VIIth millennium cal. B.C. (Borrell 2006).

Little more is commonly known about the size and shape of the sickle, but in Tell Halula the remains of a curved sickle composed by four bidirectional blades, inserted parallel to the handle, and still glued with bitumen, allow conclusions to be drawn about sickles at that site (Borrell 2006; Borrell/Molist 2007) (fig. 1). A very similar sickle, both in shape and dimension, was found at Gürcütepe II (Hauptmann 1999; Schmidt 2000). Both sickles would have originally displayed a continuous curved edge around 30 centimeters long.

THE HARVEST

It could appear risky to attempt to know how the harvesting task was managed by the communities who peopled the Euphrates valley more than 8000 years ago. And so it is, but it is necessary that we make an effort and try, with the available information, to form new theories, reflexions and hypotheses that can then be tested. In this sense, Halula offers a good opportunity with which to do so, because the Middle and Late PPNB occupations are very well preserved and, after sixteen years of field work, the quantity and quality of the data from this period of time is remarkable.

At Tell Halula there are some clues or features that can enlighten us as to how the harvest, and maybe other tasks, could have been taken on. The Middle and Late PPNB occupations at Tell Halula are characterized by a remarkable organization of the domestic unit⁸ distribution: one house next to another and all of them arranged in an east-west direction, with the door on the south side and with narrow paths in between them (SAPPO 2007). These domestic buildings have the same plan⁹ (fig. 2), the same number and distribution of rooms, built with the same techniques¹⁰ and with the same structures within (oven, fireplace, post holes, etc). These features suggest the homogeneity of both the knowledge and the skills of the builders. This is especially remarkable in the architecture, but the same homogeneity can also be observed in the flint knapping techniques¹¹ and the mortuary practices¹² as well. According to this data, the cultural links between the different domestic units appear to be very strong,

6.- That must be framed in a context of a strong decrease of the blade production that is part of a common phenomenon of divestment in the production of lithic tools, documented in the middle Euphrates valley at the end of the VIIIth millennium cal. B.C. and the beginning of the VIIth millennium (Nishiaki 2000; Borrell 2006, 2007a).

7.- In Tell Halula, bitumen especially is reserved to fix the sickle blades to the shaft. Unlike other tools, the percentage of glossed tools with asphalt remains is very high, and a functional explanation has been proposed (Borrell and Molist 2007).

8.- The house is the minimal domestic/family unit established for PPNB occupation.

9.- The houses display a rectangular plan, with a vestibule (fig. 2, C), a main room (fig. 2, B) and two small storage rooms (fig. 2, A)

10.- Mudbrick white plastered walls, usually with one or two rows of stones at the base of it.

11.- No remarkable differences have been attested to between the distribution of the abandoned blanks and tools recovered around the different domestic units (Borrell 2006).

12.- A very homogeneous and unchanging mortuary ritual is documented: primary and individual burials inside the houses, under the floor of the main room (SAPPO 2007).

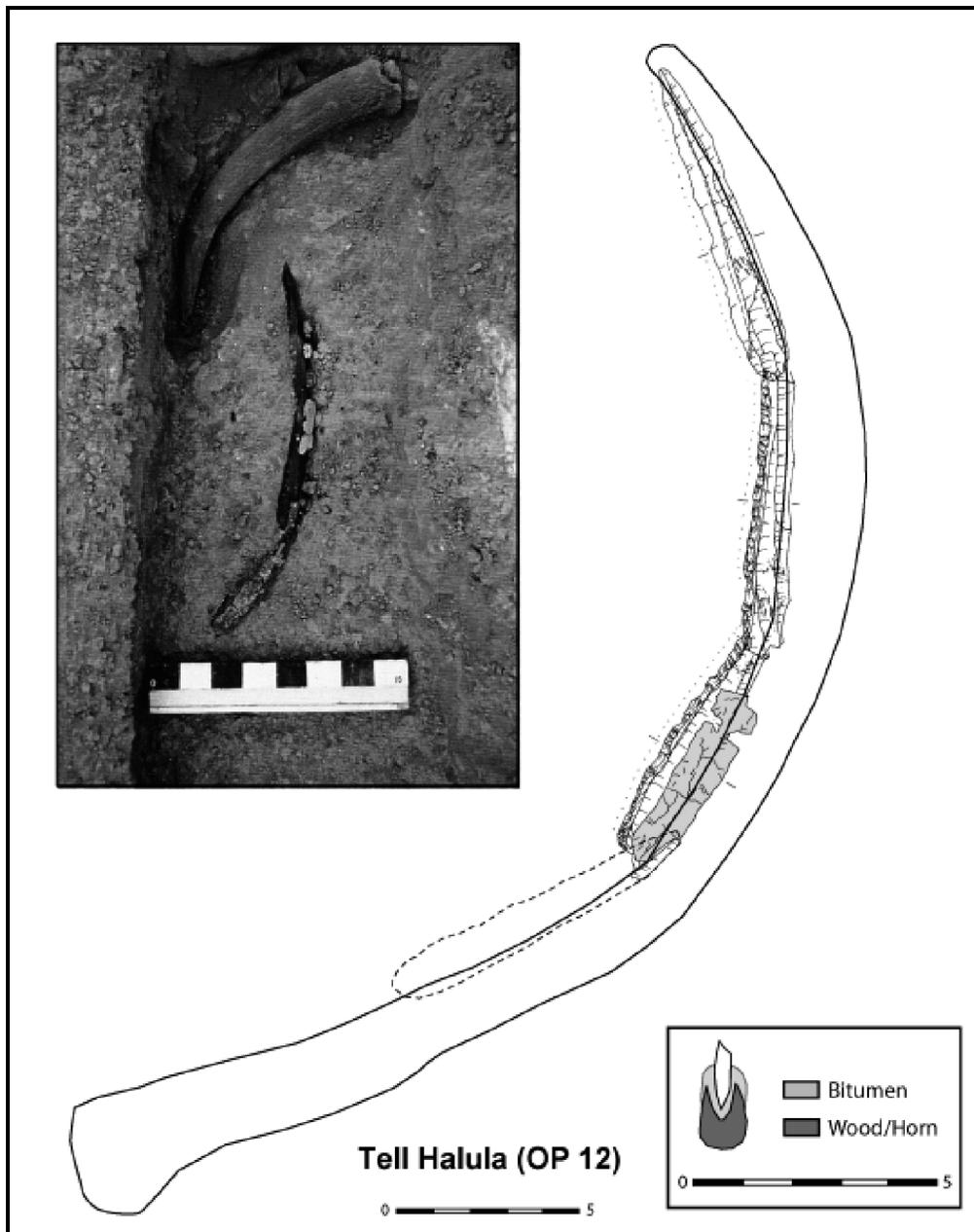


Figure 1. Sickles found at Tell Halula (Occupational Phase 12).

sharing techniques and probably some tasks, too. In fact, the existence of a massive terracing wall, from Late PPNB, provides clear evidence that some tasks were developed, not by an individual domestic unit, but for a part of and maybe even the whole community (Molist 2001). Thusly, it could be proposed that some agricultural tasks would have been performed in the same way too, as a collective job, specially when some of the agricultural tasks, specially the harvest, had to be done at the same time and in a short period of time. All this data allows for the supposition that the harvest was a task that could have been handled by the community as a whole or by groups of domestic units

in order to optimize the management of the energy and the time invested in that task.

In addition, difficulties exist in establishing how the management of the crop (grain) was done. The collective development of a task doesn't automatically mean that communal ownership of the product existed. Though not abundant, there is some evidence that could point to how the management of the crop was done. First of all, it must be stated that the only pits that have been documented are those within or next to the domestic units. These storage structures are located either just at the entrance of the building or at small storage rooms, usually related to *grill plans* and other structures that

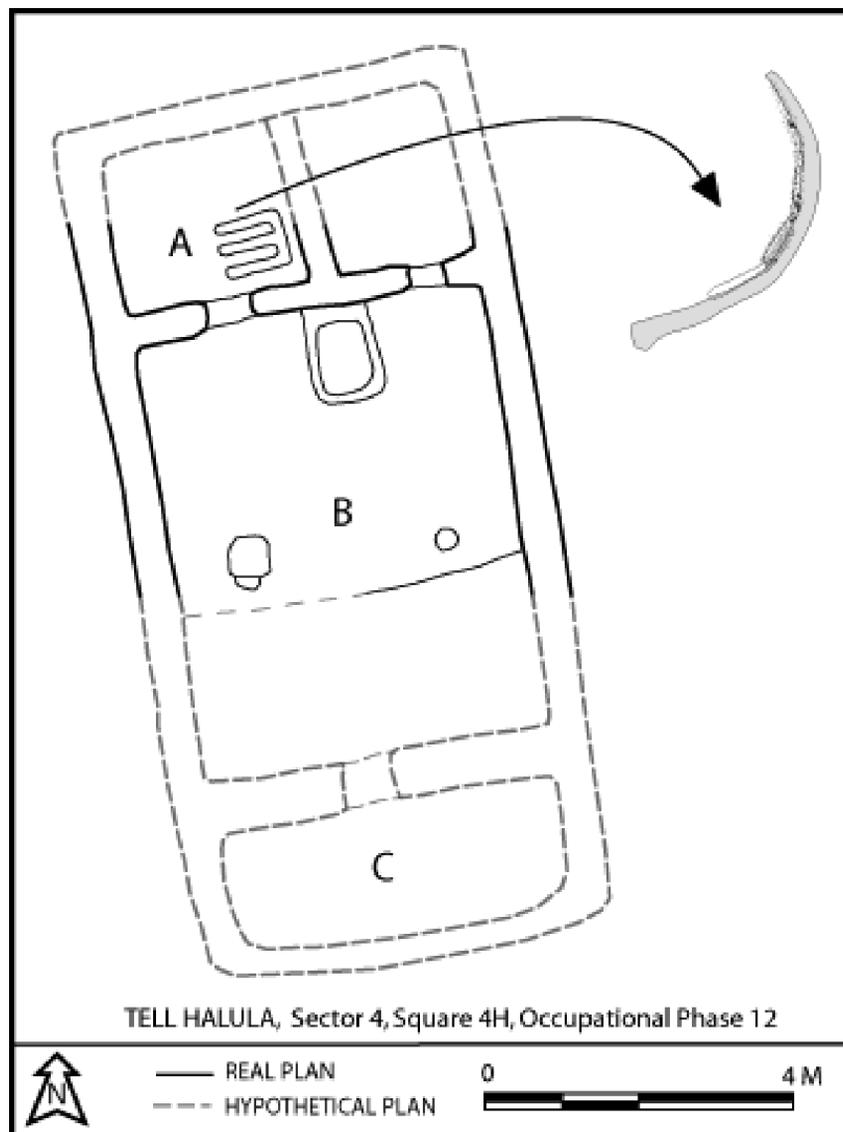


Figure 2. Hypothetical reconstruction of the house where the sickle, together with some other tools, was found next to a grill plan structure.

seem to have been connected to the treatment of food (drying, cooking, toasting, etc). Next to one of the grills is where the near-complete sickle was found¹³. Along with the sickle, on the same non-plastered floor where the structure was built, a large number of other tools were also recovered: stone tools (Byblos points, some pointed blades, glossed tools, a sidescraper, etc), bone tools (tubes) and some other macrolithic tools (a millstone, a pumice stone with remains of a red colorant over it and some middle-sized, strongly polished pebbles). All of these exceptional findings¹⁴ found within a small storage room and next to a *grill plan* structure

point to the fact that tools, whatever their use, were stored by each domestic unit and that the people from that domestic unit developed on their own and within their house the tasks related to the storage and treatment of the grain obtained after the harvest.

With this data alone it is not possible to certify that the storage and management of the all the grain obtained after the harvest was done by each domestic unit by itself. Other pits could have been built next to the fields or in a non-excavated area of the site; but the archaeological evidence shows that at least part of the grain was kept in storage structures inside the house.

13.- Sector 4, Square 4H, Occupational Phase 12 (dated around 7500 cal B.C.).

14.- Within these rooms, in every domestic building, a large number of different tools are often recovered. Besides that, over the plastered floors of the main rooms, it is rare to find any kind of tools or debris, due to the fact that it is a space that was repeatedly kept clean.

CONCLUSIONS

The second half of VIIIth millennium cal. B.C., in the middle Euphrates valley, is characterized by the consolidation of a means of subsistence based fully on food production. At Tell Halula and Akarçay Tepe, around 7500-7300 cal. B.C., agriculture seems to be completely consolidated, and some aspects of stone tools even suggest an intensification¹⁵ of agricultural tasks. The presence of big curved sickles, with continuous¹⁶ or denticulated edges, highlights the high level of development in the manufacture of the tools involved in agricultural tasks.

Besides that, and according to the data obtained at Tell Halula, it seems probable that part of the agricultural tasks, specially the harvest, were developed by the whole community or by grouped domestic units, who also faced some other collective tasks, like the terrassing wall. Despite this, the tools seem to have been stored by each domestic unit and the management (storage and treatment) of the grain obtained after the harvest would have been done, at least in part, by each domestic unit as well.

The importance of the role played by grains and crops stored by those communities who peopled the Middle

Euphrates valley during the second half of the VIIIth millennium seems doubtless. How these tasks were developed, and by who, are questions that can only be answered with forthcoming studies combining interdisciplinary data¹⁷. This particular contribution is just a proposal made possible through the study of the chipped stone assemblage and tries to bring some aspects of the Neolithic economy to light, attempting to delve into the social organization of those groups and improving our knowledge of the early farm communities of Near East.

ACKNOWLEDGEMENTS

I would like to express my gratitude to Dr. Miquel Molist, Dr. Nur Balkan-Atlı and Dr. Mihriban Özbasaran for their kind support concerning this study. My thanks also go to all the members of the SAPPO research team. This research was made possible by the economic support of the European Union (ICA3-2002-10053), the Spanish Ministerio de Educación y Ciencia (HUM2007-66237) and the Generalitat de Catalunya (SGR-2005-00241 and 2006-EXCAV0004).

15.- Ancient crop yields in the area were similar to those found in present times, despite recent agronomic and genetic advances, due to more stable climatic conditions. On the other hand, indirect evidence of progressive soil degradation during the later occupations at Halula has been detected. Such degradation appears to be associated with a loss in crop diversity and a trend towards a cereal monoculture (Araus *et al.* 2001; Ferrio *et al.* 2007).

16.- A chronological evolution from sickles with a continuous edge through a denticulated one has been documented at some sites, like at Tell Halula, between Late PPNB and PN period (Borrell/Molist 2007). There are some proposals to explain this evolution on the morphology of the sickles (Ibáñez *et al.* 1999; Hole 2001; Nishiaki 2001; Borrell/Molist 2007) but it actually seems evident that the effectiveness of both kinds of sickles during the harvest would be similar.

17.- Results obtained by the group studying the paleobotanical remains have shown that it is possible to make reliable estimates on population, past yields and land use from the study of archaeobotanical remains, together with other archaeological data (Ferrio *et al.* 2007).

11. ESTIMATION OF NUTRITIONAL STATUS, POPULATION AND HEALTH CONDITIONS: DEMOGRAPHIC AND HUMAN SPATIAL DISTRIBUTION IN TELL HALULA

Eva Fernández*, Emma Guerrero**, Josep Anfruns**

Another of the central analytical themes studied in MENMED project is population, mainly of the demographic variant. Our field work, mainly in Tell Halula, has provided us with an extensive population sequence with almost 150 osteological records of individuals from the Neolithisation period.

In the first phase, within the framework of the MENMED Project, different analyses of physical anthropology were carried out (description of the population, illnesses, etc.), but given the importance attributed to demography as a significant variable in the changes from a hunter-gatherer economy to an agricultural and livestock one, these were completed in a second phase along with demographic analysis.

a. The first phase results involve the characterization of the kinship relationships between the inhumations from the different houses belonging to distinct archaeological levels in the Neolithic site of Tell Halula (Siria), using both mt-DNA and Y-chromosome genetic markers. Considering both the technical limitations inherent to the preservation and amplification of ancient remains and our previous experience in this field, the research sought to obtain consistent amplifications of the maternal DNA lineages and to study both the genetic diversity of Hypervariable region I of mt-DNA, and the STR (Single Tandem Repeats) allele diversity of the patrilineal Y-chromosome DNA.

The results of the DNA amplification show that DNA is fairly well preserved in the Tell Halula site. The Real Time DNA quantification technique indicated that over 104 copies of DNA were preserved. This value is higher than the critical level of 100 copies suggested by different authors as a minimum requirement for ancient DNA characterization. PCR inhibitors were only detected in two of the DNA extracts considered. Aspartic amino-acid racemisation analysis reveals major heterogeneity in aa preservation among the samples studied. However, no correlation seems to exist between racemisation, DNA preservation and characterization efficiency, as

shown by the sequences finally obtained. These results suggest that racemisation may not be a good indicator of ancient DNA preservation in ancient remains.

From the mt-DNA results obtained, three maternal lineages were detected in the ancient samples. The first shows three distinct SNPs (Single Nucleotide Polymorphisms), 16224C, 16311C and 16304C, which can be grouped into the H haplogroup and is currently widely distributed in Europe and the Near East. Another lineage, characterized by SNPs 16223C, 16261T, 16278T, 16294T and 16309G, is grouped in haplogroup L2, which can only be found today in modern populations from West Africa. The presence of this L2 lineage in two samples from Tell Halula supports the authenticity of the results obtained and suggests a clear differentiation of ancient and modern populations in the Near East. The coincidence of such lineages in at least two individuals from the studied site supports close population affinities within the site.

Several Y-chromosome alleles and haplotypes could be characterized in the studied DNA extracts, especially for samples H3, H4, and H8. Three STRs systems could be amplified for both samples, except for the DYS389 system of sample H8. Although the results are still insufficient to draw definitive conclusions, it seems clear that they are not paternally related since there were different alleles for one of the studied systems (DYS388).

b. Demographic analysis aimed to analyse the process of cultural change as one of the variables of one of the theories explaining the origins of agricultural societies, in which the rise in population is related to the adoption of this new way of obtaining and exploiting resources. In any case, in the majority of these hypotheses where the population variable appears, the defined trend is that a rise in population is produced in relation to the adoption of new forms of obtaining and exploiting resources. In addition, recent studies based on the analysis of skeletal remains from sites in the Middle East southern Mediterranean reveal that the defined trend would seem

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to indicate that the growth in population would have been produced once agriculture was adopted as the form of obtaining and producing food. Thus, throughout the Neolithic period a gradual growth in population would have been produced, although this would be much faster between the PPNA periods, when the first evidence of vegetable manipulation appears, and above all during the PPNB period, as a consequence of the decrease in mortality and the increase in fertility associated with the introduction of agriculture.

Demographic analysis enabled us to define the general trend for population growth during the process of Neolithisation and also to observe at what specific moment in time it occurred, relating it as a direct cause or consequence of the change toward new forms of production for the Mediterranean Levant area.

The methodology focuses on the analysis of the birth and mortality rates of populations, and on the calculation of growth rates, based on the skeletal remains for each of the sites under study.

Two different methods were used to analyse the data: First, one that provides information referring to the population's birth and death rates by direct observation of the distribution of the human remains documented according to age and sex. Second, Bocquet-Appel's method for estimating a population's growth and birth rates, which calculates the proportion of individuals between 5 and 19 years old (noted as ${}_{15}P_5$) in relation to the total number of individuals of 5 years and over. In reference to the former method and the analysis of the diachronic evolution of the birth rate, i.e. the number of births produced in a population, and by extension, the evolution of the number of children per woman, was based on the study and observation of two variables: the first being the variability in the interval between births, since this is considered the most widely accepted explanation for an increase or decrease in the number of children per woman in pre-industrial societies. This interval can be established by estimating the age at weaning; which we did by analysing the number of infant individuals under the age of 5 grouped per year. The second was the variability in the number of women of a reproductive age in relation to the probability of reaching adulthood. We did this by analysing variability in the number of women aged 15 years and over. The diachronic evolution of mortality was analysed by calculating proportions among the different age groups, both in relation to the entire buried population and to the other age groups. In this analysis, considering that the age groups that are the most sensitive to changes in mortality are infant groups, one way of establishing the evolution of mortality is to observe the proportion of these individuals with respect to the totality of the individuals buried at a site.

The second method used started out by obtaining the ${}_{15}P_5$ proportion, for which a series of demographic estimators are calculated, specifically, the birth and growth rates of the archaeological populations. These are obtained from a series of relationships, in the form

of statistical regressions, relating the ${}_{15}P_5$ values to the birth and growth rate values obtained by simulating stable pre-industrial populations characterised using 45 reference mortality tables prior to 1870.

The demographic study was performed on three analytical levels: Firstly, a detailed analysis was made of the Tell Halula site (in Syria), enabling the main characteristics of the population's demographic structure to be observed, as well as the birth and mortality levels of a large settlement belonging to the PPNB phase, a phase of complete consolidation of agricultural and livestock practices. Secondly, a diachronic analysis of the trend in population growth during the final phases of the Neolithisation process in the Middle East (PPNB and Neolithic pottery phase) was carried out in the northern area of the Middle East Levant (Syria and Turkey), thus contextualising the data obtained for the Tell Halula site. Thirdly and finally, the sample of sites analysed was extended (to a total of 28 sites), as was the geographic zone under consideration (using data from the southern Levant area), as well as the historic chronological phases under consideration (analysing sites belonging to the Natufian, PPNA and PPNC phases), in order to establish the evolution of population growth for the whole area of the Eastern Mediterranean and between all of the historic-chronological phases that define the process of Neolithisation and the appearance and consolidation of agriculture and livestock farming in the Middle East.

The main results obtained were:

- The results obtained show how the highest ${}_{15}P_5$ and birth and growth rate values are observed in the PPNA and PPNB historic-chronological phases. It can thus be seen that these two phases would be those that would present a higher population growth in comparison to the previous Natufian phase and the subsequent Neolithic pottery phase. Based on this data, the process of Neolithisation is characterised by a growth with fluctuations over time, above all in the final stages with a complete consolidation of agricultural and livestock farming practices and cattlemen and the appearance of all of the elements specific to Neolithic populations.
- The progressive increase in the growth rate value associated with an increase in the growth rate of the size of settlements would already have been seen from the middle/end of the Natufian period. The interpretative hypotheses with the greatest degree of veracity are those that propose demographic growth prior to the phase of vegetable and animal domestication.
- As a consequence of the characteristics of the size of the sample analysed, the values obtained to -2σ for the growth rate do not discard the hypothesis of a stable or negative growth in population in all of the historic-chronological phases analysed in both geographical areas, with the exception of the PPNB phase in the northern Levant (for example, Tell Halula).

12. STUDYING THE $\delta^{13}\text{C}$ AND $\delta^{18}\text{O}$ RESULTS FROM BIOAPATITE ENAMEL OF GAZELLE (*GAZELLA SUBGUTTUROSA*) IN PPNB TELL HALULA SITE (SYRIA, MIDDLE EUFRATHES VALLEY) DURING 7800 – 7000 CAL. B.C.: CLIMATIC CONDITIONS AND VEGETAL LANDSCAPE DATA

Maria Saña i Seguí*, Carles Tornero**

INTRODUCTION

From an archaeological perspective, knowledge of the environmental characteristics during prehistory is essential for establishing the degree of human impact on it at various times and its consequent changes. This consideration is particularly relevant if we consider that human impact is occasionally significant, and even irreversible (e.g. deforestation, vegetable domestication, animal domestication, etc.). In the Near East, related with the time of the origin of the first peasant communities, a significant number of studies have taken place in order to describe and ascertain the characteristics of the environment and try to infer its role during the social event using various analytical approaches (*ice core studies*, Shackleton/Opdyke 1973; Sanlaville 1997; Galili *et al.* 2002; *speleothem studies* Bar-Matthews *et al.* 1997; 1999; 2000; Frumkin *et al.* 2000; Vaks *et al.* 2003; *pollen studies* Yasuda *et al.* 2000; *sedimentary studies* Street/Grove 1979; the Cooperative Holocene Mapping Project 1988; deMenocal *et al.* 2000). The various approaches have been able to add significant and important data for understanding the changes in the stratigraphical sequences studied, and in particular, considering both those linked to natural dynamics as those arising (directly or indirectly) from the social activities of the various human groups (see particularly Rossignol-Strick 1995; Petit-Maire/Guo 1996; Bar-Matthews *et al.* 1999; Indermuhle *et al.* 1999; Yasuda *et al.* 2000; Schilman *et al.* 2001; Vaks *et al.* 2003).

The main goal of environmental reconstitution from faunal remains is to establish and ascertain the environmental conditions in which prehistoric societies lived and to infer the main changes experienced in these conditions over time. Although these problems have been approached from various theoretical perspectives, at the methodological level essentially the same criteria and techniques have repeatedly been implemented, which are based mainly on the intrinsic characteristics of the faunal assemblages recovered from archaeological sites (Helmer *et al.* 1998; Helmer 2000). This methodology has produced general and imprecise information, and has sometimes reduced its final considerations to the local area around the archaeological site or has not produced results that are comparable between them (Tornero 2006).

However, in recent years the analyses of stable isotopes from macromammals remains recovered from archaeological sites has developed new means of redirecting the research in order to obtain more precise and specific information on the characteristics and the factors of the environment of each period studied.

STABLE ISOTOPE ANALYSES IN ARCHAEOLOGY

In recent decades, stable isotope analysis has increasingly been carried out in archaeology. Analysis of organic remains recovered from archaeological sites has taken place since the end of the 1970s (Vogel/van der Merwe 1977; van der Merwe/Vogel 1978). These applications

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were developed mainly from an anthropological perspective and focused on paleoalimentary, climatic or mobility study patterns and mainly used the humans remains analyzed. Recently, and especially from the mid-1990s onwards, these analyses were applied to other categories of materials usually recovered from archaeological sites, such as vegetable remains, faunal remains or food residue products found in artefacts as vessels or tools (Katzenberg 2000; Larsen 2002; Ambrose/Krigbaum 2003; Harrison/Katzenberg 2003).

USING STABLE ISOTOPE ANALYSIS ON FAUNAL REMAINS TO ENVIRONMENTAL RESEARCH

From an archaeozoological point of view, the application of stable isotope analysis can provide supplementary and specific data that is sometimes difficult or impossible to obtain by means of osteoarchaeozoological analysis, and is related mainly to environmental considerations, alimentary and diet studies and mobility patterns inferred (Tornero/Saña 2006). The main approaches developed from environmental data could be described as climatic reconstruction studies, vegetable landscape approaches, or hydrological factors inferred:

Climatic reconstruction

There have been many studies of these problems. The main studies have focused on the development of applications that allow climatic dynamics to be represented as changes or fluctuations in long time sequences. Initially, these works were elaborate due to their intention of covering large areas of study - even at continental level (Van Klinken *et al.* 1994; Richards/Hedges 2003; Steven/Hedges 2004), although more recent applications have produced works focusing on the analysis of time sequences in regional or local contexts (Huertas *et al.* 1997; Fricke *et al.* 1998, 193-208; lacumin *et al.* 2000; Drucker *et al.* 2000; Smith *et al.* 2002, 691). For example, Smith *et al.* (2002, 691) produced an analysis of $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values from enamel bioapatite of various macromammal land species recovered from a series of archaeological sites in the *Caledon River Valley* (South Africa), covering a timeframe between the final Pleistocene and early Holocene period (13'4ka - 5900 cal BC). The results showed, within a trend towards better climatic conditions, important changes that were previously unknown in the area and period studied. There have also been studies that intend to only consider aspects or early factors in climatic reconstitution such as obtaining data related to temperature. In this regard, models have been proposed mainly in order to infer the *mean annual temperature* (Stephan 2000).

Based on the $\delta^{18}\text{O}$ values measured in faunal remains, these applications consist of obtaining data related to temperature or changes to it. In this regard, the application is based on two main principles: 1) that the main source for environmental water is rainwater (meteoric water). Given that $\delta^{18}\text{O}$ values measured in

macromammal remains come mainly from the body of water formed and brought to it from the meteoric water, it is possible to correlate the $\delta^{18}\text{O}$ values with the values from environmental water; and 2) that the correlation with environmental water (meteoric water - rain) is well studied and it may be representative of the temperature of the region or area of study (Dansgaard 1953; 1964). Following these considerations, various works have been carried out using the faunal remains recovered in archaeological contexts. For example, the work by Stephan (2000,530-531) measures the $\delta^{18}\text{O}$ values in PO_4^{3-} groups on the bioapatite of bone tissue of bovines and suids found at various archaeological sites. After the $\delta^{18}\text{O}_{\text{phosphate}}$ values are obtained, they are converted into temperature values using the regression equation of Luz *et al.* (1990) formulated by bone tissue (bioapatite-phosphate) with modern deer ($\delta^{18}\text{O}_{\text{phosphate}} = 10,94 + 0,51\text{T}^\circ\text{C}$). The results are in this case representative of the mean annual temperature, given that bone tissue loads the oxygen values of body water during long periods of time (years).

Vegetable landscape reconstructions

Vegetable reconstructions by stable isotopes analysis in land macromammal remains have focused mainly on reconstructing environmental sequences based on the variation of predominant vegetable systems and determining the dominant continental factors in a given timeframe and aspects such as the vegetable photosynthetic pathway composition on environment and the floral structure of landscape.

Representing vegetable sequences

Analysis of stable isotopes has also been used in various studies to reconstruct the environmental fluctuations and to establish sequences of vegetable predominance at continental, regional or local level. In general, the works have taken place in tropical areas given that the fluctuations in humidity and dryness are more pronounced and significant in the δ values.

These works have mainly been produced based on analysis of the carbon and nitrogen values, taken mainly from bone tissue collagen. In these studies, the carbon values are interpreted as representative of a type of existing vegetable coverage (C_3 plants / C_4 plants), while the nitrogen values represent the degree of dryness in the environment (Ambrose/DeNiro 1989; Lee-Thorp/Beaumont 1995; Gröcke *et al.* 1997).

A good example of this kind of approach is the study by lacumin *et al.* (1997). The authors carried out an application at local level studying the remains of aurochs and horses recovered from Paglicci cave (south Italy) in a stratigraphical sequence, interpreting the oscillations of $\delta^{13}\text{C}$ values from bioapatite carbonate in bone tissue between 19,5ka and 13ka uncal BC. The authors found significant fluctuations until 15,8ka uncal BC, which they attribute to the deglaciation period and the change of arid and humid conditions. From the 15,8ka uncal BC onwards, the values for all the species stabilize,

coinciding with a predominance of a forest environment and the appearance in the archaeozoological record of forest species like the wild boar and the deer.

Drucker *et al.* (2003,376) have recently analysed the nitrogen and carbon in the collagen of bone remains in more temperate environments, where the variations in dryness are not as pronounced as in the tropical regions. In particular, they have analyzed collagen from the bone tissue of deer remains between the 13ka and 8ka uncal BC, recovered from the Rochedane archaeological site (Pledge, France). The authors record some oscillations in the $\delta^{13}\text{C}$ values that are consistent with the climatic fluctuations previously known for the period which they were studying, given the ethological characteristics of the species, such as a change in vegetable cover at that time.

Representing vegetable photosynthetic pathways

This type of data is very common in paleontological studies, which attempt to infer the vegetable consumption of the animals concerned from faunal remains recovered from sites, which could also be representative of the predominant or existing vegetable environments during the period. This type of application has also been developed in archaeological terms. For example, based on analysis of the enamel of different mammals remains recovered in the Pleistocene Tighenif site (Algeria) and dated to around 0.7Ma, Bocherens *et al.* (1996, 315) obtain a range of $\delta^{13}\text{C}$ values in all species of around -10‰, including those with a supposed diet of C_4 plants (rhinoceros). This data allows the authors to propose a vegetable environment reconstruction for the period dominated by C_3 herbaceous plants, given that no sample registers more negative levels than those that could represent wooded vegetation, and also because the majority of species documented on site were mainly herbivores.

Representing the "Canopy effect"

This application of the works by Van der Merwe/Medina (1991) and Tieszen (1991) highlighted the fact that plant species with the same photosynthetic pathway but with different conditions with regard to the sun could develop modifications in their expected isotopic concentrations. Plants in shade coming from compact wooded environments would thus show isotopic concentrations with more negative $\delta^{13}\text{C}$ values than the same plants in open environments. Various studies have used this data to characterise the vegetable structure of the landscape where animals found on the sites had fed, establishing a more or less direct relationship with the structure of the vegetable environment in the landscape of the archaeological site. For example, Balasse *et al.* (2000,45) when studying the bone collagen of wild auroch remains recovered from the site at Bercy (France) (IV mil. cal BC), observes that the $\delta^{13}\text{C}$ values were more negative than those expected. Despite a vegetable diet for this species was already being

thought to mainly be derived from C_3 plants, the results obtained showed a diet not wholly based on this type of vegetable resource, consistent with compact wooded environments.

Hydrological factors: evaluating precipitation

These types of approaches are also very common in palaeontology research. They allow aspects concerning the hydrological characteristics of the environment to be evaluated based on the isotopic concentrations counted in faunal remains. Some applications have also been developed in this area using fauna remains recovered in archaeological contexts, and these mostly focus on inferring the evaluation of the precipitation factor.

In archaeological contexts, studies have been carried out which allow the correlation of $\delta^{18}\text{O}$ values from faunal remains with values from precipitation, given that the latter can be counted in modern precipitation samples, enabling a relationship with modern animal population samples to be established.

For example, returning to Stephan's (2000) work, the $\delta^{18}\text{O}_{\text{phosphate}}$ values obtained from the faunal remains analyzed were passed $\delta^{18}\text{O}_{\text{meteoric water}}$ using equations established for the various species (*for bovines*, D'Angela & Longinelli, 1990 = $\delta^{18}\text{O}_{\text{phosphate}} = 1,01 \cdot \delta^{18}\text{O}_{\text{meteoric water}} + 24,90$; *suids*, Longinelli, 1984 = $\delta^{18}\text{O}_{\text{phosphate}} = 0,86 \cdot \delta^{18}\text{O}_{\text{meteoric water}} + 22,71$), the results can be compared to those recorded for the present day at the same sites.

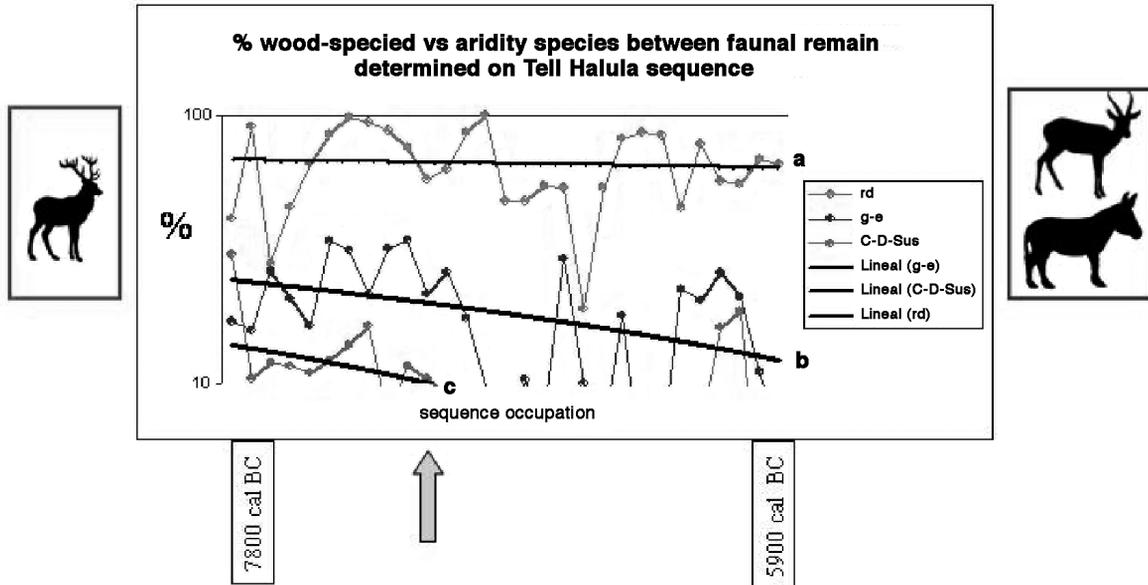
However, the main applications in the possibility of transforming $\delta^{18}\text{O}_{\text{phosphate}}$ values from faunal remains to $\delta^{18}\text{O}_{\text{meteoric water}}$ are still far from useful, mainly because not enough experimental works have been carried out and those existing are only for some species. However, some authors have raised the possibility of representing meteoric water in research on the mobility patterns of animals when there are changes in a seasonal sequence analysis (Mashkour *et al.* 2002).

This proposal includes an approach related with the possibility of studying the environmental data as a vegetable landscape or the climatic factors as temperature of the water precipitation from the faunal remains recovered and using stable isotope analysis. As described below, we analyse the $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of carbonate in bioapatite enamel from some remains of Gazelles (*Gazella subgutturosa*) recovered from the PPNB Tell Halula site (Syria, Middle Euphrates Valley) covering a timeframe between 7700 and 5900 cal BC.

THE FAUNAL REMAINS ANALYZED

Tell Halula is an archaeological site in the middle Euphrates Valley (Department of Rakka, Syria). It was occupied between 7800 and 5900 cal BC (Molist 2001a; 2001b). The archaeozoological analyses carried

**Association of macromammals on a large-sequence occupation.
- Presence / Absence of animal resources**



General increased progressive on aridity during sequence. Desaparition of wood-species from archaeozoological sequence arrived on PPNBr

Figure 1. Representation % presence wood-species (a) vs. aridity-species (b) compared with domestic animal resources (c).

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out to date show that the remains recovered from the entire sequence are highly represented by *wood-species* (*Cervus elaphus*, *Dama dama* and *Dama mesopotamica* mainly) in the first part of the sequence and by *aridity species* (*Gazelles* sp., *Equus hemionus/Equus asinus* mainly) in the latter phases. If we compare the numerical remains in terms of the percentage data of the remains analysed for each group, the sequence may be associated with an environmental change (Saña 1997; 1999) (Fig.1).

However, is the change in hunting strategy really associated with a change in environmental conditions? Is it possible that other aspects such as the kind of human management of animal resources and the role of domesticated animal resources exploited in hunting strategies could vary the sequence? Furthermore, are there variables for specific frequencies of representation that could produce anomalies in the taxonomical species represented? For the moment, this change in sequence is difficult to asseverate and correlate to an environmental change.

MATERIALS

Due to its exploitation, high representation throughout the entire sequence, and the possibilities for sample selection, the *Gazelle* sp. species is the main

representative in carrying out this kind of research (Fig. 2). The sampling was designed as follows: throughout the sequence of occupation phases from *Tell-Halula*, and using some correlate stratigraphy and archaeological squares, but focusing mainly on the initial occupation phases.

From the various hard tissues that are normally preserved in recovered fauna remains (which can be analyzed), bone, dentine, and enamel, we chose tooth enamel to carry out our analyses. Tooth enamel is thought to retain highly reliable *in vivo* isotopic signatures for long periods of time, mainly because enamel is formed by hard crystalline mineral composition, and especially in carbonate from bioapatite enamel from tooth remains, consistent with the favourable results presented in the bibliography for preservation of fixed values and non-alteration by diagenetic effects such as in collagen, bone or dentine and the possibility of simultaneous analysis of carbon and oxygen isotope composition (Balasse 2003) (Fig.3).

There were three main reasons for this choice. First, the few upper dental remains recovered at the *Tell Halula* site, which forced us to look for mandibular teeth. Second, it took into account that enamel is not remodelled once it has formed, and the values obtained are therefore only representative of the formation period tissue (Lee-Thorp/van der Merwe 1987). Third, molars

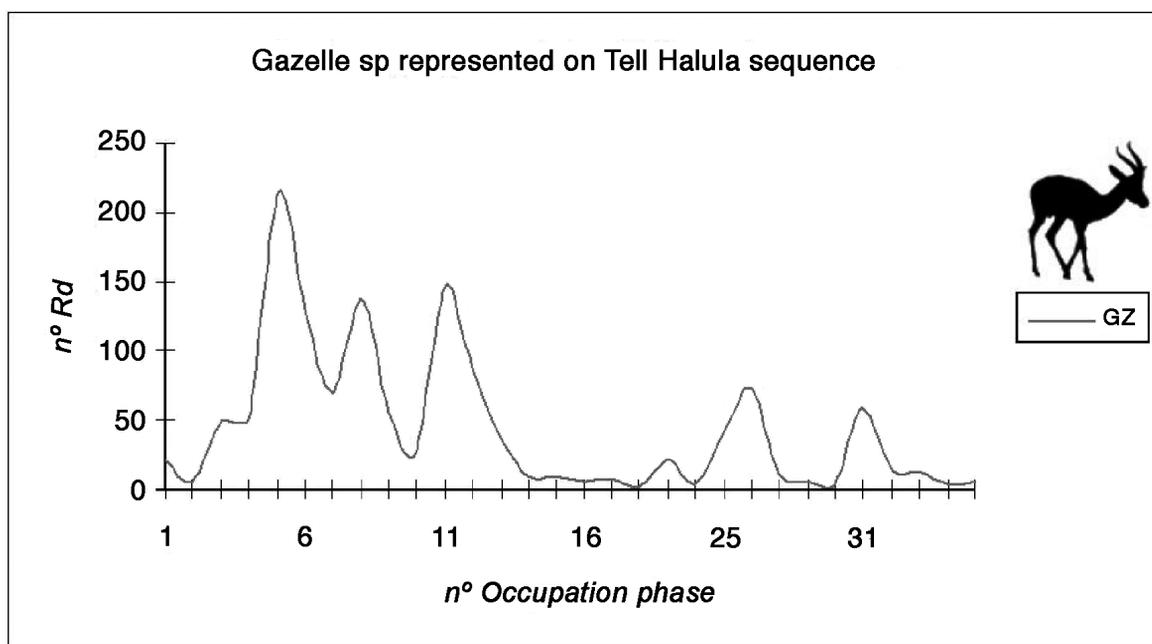


Figure 2. Representation of *Gazelle* sp. remains recovered in Tell Halula sequence

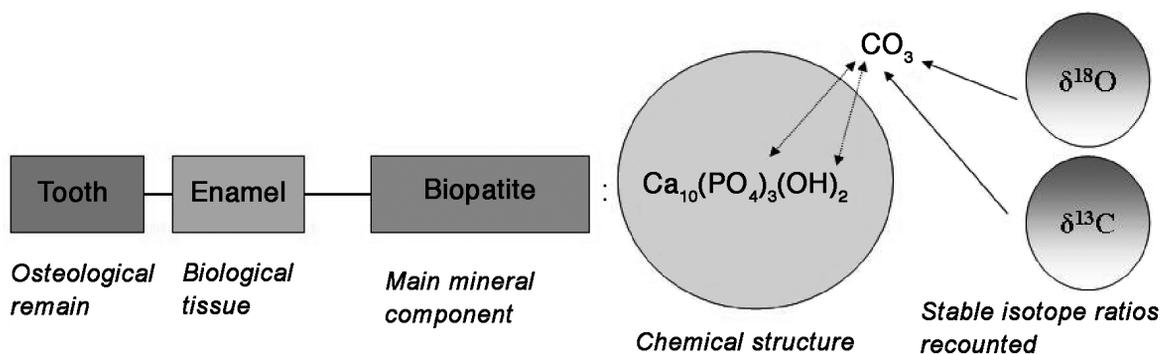


Figure 3. Analytical scene according to the tissue, component and isotope values analysed.

especially in the case of hypsodont dental formations provide longer period and lengthy formation¹.

These features facilitate obtaining sections with isotopic concentrations associated with various time intervals².

Finally, the formation process of the third molar enamel occurs when individuals are already adults and subadults, and is therefore more likely to lead to isotopic compositions free of the changes that occur during the development and growth of the individual (such as during breastfeeding and weaning).

According to the stratigraphical correlation and the same kind of sample selected (third lower molar) for each individual, we finally analysed 18 different samples (Fig. 4). The osteobiometrical analyses and digital scene registration of the wear patterns on the occlusive surface of the tooth enabled us to select the remains of individuals who had completed the enamel formation process at the time of death (Tornero 2006, 202-211).

1.- This may cover more than one and a half years in the case of cows and horses (Bryant *et al.* 1996a, 1996b), and almost one year in the case of sheep (Fricke/O'Neil 1996, 95). In the case of gazelles, it may be about 6 to 9 months according to the study by Kohn *et al.* (1998, 107).

2.- This consideration, as well as selection of the lower third molar in the case of ungulates, is very common in similar works and particularly in those that analyze sequences of full height enamel in the teeth, as in the case of *Bos sp.* (Wiedemann *et al.* 1999, 701; Zazzo *et al.* 2002, 154; Sharma *et al.* 2004:19), the case of goats and sheep (Bocherens *et al.* 2001, 71; Balasse *et al.* 2002, 926; 2003, 208; Balasse/Ambrose, 2005, 285) or various species of horse (Hoppe *et al.* 2003, 5).

Sample lab n°	Archaeological Site	Year sample	Sector	Square	Code	Occupation Phase (OP)	cal. B.C.	Esp.	Tooth analyzed	right-left
1	Tell-Halula	1994	SIV	B	D17a	4	7800-7000	<i>Gazelle</i> sp.	m3	l
2	Tell-Halula	1994	SIV	B	D7a	6	7800-7000	<i>Gazelle</i> sp.	m3	r
3	Tell-Halula	1994	SIV	B	D6a	5-7	7800-7000	<i>Gazelle</i> sp.	m3	r
4	Tell-Halula	1994	SIV	C	C10e	5	7800-7000	<i>Gazelle</i> sp.	m3	r
5	Tell-Halula	1993	SIV	C	C4e	6	7700-7600	<i>Gazelle</i> sp.	m3	l
6	Tell-Halula	1993	SIV	C	B8e	7	7700-7600	<i>Gazelle</i> sp.	m3	r
7	Tell-Halula	1994	SIV	B	A16a	8	7600-7500	<i>Gazelle</i> sp.	m3	l
9	Tell-Halula	1994	SIV	B	A16	8	7600-7500	<i>Gazelle</i> sp.	m3	l
10	Tell-Halula	1994	SIV	B	A16a	8	7600-7500	<i>Gazelle</i> sp.	m3	r
11	Tell-Halula	2002	SIV	H	A16	11	7500-7400	<i>Gazelle</i> sp.	m3	r
12	Tell-Halula	2003	SIV	H	A33	11	7500-7400	<i>Gazelle</i> sp.	m3	l
13	Tell-Halula	2002	SIV	H	A16	11	7500-7400	<i>Gazelle</i> sp.	m3	l
15	Tell-Halula	2002	SIV	H	A16	11	7500-7400	<i>Gazelle</i> sp.	m3	r
16	Tell-Halula	1996	SII	F	E21	+/- 18	7000-6900	<i>Gazelle</i> sp.	m3	l
17	Tell-Halula	2003	S43	3-4	A83	34	5900-5800	<i>Gazelle</i> sp.	m3	r
18	Tell-Halula	2003	S44	1	A2b	34bis	5900-5800	<i>Gazelle</i> sp.	m3	l
19	Tell-Halula	2003	SIV	H	A33	11	7500-7400	<i>Gazelle</i> sp.	m3	r
20	Tell-Halula	1993	SIV	B	A5a	10	7600-7500	<i>Gazelle</i> sp.	m3	l

Figure 4. Database of 18 samples selected with their specific anatomic data, and their stratigraphical and chronological relations

METHOD

The sample was designed to meet two main objectives: 1) to asseverate the analysis process; 2) to compare the end values obtained according to a similar criterion for all samples.

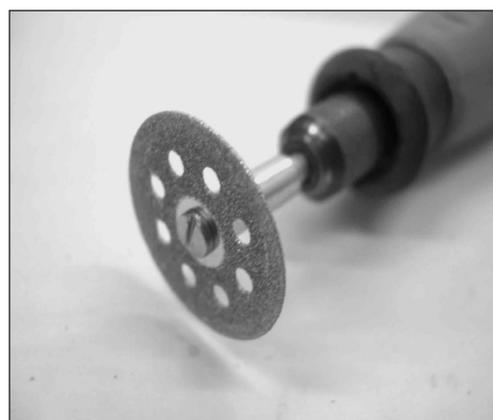
Because there could have been variability in the isotopic values depending on the enamel formation time for each tooth, we always selected the same section of enamel for each tooth; with the aid of a rotatory-disc hand-tool (Fig. 5 and 6).

The 2 mm section selected from each tooth enamel was the part located closest to the roots, on the oral part and on the first lobular for each tooth (Fig.7).

All samples were chemically pre-treated, in order to remove any possible organic and inorganic carbonates

added to the sample. These added carbonates could have modified the original isotopic values, and to remove them we followed the standard procedure proposed by Lee-Thorp and van der Merwe (1987, 713), and recent modifications by Koch *et al.* (1997, 422) and Balasse *et al.* (2002, 919-921). Organic matter was removed with NaClO 2% for 24h (1mg/1ml). The samples were then rinsed five times in distilled water (ph 5-8) and were oven-dried at 60° for 24h at "Laboratori de Làmines Primes del Departament de Geologia (UAB)". Later, the samples were treated by 0.1M acetic acid for 4h (1mg/1ml) and rinsed and oven-dried again.

The final analysis was carried out according to the original McCrea method (1950) adapted by Kolodny/Kaplan (1970) and Coplen *et al.* (1983) to enamel, as well as in other studies (Lee-Thorp/van der Merwe 1987; 1989;



Figures 5 and 6. Images of rotatory-disc hand-tool used.

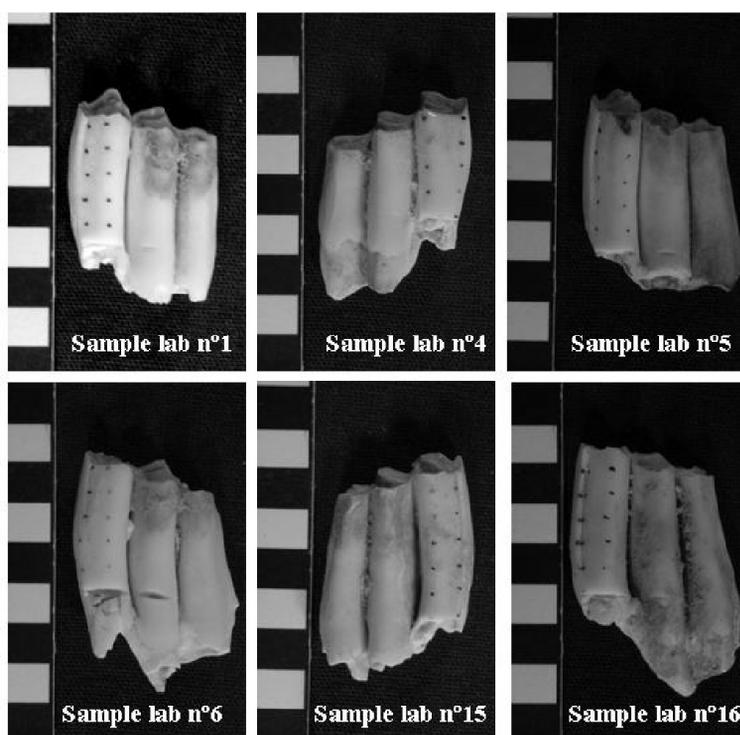


Figure 7. Image of different third mandibular tooth remains of Gazelle, sp. with the 2 mm section of tooth enamel selected by analysis (Samples lab n° 1, 4, 5, 6, 15 and 16).

Koch *et al.* 1989; 1997; Balasse *et al.* 2002; 2003). The method consists of applying phosphoric acid to each sample in order to produce carbon dioxide by hydrolysis. This was done at the *Iso-Analytical Laboratory* (UK) and counted by means of *Europa Scientific 20-20 IRMS*. Because we worked with samples at the minimum accepted weight, it was not possible to replicate some samples. However, we also counted some control samples. These samples from the same laboratory were of calcium carbonate (*IA-R022*) with hopped $\delta^{13}\text{C}_{\text{V-PDB}}$ -28‰ and $\delta^{18}\text{O}_{\text{V-PDB}}$ -22,69‰ values. We also analysed some samples as reliability control-test values of the NBS-19 and NBS-18 standards.

RESULTS

The ratios of stable isotope concentrations in carbon $^{13}\text{C}/^{12}\text{C}$ and oxygen $^{18}\text{O}/^{16}\text{O}$ were analysed and counted for all the samples sent. The results showed international standard V-PDB for carbon values, and V-SMOW for oxygen values, and they were expressed as standard delta (δ) notation per mil unit (‰) values (Fig.8), and are shown in Fig.10.

$$\delta = \left[\left(\frac{R_{\text{SAMPLE}}}{R_{\text{STANDARD}}} \right) - 1 \right] \times 1000$$

Figure 8. Equation used to convert stable isotopic ratios (R) into delta (‰) values.

Number lab sample	$\delta^{13}\text{C}_{\text{‰V-PDB}}$ Values	$\delta^{18}\text{O}_{\text{‰V-SMOW}}$ Values
TH-1	-13,5	31,6
TH-2	-13	31,4
TH-3	-12,8	34,9
TH-4	-12	31,7
TH-5	-13	33
TH-6	-12,7	33,8
TH-7	-13,8	29,7
TH-9	-13,2	34,7
TH-10	-12,8	30,1
TH-11	-11,6	32
TH-12	-10,4	37,2
TH-13	-12,6	32,2
TH-15	-12,8	33,4
TH-16	-13,3	35,2
TH-17	-11,8	30,6
TH-18	-12	32,5
TH-19	-12,8	29,8
TH-20	-13,5	30,1

Figure 9. $\delta^{13}\text{C}_{\text{‰V-PDB}}$ and $\delta^{18}\text{O}_{\text{‰V-SMOW}}$ values obtained of carbonate from enamel.

The results obtained from the various control tests are shown in Table 2 (Fig.10).

Control-test of samples quality

	IA-R022 Calcium Carbonate		NBS-18 Carbonatite		NBS-19 Limestone	
	$\delta\text{-}^{13}\text{C}_{\text{V-PDB}}$ (‰)	$\delta\text{-}^{18}\text{O}_{\text{V-PDB}}$ (‰)	$\delta\text{-}^{13}\text{C}_{\text{V-PDB}}$ (‰)	$\delta\text{-}^{18}\text{O}_{\text{V-PDB}}$ (‰)	$\delta\text{-}^{13}\text{C}_{\text{V-PDB}}$ (‰)	$\delta\text{-}^{18}\text{O}_{\text{V-PDB}}$ (‰)
	-28,69	-22,93	-5,13	-22,34	1,69	-2,53
	-28,58	-22,33	-5,20	-22,49	1,76	-2,74
	-28,71	-22,90				
	-28,36	-22,53				
mean	-28,58	-22,67	-5,16	-22,42	1,72	-2,63
1 s.d.	0,16	0,29	0,05	0,10	0,05	0,15
n	4	4	2	2	2	2
attended	-28,63	-22,69	-5,00	-23,00	1,95	-2,20

Figure 10. Result values from the different control tests made.

The values obtained show a mean difference in isotope composition of 0.05‰ for $\delta\text{-}^{13}\text{C}$ carbon values, and 0.15‰ in $\delta\text{-}^{18}\text{O}$ oxygen values (n = 4). These results are common in many studies carried out on the basis of analysis of carbonate bioapatite stable isotopes (Cerling *et al.* 1997; Wiedemann *et al.* 1999; Zazzo *et al.* 2002). In specific terms, the difference obtained for oxygen values has been observed in many studies and is accepted as a rule: “Oxygen values from carbonate enamel usually present a mean difference in isotope composition of 0.14 /0.12‰” (Balasse *et al.* 2003, 209). The $\delta\text{-}^{13}\text{C}$ values obtained in all the samples show a reduced variability and a mean of around -12.6‰. However, the $\delta\text{-}^{18}\text{O}$ values obtained in all samples show a higher variability and a mean of around 32.4‰ (Fig. 11 and 12).

DISCUSSION

The various control tests carried out during the mechanical processing, chemical pre-treatment and

during the analysis process confirm the validity of the values measured as well as the analytical method used on samples selected.

Final interpretation of the values is possible and is carried out according to the variables controlled: taxonomical and anatomical determination of the remains analysed, similar age profile by tooth remains, logical stratigraphical association, the tissue and analytical component selected and the control test carried out during the analysis process.

All values obtained in the samples analyzed fall between the possible accepted borders for the analysis of stable isotope values $\delta\text{-}^{13}\text{C}$ and $\delta\text{-}^{18}\text{O}$ in carbonate bioapatite enamel from mammalian herbivores (Quade *et al.* 1992; Blondel *et al.* 1997; Mashkour *et al.* 2002). There are also specific similar values obtained for other authors on gazelles according to an identical analytical process (Cerling *et al.* 1997a, 638; Koch *et al.* 1997).

The $\delta\text{-}^{13}\text{C}$ ‰ values in samples show a reduced interval of variability between -11‰ to -13‰. According to various studies carried out which showed a variability of

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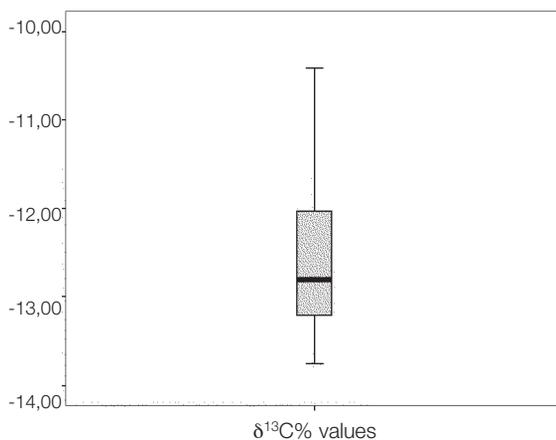


Figure 11. Variability, mean and range observed for $\delta\text{-}^{13}\text{C}$ ‰ values.

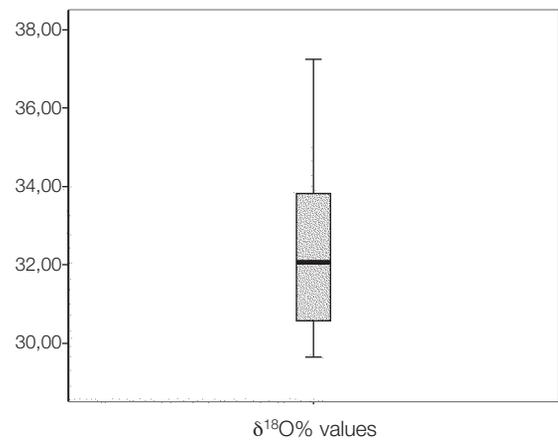


Figure 12. Variability, mean and range observed $\delta\text{-}^{18}\text{O}$ ‰ values.

between -8‰ and -20 ‰ in $\delta^{13}\text{C}$ values in bioapatite enamel ungulate-hypsodont tooth formation and diets consisting mainly of intake of C_3 plants (Cerling *et al.* 1997, 640; Wiedemann *et al.* 1999, 701), the $\delta^{13}\text{C}$ values obtained in the set of samples are representative of a increased consumption in the gazelle's diet of this type of plant resource. At the same time, this contribution of plant resources C_3 submitted a low ^{13}C content.

The ethological data consulted for gazelles, and the analysed species *Gazella sub. Subgutturosa* in particular, thus presents a steppe habitat with a predominant dietary preference for herbaceous and browser resources (Baharav 1983; Martin 2000; Campos-Arceiz *et al.* 2004), which is completely consistent with the kind of photosynthetic pathway mentioned. Finally, some examples in which an identical analysis was performed (carbonate-bioapatite-enamel) on gazelles obtained very similar values of between -11 to -13‰ (Cerling *et al.* 1997, 638).

The oxygen values show a higher variability and an average of around 32.4‰. In accordance with the method used, these results can be used as a paleoclimatic marks from the surface of drinking water. In the same spatial framework and historical background as the study at the site of *Hayonim Cave* (Israel) (10.2 ka - 8.8ka cal BC) (Shahack-Gross *et al.* 1999, 5), the same kind of analysis (carbonate - bioapatite - enamel) was carried out on gazelle remains recovered from the archaeological site and on modern gazelles remains recovered from nature reserves very close to the archaeological site. The result was that the values obtained from the archaeological remains differ by almost +10 ‰ compared to the values counted in the modern gazelles.

This data was interpreted by the authors as representing an increase in the current temperature of the surface water (drinking water for animals) during the period studied. When the values of the *tell Halula* gazelles (7800 - 7000 cal BC) were compared with those obtained from the $\delta^{18}\text{O}$ ‰ values from the gazelles from *Hayonim Cave*, there was a very high level of similarity: 30-32 ‰ in *Tell Halula* and 30-31 ‰ in the *Hayonim cave*, which also differs widely from the figures recorded in the modern gazelles (21-22 ‰).

The correlation between the carbon and oxygen values counted for the samples can also be used as a reference

for environmental conditions. As demonstrated in other studies, the mean height of oxygen values is representative of arid conditions (Wiedemann *et al.* 1999; Shahack *et al.* 1999). However, the coexistence of low C_3 values is also an indicator of open or semi-open plant systems without cover or leafy conditions (Cerling *et al.* 1997, 645). According to the ethological data, these environmental conditions are the main ones inhabited by the species of gazelle analysed, and could be called a steppe system.

CONCLUSIONS

According to all the controlled variables the values obtained test for the first time the preservation of isotopic concentrations in bioapatite enamel from the gazelle samples selected and recovered from *Tell Halula* between 7700 -5900 cal BC. The $\delta^{13}\text{C}$ values represent a vegetarian diet consisting largely of C_3 plants associated with steppe systems. The $\delta^{18}\text{O}$ values obtained for the same samples represent higher temperatures of drinking water resources in comparison with early periods (*Natufian* levels, *Hayonim Cave*. Israel). The correlation between the two isotopic values confirms steppe and semi-desert environmental conditions in the period, as well as the wild status of gazelles exploited as an animal resource by Neolithic communities in *Tell Halula*.

ACKNOWLEDGMENTS

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13. L'HOMME ET SON ENVIRONNEMENT DANS LA MOYENNE VALLÉE DE L'ORONTE A L'ÂGE DU BRONZE

Michel Al-Maqqdissi*

INTRODUCTION

La vallée moyenne de l'Oronte correspond à une vaste plaine de faible altitude (500 à 600 m en moyenne) que traverse sur laquelle débouche la vallée de l'Oronte. Elle est limitée à l'ouest par une chaîne montagneuse qui forme un promontoire presque homogène depuis Masyaf au sud jusqu'à la dépression de Ghab au nord. Cependant, cette région est marquée par la présence d'une dépression importante orientée Est-Ouest, de faible altitude, appelée "trouée de Homs", qui forme en pratique le seul passage entre la région littorale de la Méditerranée et la Syrie intérieure.

La limite orientale touche presque la zone steppique entre la Palmyrène au sud et la plaine de Jabboul au nord.

Le système hydrographique est constitué principalement par l'Oronte et sa vallée qui présente des caractères particuliers sur plusieurs niveaux car il comporte des éléments spécifiques comme le lac de Homs, la dépression du Rastan, la zone crayeuse entre Rastan, Hama et Cheyzar à la région du Ghab au nord.

LIMITES HISTORIQUES DE L'ÉTUDE

Un certain nombre d'observations sur l'évolution historique de la Syrie occidentale nous suggère de considérer le Bronze ancien III, comme étant la période du début d'un développement urbain important¹ (vers 2700/2600 av. J.-C.).

En effet, durant les premiers siècles de cette deuxième révolution urbaine, nous observons dans l'ensemble des

régions occidentales de la Syrie, et plus spécialement la vallée de l'Oronte, une organisation générale caractérisée par des nouvelles fondations ou refondations de villes et de villages dans le but d'intensifier la présence sur les voies de communications reliant les installations portuaires de la côte syro-libanaise aux grands centres de la moyenne vallée de l'Euphrate.

Ainsi, nous proposons de commencer notre enquête au Bronze ancien III et de développer notre réflexion sur les relations de l'homme avec son environnement selon la division chronologique qui suit:

AGES DU BRONZE

La documentation archéologique disponible datant du Bronze ancien III (2700-2400 av. J.-C.) montre un essor urbain en Syrie occidentale, et tout particulièrement dans la vallée de l'Oronte et au niveau du passage de la Trouée de Homs².

Le fait remarquable est la présence dans toutes les zones étudiées d'une occupation datant à cette période³. Les travaux de prospections de la plaine de 'Akkar à la plaine du al-Rouj⁴ apportent des informations très utiles sur la nature des axes de communications reliant les principaux centres du grand port de Jbeil-Byblos à Mishirfeh-Qatna au nord-est de Homs.

Carrefour routier important, centres d'activités économiques et agricoles, une forte concentration d'occupation: voilà en quelques mots la situation en Syrie occidentale au début de la deuxième révolution urbaine.

Au Bronze ancien IV (2400-2000 av. J.-C.), notre connaissance de l'urbanisation de la Syrie occidentale

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1.- Cf. à ce propos Margueron 2003, 57-74, 219-227; Akkermans/Schwartz 2003, 211-326.

2.- En ce qui concerne la moyenne Vallée de l'Euphrate, cf. Margueron 2000 (b).

3.- Nous pouvons confirmer, à ce propos, la rareté du matériel antérieur au Bronze Ancien III dans les régions étudiées.

4.- Cf. particulièrement les publications suivantes: Thalmann/Al-Maqqdissi 1989 pour la Plaine du 'Akkar et Courtois 1973 pour la Vallée de l'Oronte. Notons à ce propos les résultats comparables des travaux en cours de réalisation par deux équipes: Syro-anglaise dans la région à l'ouest de la ville de Homs (Dir. Mamoun Abdulkarim et Graham Philip) et syro-allemande dans la région entre Rastan et Shaizar (Dir. Michel Al-Maqqdissi et Karin Bartl).

doit se renforcer de solides informations épigraphiques⁵ et archéologiques grâce à l'intensification des travaux de dégagement sur des sites importants⁶. Effectivement, c'est au cours de cette période, caractérisée par la montée en puissance d'Akkad en Mésopotamie, que nous pouvons voir pour la première fois en Syrie occidentale de grands centres dont l'organisation urbaine regroupe des informations variées:

- Trame urbaine.
- Établissement d'un réseau routier et d'axes de communications.
- Développement des échanges et de la circulation des biens à longues distances⁷.

Au cours du XVIII^e siècle le royaume d'Ebla est défait par les rois d'Akkad⁸. La période du Bronze Ancien IV B (2250-2000 av. J.-C.) pose plusieurs problèmes d'interprétations historique et archéologique. Une analyse stratigraphico-archéologique de l'ensemble de la documentation nous laisse supposer la possibilité d'un effondrement des cités levantines et pratiquement un arrêt partiel de la vie urbaine. En effet, le Proche-Orient traverse une période de troubles qui doit être liée aux conséquences de l'écroulement de l'Empire d'Akkad⁹. De même, il semble que les événements des deux derniers siècles du III^e millénaire entraînent rapidement au Levant un déclin du commerce et des échanges et plus exactement la disparition d'une organisation urbaine contrôlant les réseaux de routes. La fin du Bronze Ancien fut marquée par des mouvements massifs des tribus amorites de la steppe syrienne vers les régions agricoles ce qui provoqua, au début du II^e millénaire av. J.-C., une nouvelle situation géopolitique.

Les Amorites vont créer au Bronze Moyen (2000-1600 av. J.-C.) plusieurs royaumes en Syrie occidentale¹⁰. La documentation archéologique nous renseigne sur la nature de cette nouvelle phase d'urbanisation. Nous

pouvons reconnaître à Tell Mardikh-Ebla, et à Mishrifeh-Qatna des villes qui furent rebâties, presque au début du II^e millénaire av. J.-C. suivant un plan généralement régulier avec un rempart entouré de fossés et muni de plusieurs portes monumentales. La ville se compose principalement d'une zone palatiale centrale et surélevée entourée de plusieurs quartiers d'habitation¹¹. Les textes en cunéiforme syllabique de Tell Hariri-Mari, datant du XVIII^e siècle av. J.-C., nous fournissent des informations d'une grande utilité pour les régions en question. Ils donnent une image précise de la situation politique de ces royaumes et surtout du système économique-commercial déjà perturbé à la fin du III^e millénaire av. J.-C. par l'effondrement des routes qui relient le Proche Orient ancien et traversent le Plateau iranien et le Golf Arabe puis jusqu'à la Vallée de l'Indus et à l'Afghanistan¹². En effet, plusieurs tablettes trouvées dans le Palais de ZIMRI-LIM nous indiquent que les royaumes amorites syriens sont renforcés par leur situation centrale¹³ et imposent une autorité sur les axes routiers¹⁴. La ville de Qatna devait tenir une position stratégique dans l'organisation des routes et des axes de communication. L'étude approfondie du royaume de Qatna¹⁵ nous donne également une vision de l'organisation régionale fondée principalement sur l'agriculture et les échanges:

- l'aménagement de la zone urbaine de la ville de Qatna et la déviation de plusieurs cours de wadis afin de refonder la nouvelle ville;
- l'établissement des sites le long des axes de communication afin d'organiser les étapes successives des caravanes qui relient pratiquement la côte à la steppe d'un côté et le nord au sud de l'autre¹⁶;
- enfin le développement des sites satellites autour de grands centres pour la gestion de l'agriculture.

Ce dynamisme aurait dû se prolonger jusqu'au XVI^e siècle av. J.-C., mais nous allons assister à une crise politique générale qui va secouer l'ensemble de ces

5.- Cela concerne pratiquement toute les archives de Tell Mardikh-Ebla: Matthiae/Pinnock/Scandone Matthiae 1995/Archi 1995.

6.- Nous signalons les travaux à Tell Mardikh-Ebla: Matthiae/Pinnock/Scandone Matthiae 1995, Matthiae 1995/Matthiae 2003; à Tell Arqa-Irqata: Thalmann 2000, 35-46; à Mishrifeh-Qatna: Morandi-Bonacossi 2003, 98-102 et plus récemment les fouilles inédites de 2003; à Tell Nebi Mend-Qadesh: Mathias/Parr 1989/Mathias 2000 et à Sh'eirath: Al-Maqdissi 1995.

7.- La vallée de l'Indus et le plateau iranien à l'est et l'Égypte et la Méditerranée orientale à l'Ouest.

8.- Pour la documentation concernant Tell Hariri-Mari et Tell Mardikh-Ebla, cf. Archi 1985/De Meyer/Pons 2002.

9.- À ce propos, cf. Glassner 1986, Glassner 1994, Weiss/Courty 1993, 1994 et Weiss *et al.* 1993.

10.- Nous citons par exemple les royaumes de Yamhad (Alep) au nord, de Qatna (Mishrifeh) au centre, d'Amurru sur la côte, d'Apum (Damas) au sud.

11.- En ce qui concerne Tell Mardikh-Ebla: cf. Matthiae 1997, 1998, 2000 (a), 2000 (b) et 2001; Mishrifeh-Qatna: cf. Al-Maqdissi *et al.* 2004 et Tell Hariri-Mari: cf. Margueron 1987 et 2000 (a).

12.- En effet, au début du II^e millénaire, l'équilibre international et le centre d'intérêt de la Mésopotamie se déplace vers le nord. A ce propos, la position géographique de la Syrie (au sens large), devient économiquement et politiquement plus importante. Cf. à ce propos: Margueron/Pfirsich 1996, pp. 164-166 et Margueron 2003, pp. 86-87.

13.- Pratiquement entre la Mésopotamie et la Méditerranée orientale.

14.- Pour l'ensemble des informations sur ces routes: cf. Dossin 1939, 1954 et 1970, Finet 1969, Durand 1987 et 2000.

15.- C'est pratiquement l'étendue de l'actuel Mohafazat (circonscription) de Homs.

16.- Nous voyons clairement, dans la Trouée de Homs, l'installation dès le milieu du III^e millénaire d'un réseau de sites pouvant assurer les étapes successives des caravanes, cf. à ce propos: Thalmann/Al-Maqdissi 1989.

royaumes. En effet, vers 1600 av. J.-C., le système semble s'être effondré à la suite de plusieurs actions militaires dirigées par des rois hittites et mitanniens qui sont intervenus dans les événements politiques et économiques de la région durant la deuxième moitié du II^e millénaire av. J.-C.

La période du Bronze Récent (1600-1200 av. J.-C.) nous apparaît comme une phase obscure pour l'histoire de la Syrie centrale. Les sources archéologiques nous donnent l'impression d'une évolution des formes politiques où des grandes puissances étrangères interviennent afin de contrôler les passages importants qui relient la Méditerranée orientale à la moyenne vallée de l'Oronte. En effet, les ambitions égyptiennes, hittites et mitanniennes se sont accrues à partir du milieu du II^e millénaire av. J.-C. A ce propos, nous pouvons citer la reprise de la politique d'intervention levantine par le pharaon Thoutmosis III à partir de 1469 av. J.-C., la politique active des hittites en Syrie du Nord sous le règne de Suppiluliuma I vers 1360 av. J.-C.¹⁷ et enfin l'action des rois mitanniens Tushratta et Hanigalbat en Syrie orientale¹⁸.

Nous supposons donc qu'une forte pression extérieure s'exerçait sur la Syrie. Les fouilles récentes de Mishrifeh-Qatna montrent clairement ce climat de tension¹⁹.

Cet épisode se termina par un affrontement militaire vers 1284 av. J.-C.²⁰, suivi d'un traité de paix hittito-égyptien conclu, vers 1270 av. J.-C., entre Hattusilli III et Ramsès II qui divise la Syrie en deux zones d'influences dont la limite se situe le long de la Trouée de Homs. Ce nouvel équilibre international aura plusieurs effets sur le terrain dont la correspondance de Tell el-Amarna²¹ qui illustre clairement cette situation notamment pour les villes comme Qatna (Mishrifeh), Sumur (Tell Kazel) dans la plaine du 'Akkar et Byblos (Jbeil) sur la côte libanaise²².

Cependant, un événement catastrophique au début du XII^e siècle av. J.-C. marque l'achèvement du *statu quo* hittito-égyptien. En effet, le passage des Peuples de la Mer va mettre fin à cette période et à son cadre politique par l'écroulement et la disparition des cités en Syrie côtière et intérieure²³.

ÂGE DU FER

Un siècle plus tard, les araméens, apparaissent au Proche-Orient. Ils quittent la région steppique pour s'installer dans une zone relativement large allant de la

Mésopotamie du nord jusqu'à la Syrie côtière. Au début de l'1^{er} millénaire av. J.-C., cette population se compose de plusieurs états politiques et commence à jouer un rôle de premier plan²⁴.

L'état araméen de Hama englobait presque toute la moyenne vallée de l'Oronte, de la région de Homs au sud presque jusqu'à la vallée d'al-Rouj au nord. La fouille de la citadelle de Hama nous renseigne sur la nature de la capitale²⁵ et les fouilles de Mishrifeh apportent des indications importantes sur l'organisation d'une ville secondaire.

Effectivement, les dégagements récemment réalisés à Mishrifeh ont permis d'affirmer que le site était occupé du IX^e jusqu'au VIII^e siècle av. J.-C. et que le bâtiment du niveau II/b fait partie d'un ensemble monumental araméen détruit par Sargon II vers 720 av. J.-C. au même moment que la ville de Hama²⁶.

Ainsi, l'installation progressive des araméens en Syrie occidentale et la montée des intérêts assyriens dans la moyenne vallée de l'Oronte va marquer la Syrie centrale pour plusieurs siècles.

Enfin, notons que l'analyse des données historiques, archéologiques et épigraphiques de la période hellénistique complétées par l'étude de la nature de l'occupation de l'Émèse prouve la présence d'une activité importante qui relie pratiquement les sites de l'Oronte avec la région agricole qui se trouve à la limite de la steppe. Il semble qu'Émèse, en tant que ville importante, n'ait pas existé avant l'époque romaine alors que des villes comme Arêthuse (Rastan) ou Hama, situées elles aussi sur les bords de l'Oronte, étaient déjà des cités hellénistiques importantes.

LIMITES GÉOGRAPHIQUES DE NOS RECHERCHES

Notre enquête se limite à la partie centrale de la Syrie qui occupe une position importante au milieu de plusieurs régions et unités politiques, dès le début de la Deuxième révolution urbaine (fig. 1). Il s'agit d'une zone limitée au nord par la dépression de Rastan et l'étroite vallée de l'Oronte au niveau de la ville de Hama.

A l'ouest, c'est le triangle du 'Akkar (pays d'Amurru) qui domine le passage vers la mer et les grands ports de la Méditerranée orientale (Jbeil-Byblos).

17.- À ce propos cf. Freu 1992; Archi 2002.

18.- Pour les Mitanniens, cf. récemment: Freu 2003.

19.- Cf. particulièrement: Al-Maqdissi *et al.* 2004.

20.- Bataille de Qadesh à l'emplacement de l'actuel Tell Nebi Mend. A ce propos, cf. Guidotti/Daddi 2002; Liverani 2002.

21.- Archives internationales trouvées en Égypte datant pour la plupart du règne du pharaon Amenhotep IV (1364-1347 av. J.-C.).

22.- Cf. à ce propos Morin 1987.

23.- Pour une présentation des Peuples de la Mer, cf. Sansars 1978.

24.- Cf. particulièrement Sader 1987.

25.- Cf. à ce propos Fugmann 1958.

26.- Cf. à ce propos Al-Maqdissi *et al.* 2004

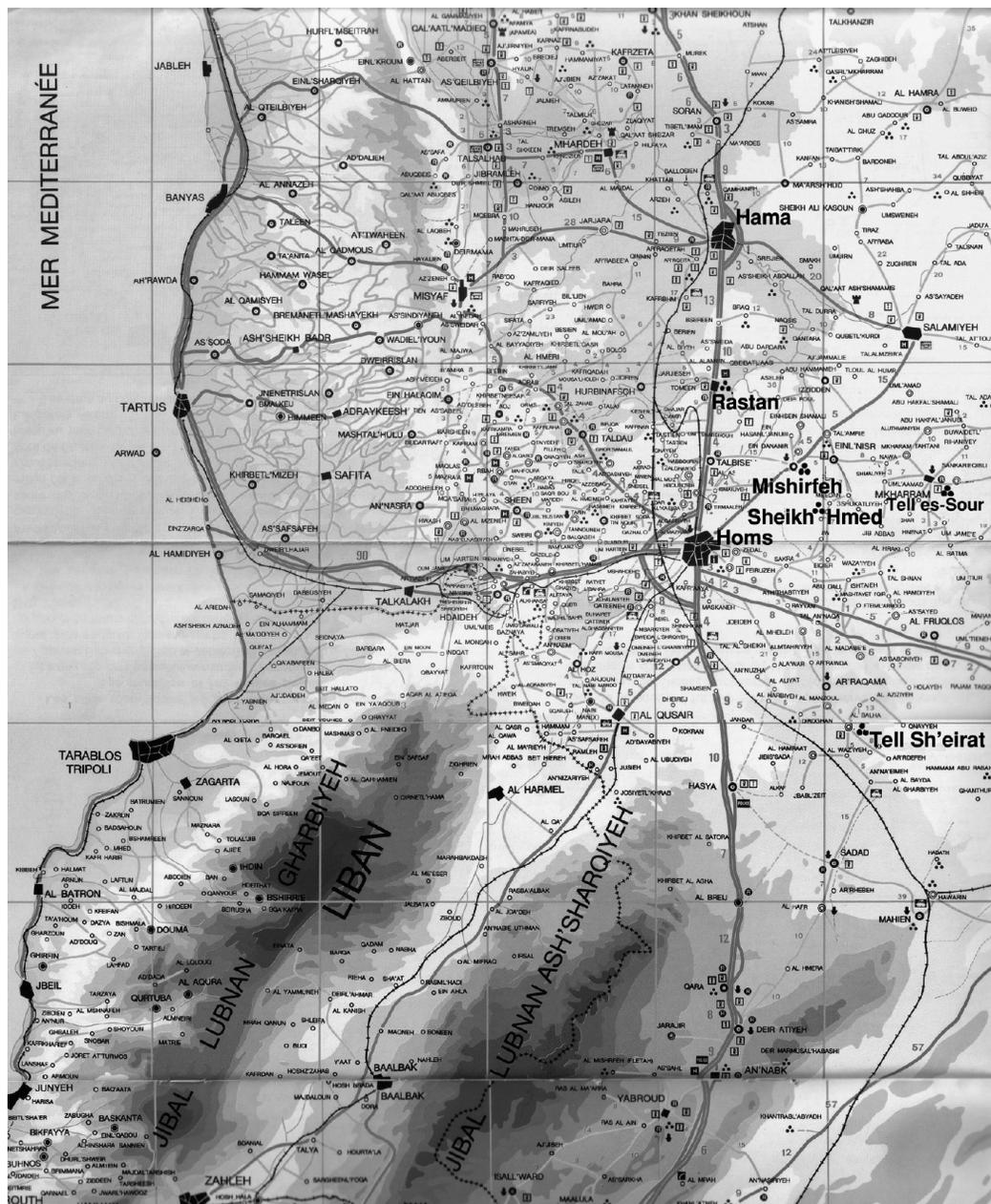


Figure 1. Carte générale de la Syrie Centrale avec les principaux sites.

Au sud, le plateau du Qalamoun, permet un passage relativement facile à travers deux chaînes montagneuses vers le pays d'Apum (actuelle Damas).

Enfin, la lisière occidentale de la steppe syrienne trace une limite géographique nette et sépare la région de Homs de plusieurs oasis (Palmyre et Qaryatein) occupés dès la haute antiquité. Les informations archéologiques et textuelles énumèrent plusieurs routes qui traversent la steppe vers la moyenne vallée de l'Euphrate.

27.- Pour une présentation d'ensemble cf. Dussaud 1927.

28.- Pour ces travaux cf.: Seyrig 1952, 1953 et 1959.

HISTORIQUE DES RECHERCHES ARCHÉOLOGIQUES²⁷

VILLE DE HOMS

La nécropole d'Émèse a été fouillée en 1936 par Henri Seyrig, l'Émir Djaafar el-Hussani et Daniel Schlumberger²⁸. Elle comporte vingt-deux tombeaux de l'époque classique caractérisés par un mobilier funéraire riche en particulier par un masque en or.

Les catacombes ont été mises au jour en 1957 par Adnan Bounni et Nessib Saliby²⁹. Cette découverte témoigne de l'occupation de la ville à l'époque byzantine. Elle offre aussi un intérêt exceptionnel par la présence de mosaïques, de fresques, et d'un important matériel archéologique.

Les fouilles de sauvetage de ces dernières années ont mis au jour, dans plusieurs quartiers de la ville, de nombreux hypogées et des édifices aux plans divers ainsi que nombreuses mosaïques et fresques³⁰.

Enfin, notons les fouilles menées dans la citadelle de la ville par une équipe syrienne³¹ et, depuis 1999, par une mission syro-anglaise. Les niveaux d'occupation englobent des phases de l'âge du Bronze et des phases importantes des époques classiques et arabo-islamiques.

MISHIRFEH-QATNA

Le site de Mishrifeh (ancienne Qatna) est un vaste site à 18,50 km au nord-est de la ville de Homs, fouillée par une mission française sous la direction du Comte Robert du Mesnil du Buisson durant quatre campagnes (1924, 1927-1929)³². Depuis 1994, une mission syrienne dirigée par Michel Al-Maqdissi a réalisé neuf campagnes³³, tandis que une mission conjointe syro-italo-allemande, sous la direction de Danièle Morandi-Bonacossi et Peter Pfälzner a terminé en 2003 sa cinquième mission³⁴. À partir de 2004, trois missions fouillent ce site : une mission syrienne dirigée par Michel Al-Maqdissi, une syro-italienne co-dirigée par Michel Al-Maqdissi et Danièle Morandi-Bonacossi et une mission syro-allemande co-dirigée par Michel Al-Maqdissi et Peter Pfälzner.

Les fouilles attestent une occupation qui remonte au milieu du Bronze Ancien. Nous pouvons distinguer quatre grandes phases d'urbanisation datées respectivement du Bronze Ancien III-IV, du Bronze Moyen, du Bronze Récent et du Fer II.

TELL NEBI MEND-QADESH

Tell Nebi Mend est situé sur la rive droite de l'Oronte dans une position centrale entre la vallée de la Beka' au sud, la trouée de Homs à l'Ouest et la moyenne vallée de l'Oronte au nord et au nord-est.

Le site est composé d'un grand tell central entouré au sud et à l'ouest d'une série de structures de l'époque classique.

Il fut fouillé successivement par des missions française en 1921 et 1922³⁵, syrienne en 1950 et anglaise à partir de 1975 sous la direction de Peter Parr³⁶.

Les niveaux d'occupation mise à jour couvrent une longue séquence stratigraphique allant de la fin du quatrième millénaire jusqu'à l'époque byzantine.

RASTAN

Les travaux de fouilles effectués sous la direction de Michel Al-Maqdissi et de Massoud Badawi en 2000 et 2001 sur le versant méridional du tell antique apportent des indications sur les occupations datées du IV^e et du III^e millénaire av. J.-C.

Notons que la ville classique (Arèthuse) révèle toujours des éléments importants. À ce propos, nous signalons la présence de plusieurs sarcophages trouvés récemment dans sa nécropole³⁷.

PROSPECTION DE LA RÉGION DU TELL NEBI MEND

La mission anglaise de Tell Nebi Mend réalise durant ses travaux de fouilles, une prospection dans la région, avec le but de reconstituer la nature de la plaine, en relation avec les résultats issus des séquences stratigraphiques du site.

Cette prospection a permis de localiser et de fouiller le site néolithique d'Arjouné qui se trouve à quelques kilomètres au nord-est de Tell Nebi Mend³⁸.

PROSPECTION DE LA RÉGION À L'OUEST DE HOMS³⁹

Depuis 1999, une mission syro-anglaise sous la direction de Mamoun Abdulkarim et Graham Philip, prospecte la région située à l'ouest de Homs⁴⁰ dans le but d'étudier le développement de la nature de l'occupation de plusieurs microrégions.

Les résultats montrent la présence de plusieurs phases d'occupation datées du Néolithique, du Bronze Ancien, du Bronze Moyen et de l'Époque Classique.

29.- Pour ces travaux cf. Bounni/Saliby 1961 et Bounni 1970.

30.- Pour ce monument religieux cf. Saliby/Griesheimer 1999.

31.- Pour ces travaux cf. Mousli 1984.

32.- Pour les travaux de la mission française cf. Du Mesnil du Buisson 1935.

33.- Pour les travaux de la mission syrienne cf. Al-Maqdissi 1996.

34.- Pour les travaux de la mission conjointe cf. Al-Maqdissi *et al.* 2004.

35.- Pour les travaux de la mission française cf. Pézard 1931 Dussaud 1921-1922.

36.- Pour les travaux de la mission anglaise cf. Parr 1983 et 1998.

37.- Cf. à ce propos Chéhadé 1982 et Gatier 1997-1998.

38.- Cf. la publication définitive Parr 2003.

39.- Pour les premiers travaux, cf. Gautier 1895.

40.- Cf. à ce propos Philip, Jabour *et al.* 2002.



Figure 2. Mishirfeh 2006, chantier R, séquence stratigraphique de la deuxième moitié du III^e millénaire av. J.-C.

L'analyse préliminaire des données récoltées révèle l'existence d'une cadastration romaine conservée sur plusieurs centaines de mètres. Nous pouvons aussi confirmer la présence de monuments religieux (sanctuaires et temples) de caractère villageois dont la datation pourrait remonter aux époques préclassiques⁴¹.

Notons de plus les travaux de fouilles de sauvetages réalisés par le Service des Antiquités de Homs, sous la direction de Majed Moussly, à Tell Et-Tin, à Tell al-Wawiyah⁴² et à Tell Sefinaf Nouh⁴³.

Ajoutons pour terminer le projet de prospection de la région d'al-Bouquei'a réalisé à partir de 2005 par une

mission syro-libano-espagnole sous la direction conjointe de Michel Al-Maqdissi, Maya Boustani et Juan José Ibáñez.

PROSPECTION DE LA RÉGION DE MISHIRFEH-QATNA

Les prospections réalisées au cours des fouilles de Mishirfeh-Qatna autour du site, sous la direction de Michel Al-Maqdissi, offrent des informations utiles pour la compréhension de l'organisation de la région et surtout pour la nature du rapport entre un grand centre urbain et ses sites satellites.

41.- Vraisemblablement de l'Âge du Bronze.

42.- Pour ces travaux cf. Mousli 1981-1982.

43.- Pour ces travaux cf. Mousli 1986-1987.



Figure 3. Mishrifeh 2007, complexe palatial du II^e millénaire av. J.-C.

Les périodes d'occupation s'échelonnent du Bronze Ancien III-IV, Bronze Moyen, Bronze Récent au Fer II-III.

QATNA ET SA RÉGION: TOPOGRAPHIE ET ORGANISATION TERRITORIALE

QATNA ET SES PHASES DU DÉVELOPPEMENT URBAIN

Les fouilles ponctuelles réalisées dans différents chantiers de la ville haute (chantiers K et R) ont apporté une documentation importante indiquant que le premier niveau posé sur le sol vierge date du milieu du III^e millénaire. Ces résultats associés aux prospections menées dans différentes zones du site et à l'étude des photographies satellitaires ont permis de conclure que la ville du III^e millénaire prend une forme circulaire de 30 hectares environ. Elle est située exactement à l'emplacement de l'actuelle ville haute (Fig. 2).

La deuxième phase commence avec le début du II^e millénaire. À cette période, nous assistons à une refondation du site en son plan actuel et la superficie atteint désormais plus de 100 hectares. Par ailleurs, la forme change radicalement passant du circulaire au carré. Nous ignorons complètement l'organisation urbaine de cette phase mais les quelques indices issus des fouilles nous laissent imaginer la présence de monuments importants au sommet de la ville haute (chantier T) entourés vraisemblablement de plusieurs quartiers d'architectures domestiques dans la ville basse (chantiers U et V). Quatre portes aménagées, en

position médiane, dans les murailles permettaient un accès direct à la ville basse (chantiers E et F).

Cette situation demeure la même au Bronze Récent. La fouille a également livré une documentation importante pour la deuxième moitié du II^e millénaire. Nous pouvons ainsi affirmer que la ville du Bronze Récent est caractérisée par la présence d'un palais royal dans la partie nord de la ville haute entouré de plusieurs monuments palatiaux au sud (chantier C), à l'est (chantier T) et au nord (chantier K) (Fig. 3). Par ailleurs, nous pouvons confirmer que la ville basse était occupée par plusieurs quartiers d'habitations caractérisés par une architecture domestique variée (chantiers A-B, U). Sur le versant occidental de la coupole de Loth, nous attestons la présence d'un quartier riche composé de plusieurs structures domestiques juxtaposées (chantier Q).

Nous ignorons complètement la date de destruction de la ville du Bronze Récent mais nous suggérons que plusieurs étapes ont marqué la fin de l'occupation.

La phase suivante correspond à un *hiatus* de plusieurs centaines d'années. Nous ne possédons à ce jour aucun document archéologique datant du Fer I.

Vers le IX^e siècle av. J.-C., l'occupation redevient intensive. En effet, nous assistons à un développement urbain conséquent caractérisé par une organisation de la ville très proche, dans sa conception, de celle du II^e millénaire avec un complexe palatial sur le versant occidental de la ville haute (chantier C) entouré de plusieurs structures diverses: domestiques (chantier R), artisanales (chantier O) et autres. De même, nous pouvons confirmer la mise en place d'un système de fortification et surtout de la reconstruction de la porte

occidentale selon un plan tout à fait nouveau. Cette ville prend fin vers 720 avant J.-C. à la suite des campagnes militaires de Sargon II qui a placé cette région définitivement sous la domination néo-assyrienne. Ensuite, l'occupation a diminué considérablement. La fouille a révélé quelques petites structures domestiques (chantier C), datées du Fer III, principalement au sommet de la ville haute.

En revanche, le site est complètement vide durant la période classique, l'occupation s'est déplacée à l'extérieur sous une forme réduite et de caractère clairement différent.

LES TRAVAUX DANS LA RÉGION ENVIRONNANTE

Les campagnes de prospections menées autour du site de Mishirfeh durant trois années successives se sont avérées très concluantes pour la compréhension des différentes phases d'occupation des sites satellites. Nous pouvons résumer les résultats ci-dessous :

- L'installation commence généralement au IV^{ème} millénaire avec de petits sites très limités situés en bordure des wadis. Nous ignorons précisément leur nature mais il s'agit probablement des sites à caractère agricole en relation à un grand centre qui devrait se trouver dans la vallée de l'Oronte.
- La situation change au milieu du III^{ème} millénaire et vers la fin du Bronze Ancien III, nous assistons à une réorganisation générale de la région avec plusieurs

types de sites. Cependant, la forme circulaire domine dans les principales agglomérations comme à Tell Sh'eirat (Fig. 4), Mishirfeh et es-Sour/Sinkari. Cette organisation se développera durant toute la deuxième moitié du III^{ème} millénaire. Nous pouvons également attester la présence de plusieurs nécropoles composées de tombes à puits creusées dans la roche. Nous ignorons malheureusement la fin de l'occupation de l'ensemble de ces sites en raison du manque de documents fiables concernant la fin du III^{ème} millénaire.

- Au début du II^{ème} millénaire, apparaît un changement complet. Ce sont probablement des mouvements massifs de nouvelles populations qui ont fondé des villes ou occupé des sites préexistants. La forme des sites change alors radicalement en passant au système rectangulaire. Nous avons eu la chance de voir ce phénomène à Mishirfeh (Fig. 5) et récemment sur le site de Tell es-Sour/Sinkari (Fig. 6) où nous assistons clairement au passage d'une forme à l'autre. Dans ce dernier cas, le système circulaire fait partie, comme à Mishirfeh, de l'organisation des sites au II^{ème} millénaire. Ces sites ont été ensuite occupés durant tout le II^{ème} millénaire alors que nous remarquons un vide de l'occupation marquant la fin du Bronze Récent. Nous ne connaissons pas les causes de cet abandon mais nous pensons qu'il serait lié à des changements politico-économiques qui frappèrent Mishirfeh et l'ensemble de la région lors des Guerres Syriennes de Suppiluliuma et durant le conflit opposant les égyptiens à l'empire Hittite.



Figure 4. Tell Sh'eirat 2006, vue aérienne du site circulaire qui date de la deuxième moitié du III^{ème} millénaire av. J.-C.



Figure 5. Mishirfeh 2007, vue aérienne du site carré qui date du II^e millénaire av. J.-C



Figure 6. Tell es-Sour 2007, vue aérienne du site circulaire qui date de la deuxième moitié du III^e millénaire av. J.-C. et du site carré qui date du II^e millénaire av. J.-C.

- La phase suivante qui marque la période du Fer I et le début de l'1^{er} millénaire nous échappe. Nous constatons que cette période existe uniquement dans les sites de la vallée de l'Oronte, contrairement à ceux situés dans la lisière occidentale de la steppe, autour de Mishirfeh.
- La situation évolue au Fer II avec une réoccupation massive durant la période arménienne caractérisée par l'installation de nouvelles agglomérations à l'emplacement des sites des II^e et III^e millénaires. Ce phénomène durera jusqu'à la fin du Fer III. Nous pouvons d'ailleurs signaler que de grandes modifications de la

nature de l'occupation auront lieu après 720 av. J.-C. et que plusieurs sites seront abandonnés à cause des invasions de Sargon II. De manière générale, l'occupation fut radicalement modifiée à l'époque hellénistique.

- Durant la période classique, la grande majorité des sites occupés pendant plusieurs millénaires a été abandonnée pour de petites agglomérations de caractère agricole éparpillées et articulées, pour la période byzantine, autour d'un monument religieux englobant plusieurs maisons, une petite nécropole et des ateliers en relation avec des pressoirs et des installations généralement de fonction agricole.

Nous présentons dans le tableau ci-dessous la distribution chronologique des sites prospectés jusqu'à la fin de la campagne de 2007:

Pourcentage	Sites	Période
1,2 %	1	Paléolithique
4,7 %	4	Pré-Bronze
57,1 %	48	Bronze
42,8 %	36	Fer
28,5 %	24	Hellénistique
38 %	32	Romano-byzantine
14,2 %	12	Mamelouk
15,4 %	13	Ottoman

Par contre, les fouilles ponctuelles menés sur les deux sites de Rastan, sur l'Oronte, et de Tell Sh'eirat, à la lisière occidentale de la steppe, ont apporté des informations concernant la nature de l'installation de chaque région. Effectivement, nous remarquons que les phases d'occupation de la région située autour de Mishirfeh débutent au milieu du III^e millénaire et disparaissent totalement après 720 avant J.-C. En revanche, la vallée de l'Oronte, par sa position stratégique et par la présence des ressources hydrauliques et agricoles, présente un schéma différent. En réalité, l'occupation est nettement plus ancienne et remonte parfois à l'époque néolithique. Les fouilles de Rastan témoignent d'une architecture imposante au IV^e millénaire et l'occupation continuera sans grande interruption jusqu'à la période classique. Les fouilles menées par les collègues anglais au sud-est de Homs apportent la documentation la plus complète.

Afin d'expliquer ce phénomène, nous suggérons que la ville de Mishirfeh et sa région s'est développé durant des périodes de stabilité politique et durant les grandes périodes d'occupation de la Syrie occidentale.

CONCLUSION

Le principal résultat de l'ensemble des travaux réalisés en Syrie centrale et dans la moyenne vallée de l'Oronte

concernant l'étude des relations de l'homme avec son environnement nous paraît être la mise en évidence de l'apparition d'un changement au niveau de la nature de l'occupation au Bronze ancien III (vers 2700 ou 2600 av. J.-C.). En effet, à cette période nous assistons à une transformation du niveau de l'intervention de l'homme sur plusieurs régions et l'apparition d'une nouvelle forme d'organisation territoriale afin de répondre à plusieurs demandes en relation directe avec la deuxième révolution urbaine qui doit marquer l'ensemble du Proche-Orient ancien à cette période. La mise en valeur de l'ensemble des régions étudiées s'effectue à partir d'une forme urbaine avec la création d'un système hiérarchisé de sites afin de répondre à des besoins que nous pouvons présenter selon les deux points suivants:

- Organisation des axes de communication contrôlés par des sites clés afin d'assurer les échanges à courte ou à longue distance et la circulation des caravanes.
- Mise en valeur agricole de l'ensemble des surfaces disponibles par des travaux importants de drainage et d'irrigation afin de répondre à des besoins en augmentation.

Cette situation perdure pendant un millénaire, c'est-à-dire jusqu'au milieu du deuxième millénaire av. J.-C. Le Bronze récent (1600-1200 av. J.-C.) doit apporter une transformation profonde des structures urbaines, un affaiblissement du tissu urbain et même une transformation de la nature de l'occupation car la Syrie Centrale devient une région frontalière, une zone de conquête et de rivalité entre les égyptiens et les hittites qui va être achevée par la bataille de Qadesh (dans la région de Tell Nebi Mend) vers 1250 av. J.-C.

Un siècle plus tard, au moment des invasions des 'Peuples de la Mer', toute la région perdra son organisation, jusqu'à la disparition même de l'ensemble des grands sites pour céder la place à des petites agglomérations dispersées sans aucune statut urbaine. L'ensemble des résultats présentés dans cette note indique que le début de l'installation humaine à Mishirfeh et dans cette région est lié principalement, au milieu du III^e millénaire, à la deuxième révolution urbaine. L'ensemble de cette région s'organise à cette période et suivra les événements qui marqueront l'histoire de la Syrie occidentale avec des périodes d'abandon durant le Fer I et ou des périodes secondaires à la fin de l'Âge du Fer. Ce phénomène changea radicalement à la période classique en raison du passage d'Alexandre le Grand dans les villes d'Arêthuse et Émèse qui contrôlèrent alors la Syrie centrale. Ainsi, l'Oronte a tenu un rôle important alors que la région de Mishirfeh est devenue une région secondaire et agricole dirigée par le pouvoir central d'Arêthuse à l'époque hellénistique et celui d'Émèse à la période romano-byzantine.

14. L'ÉVOLUTION DE LA MOYENNE VALLÉE DE L'ORONTE DURANT L'ÉPOQUE ROMAINE

Maamoun Abdulkarim*

INTRODUCTION

L'Oronte constitue un axe remarquable tant par sa propre morphologie que par la place particulièrement importante que ce fleuve permanent occupe dans l'hydrographie et l'économie syrienne. Il n'est donc pas surprenant que, dès les temps les plus reculés, l'ensemble de sa vallée ait constitué un intérêt majeur pour les populations qui y vivaient, notamment dans l'Antiquité et que de nombreuses descriptions locales relatives à son développement, accompagnées parfois de narrations légendaires, aient pu être ainsi transmises au cours des temps historiques. Une partie de nos recherches étant centrée sur l'analyse des contextes environnementaux naturels qui ont pu favoriser le développement ou le choix de certains sites antiques datés de la période romano-byzantine, nous avons été amenés à confronter nos observations, ainsi que les déductions qui en résultaient, avec celles formulées dans les travaux historiques qui pouvaient constituer, soit une validation de nos travaux, soit nous éclairer sur des points litigieux, peu accessibles aux observations actuelles.

Au cours de cette analyse, nous aborderons successivement l'aspect dynamique de l'évolution paléogéographique de la vallée de l'Oronte, puis une analyse des conditions d'évolution de certains sites historiques situés sur son parcours (notamment celles de Homs, de la région du lac de Qattiné et celles de la zone d'Apamée, au sein de la dépression du Ghab) (Figure 1).

L'ÉVOLUTION MORPHOLOGIQUE DE LA VALLÉE DE L'ORONTE

L'observation actuelle de la morphologie de l'ensemble de la vallée de l'Oronte, montre que le lit de ce fleuve

est constitué, en très grande partie, par une succession de multiples méandres qui sont formés au sein de toutes les unités stratigraphiques sur lesquelles il s'écoule. Or, il est courant de caractériser le profil d'un fleuve par trois états successifs, relatifs à sa pente et à l'état dynamique de son débit. Le premier est le stade dit de "jeunesse". Il est caractéristique de la vallée supérieure d'un cours d'eau où, depuis sa source, il s'écoule rapidement et creuse son lit. Le second est qualifié de stade de "maturité" et correspond à la partie du lit où la pente est encore suffisamment forte pour provoquer un écoulement capable d'assurer l'évacuation des charges solides transportées dans une vallée souvent large et relativement rectiligne. Le troisième est le stade "de sénilité". C'est le domaine de la basse vallée, où les eaux sont tout au plus capables de s'écouler vers son estuaire (niveau de base du profil), sans exercer aucune action d'ablation ni de transport. C'est aussi le domaine caractéristique des méandres qui serpentent dans la pénélaine estuarienne (Abdulkarim et al. 2004, 5-17). Si on applique ce schéma à l'aspect morphologique actuel de la vallée de l'Oronte, il est notable qu'elle ne présente qu'un stade de jeunesse réduit entre ses sources, situées à des altitudes assez élevées (aux environs de 900 à 1000m, dans le secteur El Laboué, vallée de la Beqaa) et le début de la grande plaine située au sud du lac de Homs, qui s'étend jusqu'au pied du Liban et de l'Anti-Liban et d'altitude moyenne de 550 à 600 m (Abdulkarim et al. 2004, 7).

Ensuite, tout son parcours est constitué de méandres, en amont et en aval de Homs, puis de Homs à Rastan, Hama et jusqu'à Cheizar, où son caractère sinueux est constant. Il en est de même pour son trajet naturel dans la plaine d'Acharné puis dans le Ghab et jusqu'à son embouchure. Le cours de l'Oronte présente donc, sur la majorité de son trajet, un caractère de sénilité, peu compatible avec le relief actuel de son lit et sur une aussi grande distance. Il faut donc admettre que la

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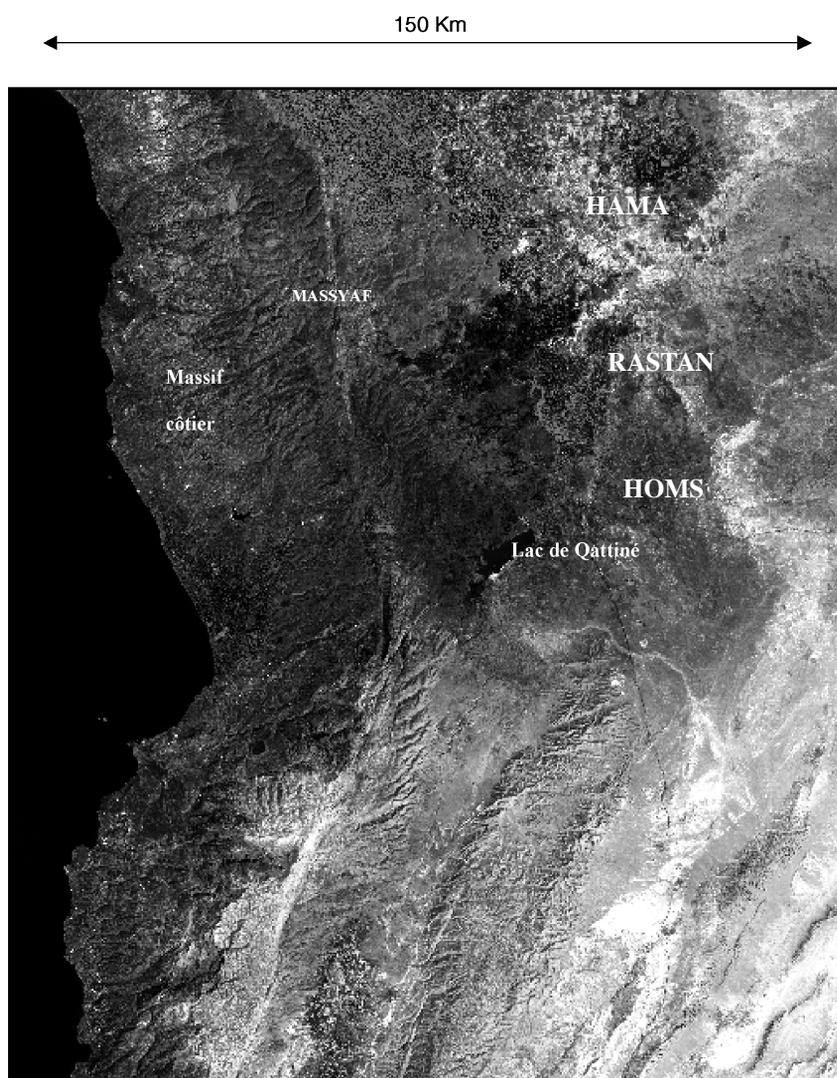


Figure 1. Composition des canaux 1,4,et 5 de la donnée Landsat T.M. image du 10 septembre 1997. Tracé du cours de l'Oronte, depuis Acharné vers la plaine de Ghab jusqu'à ses sources au Liban.

formation de ce fleuve est beaucoup plus complexe qu'il n'y paraît et nous proposons un schéma de son évolution qui nous paraît plus apte à expliquer ses caractères actuels et les aléas de son histoire.

En effet, dans une première étape, la naissance du fleuve a pu s'effectuer dès la fin de l'ère tertiaire (Pliocène ?), au niveau de ses sources actuelles dans la Beqaa. Cette "gouttière" tectonique était déjà organisée et dirigée vers le nord-nord-est, en direction des zones de plaines lacustres et marécageuses formées au Pontien.

Les systèmes karstiques alimentant les sources pouvaient déjà fournir de grandes quantités d'eau qui s'écoulèrent vers les dépressions formées par ces lacs et marais (qui avaient parallèlement tendance à s'assécher en raison du soulèvement continu de l'ensemble de la plaque arabique), déterminant ainsi, très précocement, le caractère sinueux du cours d'eau

qui, rappelons-le, ne pouvait s'écouler que sur la bordure de cette plaque exondée, donc sur les affleurements de calcaires, de craies et des formations de calcaires lacustres qui en forment le substratum, notamment dans la région comprise entre Rastan, Hama et Cheizar (Abdulkarim et al. 2004, 8-10).

A ce stade, comme le fait remarquer J.Weulersse (Weulersse 1940), le fleuve tente de constituer une vallée aux flancs adoucis et se dirige vers les régions désertiques du N.E. de la région où il aurait pu se perdre. Cependant, la deuxième étape de l'évolution du cours de l'Oronte va débiter avec le développement des systèmes de failles "en doigts de gant" et la lente formation des fossés d'effondrement qui en résultent. Le début de la formation de la plaine d'Acharné et du Ghab va modifier la direction d'écoulement de ses eaux qui vont se diriger vers ces zones de plus basse

altitude. C'est au cours de ce lent effondrement que les phénomènes de *surimposition* du cours de l'Oronte vont se produire, en particulier dans les craies et les calcaires situés entre Rastan et Cheizar. Ainsi se forment les gorges profondes que nous observons encore de nos jours, mais qui ont cependant conservé le caractère très sinueux du réseau primitif, par le surcreusement, sur place, de l'ancien lit du fleuve, afin qu'il adapte son profil d'équilibre en fonction de la profondeur du Ghab. Pour compléter ce bref aperçu des paramètres pouvant justifier les caractéristiques particulières de l'Oronte, il faut aussi souligner le rôle perturbateur que vont jouer les coulées basaltiques contemporaines de la tectonique tertiaire et quaternaire dont on vient d'analyser les effets. Ces coulées vont atteindre et modifier le cours du fleuve en plusieurs lieux.

D'abord, à sa sortie de la vallée de la Beqaa, au niveau des villes de Joussiyé, Qoussaïr et Aïn Tannour, qui limitent un périmètre constitué par des couches basaltiques de faible épaisseur, issues de coulées du volcanisme centré sur la faille décrochante majeure situé au N.O. de cette zone.

Ensuite, dans toute la région de Homs puis de Rastan, où le cours de l'Oronte présente, comme dans le périmètre défini précédemment, un caractère diffus au niveau de son contact avec ces coulées, qui, comme nous le verrons, a pu constituer le cadre de problèmes historiques.

Enfin, plus vers le Nord, où ces coulées récentes ont pu modifier le profil d'équilibre du fleuve, en constituant des barrages naturels que ce dernier devait franchir. On retombe alors sur les excellentes analyses fournies par J. Weulersse, mais qu'il nous soit permis de compléter sa définition de l'Oronte, en précisant: "l'Oronte est une création de la tectonique; ici elle a constamment participé à la modification de sa vallée" (Weulersse 1940, 50).

L'APPORT DES OBSERVATIONS DE STRABON DANS L'ANALYSE HISTORIQUE DE L'ORIGINE DE QUELQUES SITES ANTIQUES DE LA VALLÉE DE L'ORONTE

Les travaux de Strabon, concernant les observations à caractère géographique qu'il livre à propos du territoire syrien, sont essentiellement consignés dans le chapitre II, du livre XVI de sa "Géographie".

Bien que, dès le début de ce chapitre, il prenne soin de nous expliquer sa conception de la constitution du pays (Chapitre II, 2: "*Voici maintenant comment nous divisons la Syrie à partir de la Cilicie et de l'Amanus: 1° la Commagène; 2° la Séleucide dite de Syrie; 3° la Coélé-Syrie; 4° une dernière division comprenant une partie maritime qui est la Phénicie et une partie intérieure qui*

est la Judée"), il apparaît clairement à la lecture de son ouvrage que les "divisions" qu'il a sans doute réellement parcourues et géographiquement analysées, se résument à la Séleucide (intérieure et côtière) et, plus partiellement, à la Coélé-Syrie. Le territoire le mieux analysé correspond alors à l'Antiochène (Séleucis et Pierie) et surtout à l'Apamène, au Casiotis et au Laodicène, mais qui ne sont pas cités en tant que tels, par Strabon.

Quoi qu'il en soit, ces unités territoriales correspondent essentiellement à l'ensemble de la vallée de l'Oronte et de ses bordures qui font l'objet de notre analyse, et c'est la raison pour laquelle nous avons souhaité comprendre et contrôler les indications que Strabon pouvait nous fournir pour compléter notre connaissance de leur évolution géographique et historique.

En dépit de l'énorme erreur concernant l'orientation des chaînes du Liban et de l'Anti-Liban et de son implication dans la localisation des zones correspondant à la haute vallée de l'Oronte, de la Coélé-Syrie, ainsi que de celle des limites territoriales orientales de la "Séleucide", plusieurs points positifs semblent pouvoir être retenus (Abdulkarim et al. 2004, 10-11).

En premier lieu, les descriptions locales sont généralement honnêtes et reflètent exactement les observations qu'on peut y effectuer de nos jours. C'est la raison pour laquelle les observations divergentes qu'il est également possible de mettre en évidence actuellement en un lieu précis, présentent, à nos yeux, un fort intérêt historique (cas de l'absence totale de la description du lac de Qattiné, descriptions de la présence de grands lacs dans le fossé du Ghab, par exemple) (Figure 2).

En second lieu, l'organisation de la rédaction même du texte, bien que parfois peu logique, paraît sincère et nous permet aussi de mieux comprendre la relativité des méthodes de raisonnement analytique du territoire qui régnait à cette époque, ce qui peut expliquer certaines lacunes, par exemple: la crainte systématique de l'action du brigandage et le danger qu'il représente pour étudier certains secteurs ou, plus brutalement, le peu d'intérêt présenté par certains autres, fréquentés par des peuplades ne possédant pas (ou étant réputées ne pas posséder) un degré de "civilisation" suffisant, pour justifier leur étude.

LA MOYENNE VALLÉE DE L'ORONTE DEPUIS HOMS JUSQU'À APAMÉE ET LA DEPRESSION DU GHAB

Bien que n'ayant probablement pas observé la haute vallée de l'Oronte, Strabon a parcouru suffisamment le cours du fleuve vers le sud pour pouvoir décrire la présence du lac de Qattiné, *si ce dernier avait alors existé*. Or, il n'en dit mot et c'est la raison pour laquelle il est pertinent de penser que la création de ce lac, à l'aide

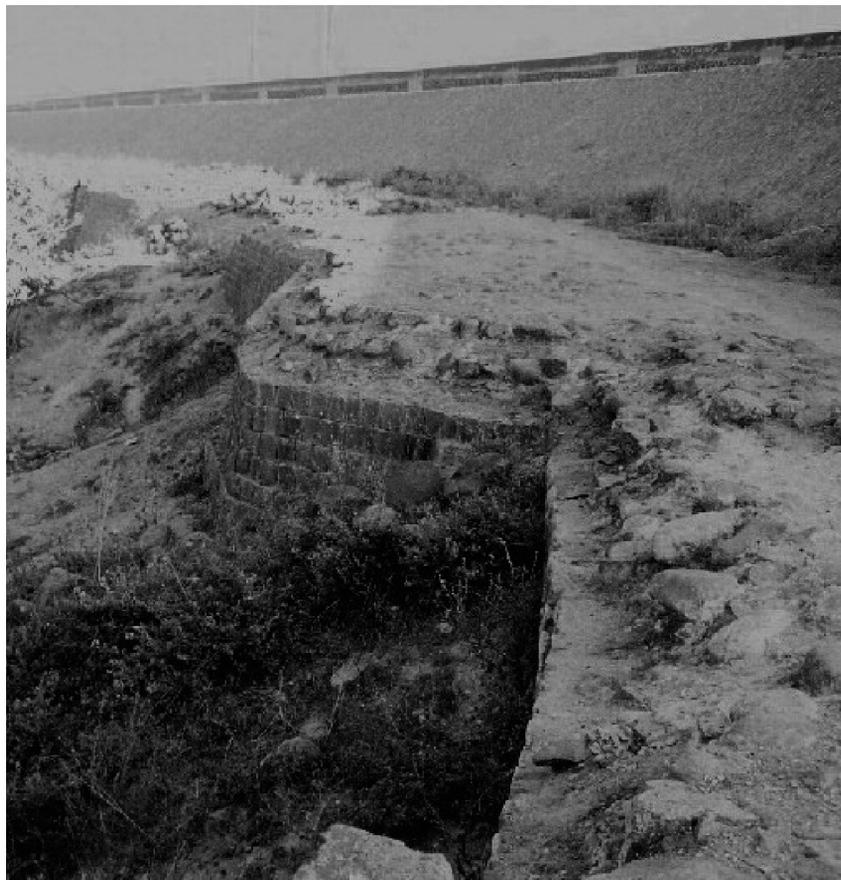


Figure 2. Aspect du barrage antique et en arrière plan, le nouveau barrage.

d'un barrage, est postérieure à l'époque où Strabon a réalisé son périple syrien, et surtout à l'époque de la parution de son ouvrage, dont l'hypothèse la plus probable propose son écriture et sa publication vers 7 av.J.C. Puis une reprise et une révision vers 18 ap. J.C. Pour ce qui concerne les sites de refondation hellénistiques, comme Aréthuse, Epiphanie ou Larisa, Strabon ne nous fournit pas de renseignements précis susceptibles d'apporter des visions plus complètes de leur environnement géographique. Il rattache ces sites à des problèmes plus politiques et historiques, car il semble considérer, de plus, qu'ils ne constituent que des localités "tributaires d'Apamée", ville qu'il estime être le centre le plus important "ne présentant que des avantages". Cette conception lui permet donc de nous fournir de nombreux détails sur l'aspect du paysage au sein duquel se situe Apamée, et pour nous, sur l'aspect de la vallée de l'Oronte, dans la dépression du Ghab. Le canton d'Apamée, décrit Strabon, "contient une ville (de même nom), qui, à en juger par les défenses naturelles qu'elle présente sur presque tous les points, paraît être aussi une forteresse imprenable. Qu'on se figure en effet une colline abruptes s'élevant du milieu

d'une plaine très basse, et qui, ceinte déjà de très belles et de très fortes murailles, se trouve protégée en outre et convertie en une véritable presqu'île par le cours de l'Oronte et par un immense lac dont les débordements forment des marécages et des prairies à perte de vue où paissent en foule les chevaux et les bœufs Mais ce n'est pas là l'unique avantage d'Apamée: cette ville, qu'appelle quelquefois aussi Chersonesus à cause de sa configuration même, possède un territoire à la fois très étendu et très fertile, traversé par l'Oronte et où sont répandus de très nombreux villages qui forment en quelque sorte sa banlieue" (Strabon, XVI, II, 10).

Il ajoute: "que Séleucus Nicator et tous les rois ses successeurs l'avaient choisie pour y loger leurs cinq cents éléphants et la plus grande partie de son armée. et qu'enfin elle se trouvait posséder encore les bureaux de recensement de l'armée, les haras royaux, c'est à dire plus de 30 000 juments avec 300 étalons au moins, et tout un monde de dresseurs de chevaux, de maîtres d'armes et d'instructeurs experts dans tous les exercices militaires, nourris et entretenus à grands frais".



Figure 3. Vue générale de la position d'Apamée prise depuis le flanc occidental du Ghab. A l'horizon, terminaison du massif du Zawiyé vers la plaine d'Acharné. Apamée peut apparaître comme une "presqu'île" dominant la vaste dépression recouverte d'eau à l'époque de Strabon.

Cette description de la ville correspond parfaitement à celle que l'on retrouve de nos jours sous le nom de Qalaat el Moudiq, associée au site des ruines d'Apamée, bien que "l'immense lac" ne soit plus réduit de nos jours qu'à la présence de quelques bassins de pisciculture alimentés par des biefs reliés au système de canalisation de l'Oronte, destiné précisément à assainir et rendre cultivable l'immense dépression marécageuse du Ghab (Figure 3-4).

Cette description du Ghab, alors constitué d'une succession de lacs, sans doute peu profonds, mais de grande étendue, est aussi confirmée par la suite du texte de Strabon qui nous indique notamment le rôle prédominant d'Apamée par rapport aux villes voisines. Il cite notamment que, voulant s'emparer du trône de Syrie, Tryphon dit Diodote "leva l'étendard de la révolte depuis Apamée et des villes qui l'entourent, à savoir de Larisa, Casiana, Mégara, d'Appolinie et autres localités semblables, toutes tributaires d'Apamée" puis qu'en suite, Caecilius Bassus "entraîna Apamée dans son insurrectioncar il avait pu recruter aisément de nombreux auxiliaires en s'adressant aux phylarques des environs tous maître d'inexpugnables positions, au phylarque de Lysias par exemple (Lysias est ce château qui domine le lac d'Apamée)" (Strabon, XVI, II, 10).

On retrouve aujourd'hui les traces de cette forteresse, à Qalaat El Marza, placée sur le sommet d'un piton rocheux formant un à pic sur le Ghab, lui conférant bien le qualificatif "d'inexpugnable position" et permettant de situer l'étendue du lac d'Apamée.

Pour parvenir dans le fossé du Ghab, il est probable que Strabon ait pu cheminer depuis Laodicée vers la vallée de l'Oronte, en empruntant un parcours sensiblement proche du tracé actuel de l'autoroute reliant Lattaquié à Djisr Ech Chougour car la description qu'il nous livre de cette traversée de la partie la plus accessible du Massif côtier est très réaliste:

"Laodicée à laquelle nous arrivons maintenant est une ville maritime magnifiquement bâtie, et qui à l'avantage de posséder un excellent port joint à celui d'avoir un territoire d'une extrême fertilité, mais particulièrement riche en vignes, ce qui lui permet de fournir à la population d'Alexandrie la plus grande partie du vin qu'elle consomme. Signalons notamment au dessus de la ville une montagne plantée de vignes presque jusqu'à son sommet, lequel se trouve fort éloigné des murs de Laodicée, la montagne s'élevant de ce côté graduellement et par une pente très douce, tandis qu'elle surplombe Apamée et forme au dessus de cette ville comme une muraille à pic" (Strabon, XVI, II, 9).

Elle correspond, en effet, à la réalité géomorphologique du flanc occidental du massif côtier qui, notamment au niveau de Lattaquié, est formé de couches calcaires comprenant aussi des intercalations de couches argilo marneuses, donc très favorables à la formation d'un terroir propice à la viticulture et dont la faible inclinaison permet l'organisation de "planches" bien orientées pour la culture de la vigne. De plus, la brusque et très importante retombée de son flanc oriental, due au grand accident tectonique qui a présidé à la formation du



Figure 4. Haut, vue de Qalaat el Moudiq (2) et d'un lac de source au pied de la ville (in Weulersse 1940) – Bas, aspect actuel de Qalaat el Moudiq (Apamée).

fossé d'effondrement du Ghab, a permis la construction d'une série de forteresses et notamment celle de Lysias, dont la position "perchée" leur conférait donc une réputation d'invincibilité certaine, et dont l'accès était rendu encore plus difficile grâce à la présence des marais et des lacs décrits par Strabon.

On notera enfin que les observations relatives à la bordure orientale de la dépression du Ghab, constituée par les falaises correspondant aux failles tectoniques affectant notamment les gebels Zawiyé, Semman et Baricha sont, en revanche, inexistantes (hormis celles relatives à Apamée). Il ne s'agit peut être pas d'une lacune, puisque l'occupation du gebel Zawiyé, ainsi que celle de tous les autres situés à l'Est de la vallée de l'Oronte et qui constituent le "Massif calcaire", n'a réellement débuté qu'à partir du IIe siècle ap. J.C., comme le montrent les travaux de G.Tchalenco (Tchalenco1958) et ceux de G.Tate (Tate1992). Néanmoins, on ne peut exclure le fait que Strabon ait pu avoir une certaine répugnance à tenter de les visiter, car il est constant dans son texte qu'il considérait les zones orientales de la vallée de l'Oronte comme des lieux peu sûrs car peuplés par des habitants "peu civilisés". Il écrit d'ailleurs: "*Le canton d'Apamée est borné à l'est par ce vaste territoire dépendant des*

phylarques arabes que l'on nomme la Parapotamie, et par la Chalcidique, laquelle commence à partir du Massyas. Quant au territoire situé au sud d'Apamée, il est peuplé surtout de Scénites, dont les mœurs rappellent tout à fait celles des populations nomades de la Mésopotamie. En général, à mesure qu'elles se rapprochent de la Syrie, les populations nomades se civilisent davantage, elles ont moins l'air d'Arabes et de Scénites et le pouvoir de leurs chefs..... Prend de plus en plus le caractère d'un gouvernement régulier" (Strabon XVI, II, 11).

Strabon nous renseigne dans ce texte sur l'évolution politique des dynastes d'Émèse dans la deuxième moitié du Ier av.J.-C. Il est utile de souligner deux informations données par Strabon dans ce texte: le degré de civilisation de ces populations et la régularité de leur gouvernement. Il est probable que les progrès de civilisation que connaissent ces peuples viennent de leur stabilisation et de l'exploitation de la plaine, à l'opposé des Arabes sunnites (non sédentarisés) qui habitent dans la Parapotamie et qui se consacraient à l'élevage des troupeaux. On peut penser que c'est en référence aux régimes politiques, qu'il a connus auparavant dans d'autres régions, que Strabon considère l'évolution des dynastes locaux comme une



Figure 5. Haut, vue du fossé du Ghab et de la retombée faillée du flanc oriental du massif côtier, à la hauteur de Jisr ech Choghour. Bas (gauche), emplacement très probable de la forteresse de Lysias à Kalaat El Marzia, sur un piton surplombant le Rhab (et le lac décrit par Strabon). Au fond, la retombée du massif côtier dont le flanc occidentale en pente douce (non visible ici) était couverte de vignobles (Strabon). Bas (droite), photo de Weulersse (1940), qui montre le rapide de l'Oronte courant sur les boules basaltiques d'une coulée volcanique à Karkor. Elle n'est pas sans rappeler l'allure que devait avoir aussi le fleuve, vers Joussiyé et vers le Tell de Kadesh.

forme plus régulière et stable de gouvernement. Il est possible que la stabilité de cette région fertile ait donné naissance à une nouvelle organisation politique.

INFLUENCE DE LA PRESENCE DU BARRAGE DE HOMS SUR L'ENVIRONNEMENT DE CETTE REGION

Un des grands problèmes relatifs à la datation du développement de la ville de Homs semble directement lié à celui de l'époque de la construction du barrage réalisé sur l'Oronte, à une douzaine de kilomètres en amont de cette ville. Sur ce sujet, de nombreux auteurs proposent des hypothèses variées, situant parfois la création du barrage et de la ville à des époques différentes (voir Abdulkarim 1997; Brossé 1923, 234-240; Calvet/Geyer 1992; Seyrig 1959, 184-192; Smith 1971; Dussaut 1922, 133-141).

Pour notre part, l'étude des textes anciens, associée à nos observations réalisées tant sur le terrain que sur les

données satellites, nous poussent à penser que le développement de la ville est directement lié à la création du barrage. Rappelons, en effet, comme nous l'avons déjà exposé, que le territoire sur lequel la ville de Homs est bâtie a été très longtemps marécageux. Nous formulons donc l'hypothèse que la création d'un barrage permettant la retenue et le contrôle des eaux de l'Oronte, qui formaient un réseau particulièrement diffus dans ce secteur, aurait pu faciliter l'assainissement partiel de la vallée et, par conséquent, constituer un facteur favorable au développement de la ville de Homs à l'époque romaine. Si on accepte l'hypothèse concernant l'origine romaine du barrage impliquant l'assainissement et la réorganisation hydrologique de la vallée de l'Oronte, au niveau de la ville de Homs notamment, il reste à démontrer que cette ville a connu un développement urbain très important, nécessairement postérieur, à l'installation de ce barrage.

En dehors des nombreux arguments historiques, il est encore possible, de montrer l'existence de phénomènes naturels qui vont aussi dans ce sens. Ainsi, l'examen

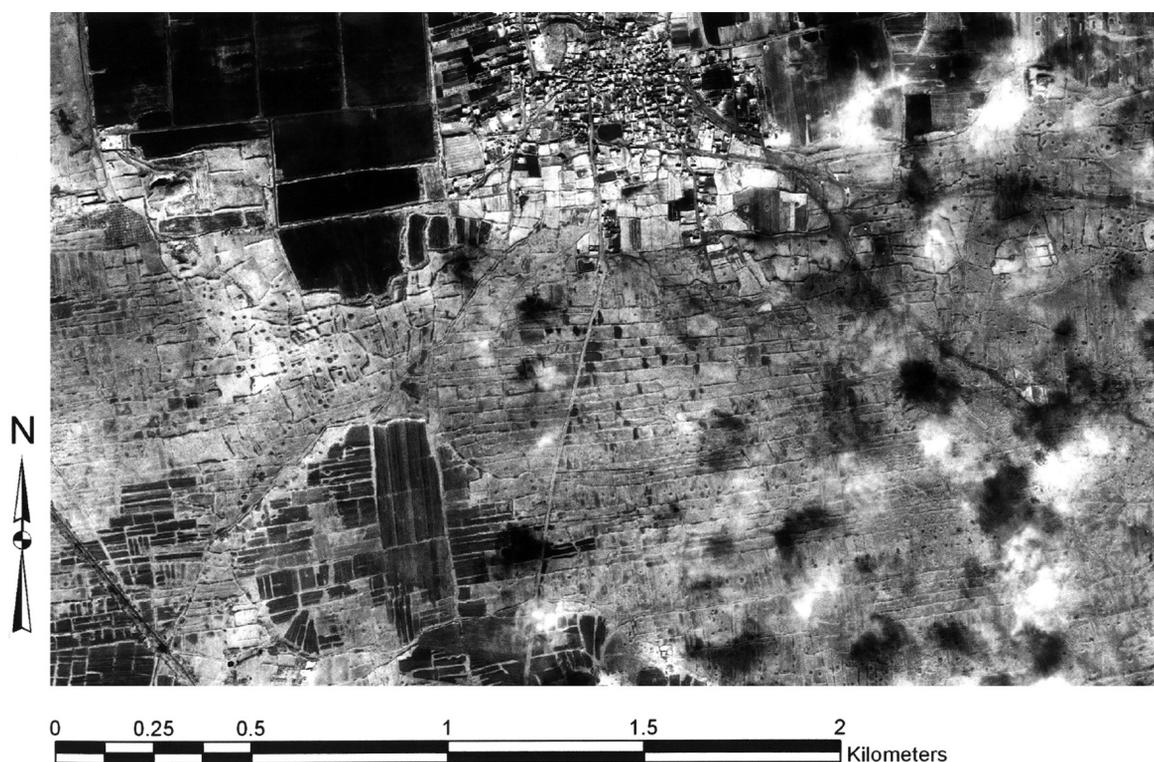


Figure 6. Image de Ikonos de la région de Borg el-Qay.

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actuel de profondes excavations réalisées pour la construction de fondations d'immeubles, dans différents quartiers du centre ville, nous permet de constater, l'existence de couches basaltiques puissantes, surmontées par, un ensemble parfois très épais (8 à 10 m) de produits argileux résultant, en partie de l'altération de coulées volcaniques en place et également d'apports latéraux pouvant provenir du lessivage et de l'altération des zones volcaniques périphériques (Abdulkarim 1999, 14-19).

Ces couches argileuses, accumulées dans les parties les plus basses de la vallée de l'Oronte, ont donc favorisé l'établissement d'un milieu marécageux interdisant toutefois la construction d'une ville importante. Il faut noter cependant que la présence de ces couches argileuses, par leur qualités céramiques, ont pu constituer un pôle d'intérêt local. Aussi, la nécessité de drainer ces marais, afin d'assainir le milieu, s'est rapidement imposée. Ce drainage a dû avoir pour conséquences, la stabilisation hydrique de couches argileuses, à tel point, qu'il a été possible de creuser des tombes, de l'époque romaine et byzantine, dans ces sédiments. La création du barrage a permis, comme nous l'avons vu, l'installation de canaux d'irrigation latéraux au cours principal de l'Oronte, destinés à favoriser le développement des zones cultivables, dans les environs de la ville. C'est pourquoi, cette dernière présente aussi une très belle organisation cadastrale.

Cette conception de l'organisation de la ville peut être aussi incluse, dans l'ensemble des grands travaux d'irrigation caractéristiques du monde romain, à cette époque. Rappelons, que c'est à cette même période que différents grands ouvrages ont été réalisés tels que le barrage de Harbaqa dans le désert entre Palmyre et Damas ou le canal d'irrigation reliant Salamyé à Apamée par exemple. De plus, de nombreux canaux d'irrigation ont été découverts, notamment dans la partie sud-est de la région crayeuse. Ainsi, le canal de Joussiyé, situé au sud, a été décrit par Al-Idrissi au XII^{ème} siècle de notre ère, il pensait déjà qu'il alimentait la ville (Al-Idrissi 1989, 374). Plus récemment, les travaux de F et J. Metral mettent l'accent sur l'importance des systèmes gravitaires fonctionnant à partir des sources dans la région méridionale du lac. Construits en souterrains, des canaux, comme ceux de Joussiyé, Rablé, et Qousseir, sans doute romains, ont été remis en usage, il y a environ un siècle (Metral 1987, 171-191).

Nous avons observé nous même cette réutilisation des eaux provenant d'anciennes constructions romaines (canaux souterrains) notamment vers Hassiyé, où actuellement les agriculteurs utilisent ces anciennes structures pour alimenter leur village. Il apparaît donc que le rôle de ces structures drainant a dû jouer un rôle important dans l'Antiquité. Malheureusement les recherches systématiques de ces réseaux n'ont pas encore été effectuées. Il est donc nécessaire d'en faire

le bilan le plus rapidement possible pour compléter le schéma des systèmes hydriques susceptibles de converger vers Homs.

LES MODIFICATIONS HYDROLOGIQUES RECONNUES DANS LE COURS AVAL DE L'ORONTE

L'étude du comportement du cours de l'Oronte, en aval de Homs, jusqu'à Apamée tend à montrer, que le régime de ce fleuve a subi des variations importantes, au cours de l'histoire. Il est en effet possible d'observer, des phénomènes, tendant à prouver l'enfoncement général, du cours de l'Oronte et de celui de ses affluents. Ce phénomène de surcreusement ne peut s'expliquer, que par une variation du niveau de base, du cours de ce fleuve.

Ce surcreusement est particulièrement visible, dans les soubassements argileux de la ville, où dans les points actuellement bas, on observe, des successions de lits caillouteux constitués par d'anciens bras de l'Oronte. De même, les affluents de l'Oronte, voient également leur niveau de base s'abaisser puisque le cours du fleuve subit le même sort. Ainsi, près d'Akrabe sur la route de Homs et Massyaf, nous avons observé ce phénomène dans le cours des Wadis se jetant dans l'Oronte. On peut penser que la construction du barrage en tête de la vallée moyenne de l'Oronte, puis la construction de nombreux moulins ont permis une répartition, des quantités d'eau différente, de celle qui existait, lorsque le cours de l'Oronte n'était pas organisé. La réorganisation du cours de l'Oronte peut donc constituer également un facteur d'assèchement local, qui aurait pu débiter dès la construction du barrage. Ici nous allons de nouveau faire appel aux observations historiques. En effet, Strabon décrit le lac d'Apamée *"comme un immense lac dont les débordements forment des marécages et des prairies ..."*. Comme nous avons déjà signalé, il décrit également la ville d'Apamée comme *"une ville ... se paraît devoir être aussi une forteresse imprenable, Il rajoute "qu'on figure en effet comme une colline abrupte s'élevant du milieu d'une plaine très basse, et qui, ceinte déjà de très belles et de très fortes murailles, se trouve protégée en outre et convertie en véritable presque île encerclée par le cours de l'Oronte et par un immense lac..."*. Or, aujourd'hui Apamée ne se présente plus que comme une ville fortifiée, en bordure du massif calcaire et dominant une plaine fertile (le Ghab).

En revanche, au Moyen Age, Aboulféda, au 14ème siècle, décrit la région d'Apamée: *"On donne le nom de lac d'Apamée à une quantité innombrable de marais séparés les uns des autres par des forêts de roseaux. Le plus grand de ces marais forme deux lacs situés l'un au midi et l'autre au nord. L'eau de ces deux étangs est fournie par l'Oronte, qui s'y décharge du*

côté du midi, et qui donne naissance aux marais. L'Oronte sorte ensuite du côté du nord. Celui des deux lacs qui se trouve au midi est le lac d'Apamée; son étendue est d'environ un demi-parasang; pour sa profondeur, elle n'égale pas tout à fait une taille d'homme; le fond consiste dans un sol argileux sur lequel il serait impossible de marcher (Aboulfed 1985, 50). Plus récemment, L.Dubertret décrit encore un lac, mais de profondeur de plus en plus faible (Dubertret 1933).

Ainsi au cours de l'histoire, la tendance régulière à l'abaissement du niveau du lac d'Apamée tend à se développer. Rappelons qu'aujourd'hui grâce aux barrages modernes successifs réalisés sur l'Oronte tant à Rastan, qu'à Cheizer, ou aux norias réalisées dès le Moyen-âge, le lac ne constitue plus finalement qu'une immense plaine alluviale argileuse (le Ghab), où les sources karstiques sont toutes drainées ainsi que la vallée de l'Oronte elle-même. Naturellement, il est certain, que ces phénomènes ne résultent pas uniquement de l'implantation du barrage de Homs. Cependant, il est aussi probable, que son influence locale, dans le secteur de notre terrain a du participer à cette tendance générale de la domination de la vallée sauvage de l'Oronte, pour régulariser progressivement son cours et utiliser l'eau qu'il transporte à des fins plus rationnelles, pour des domaines divers (irrigation des cultes, alimentation en eau des villes et des villages, etc.).

RÉORGANISATION DU TERRITOIRE

La création du barrage de Homs a permis l'installation de canaux d'irrigation latéraux au cours principal de l'Oronte, destinés à favoriser le développement des zones cultivables, dans les environs de la ville. C'est pourquoi, cette dernière présente aussi une très belle organisation cadastrale (Van Liere 1958, 55-58).

Afin de reconnaître avec la plus grande précision possible l'existence et l'extension d'une limitation dans le paysage antique de la région d'Émèse, nous avons procédé à l'analyse des nombreuses données que nous possédions: cartes topographiques actuelles, photographies aériennes, donnés satellites et observations réalisées sur le terrain. L'examen de ces cartes et photos nous montre que la région d'Émèse est marquée par la présence de structures géométriques. Ce sont des chemins, murets, et des parcelles de terrain.

Le relevé de toutes les traces qui respectent cette orientation et qui sont aussi significatives, sur toutes les cartes de la région, nous a conduites à obtenir un réseau orthogonal.

Le réseau s'étend, d'abord, dans la région de l'est d'Émèse sur une longueur proche d'une vingtaine de kilomètres, jusqu'aux limites du désert. Ensuite, la



Figure 7. Exemples de parcelles antiques dans la région de Borj el-Qay.

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deuxième partie de ce même réseau, s'étend dans la région située au nord-ouest d'Émèse, plus précisément entre le lac de Qattiné jusqu'à l'est de Hama, dans la direction du nord ainsi qu'entre la faille et l'Oronte. Elle représente une surface de 50 km de longueur et de presque 10 km de large.

La densité des traces est très concentrée autour du lac de Rastan et aussi à l'est d'Émèse. La région située à l'est de l'Oronte et au sud d'Émèse est marquée par l'absence de traces ayant la même orientation ce que nous avons relevé. Cette absence est due probablement aux réaménagements modernes et également aux variations dans la pédologie.

Au contraire, dans la partie située à l'ouest de la vallée de l'Oronte, la grande densité des murets antiques conservés peut s'expliquer par le fait qu'ils sont situés sur des zones de calcaires épais ou de basalte, donc plus résistantes à l'érosion, et qu'ils sont eux-mêmes constitués de roches calcaires ou basaltiques favorables à leur conservation. Nous avons vérifié sur le terrain les traces des structures et des grands axes que nous avons trouvées sur les cartes topographiques, les photos aériennes et examinés sur les données spatiales. Le but de notre travail sur le terrain est de comprendre les relations qui existent entre ces traces et la nature du sol, car sur certains zones, il apparaît une grande densité de traces qui sont bien préservées, en revanche sur d'autres zones, nous ne trouvons pratiquement pas une présence des traces des structures.

La prospection a été réalisée sur un terrain très vaste notamment au moyen d'un hélicoptère, en insistant sur les secteurs où se trouvent les traces des structures déjà relevées sur les cartes topographiques et les photos aériennes. Notre objectif était d'étudier ces traces afin d'éviter les possibles confusions avec des structures récentes présentant les mêmes orientations que celles du réseau ancien que nous avons défini.

RÉPARTITION DES MURETS

LA ZONE SITUÉE A L'EST DE LA VILLE D'ÉMÈSE

Cette zone s'étend sur une vingtaine de kilomètres, depuis la ville d'Émèse jusqu'aux limites de la zone désertique qui s'étend, à l'est, vers Palmyre. Elle est surtout constituée d'affleurements crayeux, et de sols résultant du mélange des produits argileux d'altération des zones basaltiques avec des craies. Ces mélanges forment d'excellentes terres de cultures, dans cette zone qui présente une topographie presque plane et où il existe des systèmes de wadis susceptibles d'irriguer en partie ces plaines à la période pluvieuse. La culture dominante de cette région est une culture d'oliviers et vignobles, mais dans certaines zones se trouvent observer d'autres types de culture dépendant de l'irrigation.



Figure 8. Exemple d'un chemin antique dans la région de Borj el-Qay.

Cette zone est en effet très riche en axes, représentés généralement par des chemins et des parcelles (souvent limitées ou bordées par des restes de murets), qui sont bien repérables sur les photos aériennes que nous avons utilisées. Les grands axes sont actuellement des chemins fréquentés pendant l'été par les voitures, mais aucun muret antique n'été retrouvé qui pourrait donner les limites de ces parcelles.

LA ZONE BASALTIQUE SITUÉE AU NORD-OUEST DE LA VILLE D'ÉMÈSE

Cette zone constituée par des coulées volcaniques récentes, située entre le grand accident et la vallée de l'Oronte, et autour du lac Rastan. Cette zone est très riche en traces de structuration qui sont constituées par des murets et des chemins.

Tout d'abord, dans les plaines basaltiques vers le village de Borg el-Qay et le village d'Akradisnyé, nous avons observé de très belles structures de parcellaire antique en basalte. Dans cette région, se trouvent aussi plusieurs sites antiques qui remontent aux époques romaine et byzantine. Enfin, nous trouvons ici des éléments importants comme des murets, des sites, des chemins qui relient les villages, des moulins, des tombes, des temples, des sources, des maisons rurales. Ces éléments peuvent nous aider à reconstituer le paysage antique dans certains villages de cette région comme, à Semlil (Figures 5-6-7-8).

LA ZONE CALCAIRE SITUÉE AU NORD DU LAC RASTAN

La recherche a été menée dans les zones de calcaire, qui sont situées au nord du lac Rastan et à l'ouest de Hama. Cette région n'est pas recouverte par les coulées volcaniques, mais les produits argileux résultant de l'altération de ces dernières parviennent, par érosion, à les recouvrir partiellement.

Dans la partie septentrionale de cette région calcaire, à l'ouest de Hama, entre les villages de Arrabi'a et Bahra, nous avons observé de très belles structures de parcellaire antique, réparties sur un très vaste territoire. Ces structures sont bien conservées grâce au fait que la région dans laquelle elles sont situées semble encore abandonnée. En revanche, quelques kilomètres plus loin, l'ensemble de la retombée du Massif Calcaire dans cette région est actuellement utilisée pour des cultures et des plantations d'arbres fruitiers (figuiers, oliviers) et seuls les murets modernes sont visibles, bien que parfois il semble qu'ils peuvent avoir été rebâties sur des murets antiques.

Ces trois exemples montrent aussi l'étroite relation de dépendance qui existe entre la nature du sol, sa disposition topographique et la densité des murets qui constituent le réseau de surface. Dans les zones où les produits d'altération basaltique sont très développés et parfois mélangés aux sols crayeux plus constants, l'organisation moderne de ces zones a favorisée une



Figure 9. Exemple d'un muret antique dans la région de Borj el-Qay.

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destruction plus rapide des structures antiques qui ne sont plus représentées que dans quelques villages. En conclusion, pour l'ensemble de la vallée moyenne, la concordance est très nette entre les observations qui nous parviennent des écrits anciens et celles que nous pouvons constater ou déduire, de nos propres

recherches de terrain. Ceci nous permet de croire, au rôle important qu'a joué l'organisation ancienne de la vallée moyenne de l'Oronte, vis à vis, des structures citadines qui le bordent, en particulier pour celles qui ont permis à Homs de devenir une importante ville à l'époque romaine.

**VI. PRESENT-DAY AGRO-ECOLOGICAL
CHARACTERISATION AND CONTEMPORARY
SOCIO-ECONOMIC CONDITIONS**

15. SOCIO ECONOMICS OF HALULA REGION (MIDDLE EUPHRATES, SYRIA)

Georges Arab*

HISTORIC INTRODUCTION

The region, east of the Aleppo-Damascus road, remained unpopulated, with no farming activities, and was the playground of the nomads, for centuries. The resettlement in this region has started in the second half of the 19th century. D. Kennedy & D. Riley wrote in their book; Rome's desert frontier from the air: "The prosperity of the late Roman period continued through the brilliant century of the Muslim Umayyad dynasty (661-750), but this was followed by decline in the later Arab centuries, the disaster of the Mongol invasion and neglect under the Ottoman empire, and Wholesale abandonment of land and of many outlying towns and villages took place". Hutteroth and Abdelfattah (1977) and Lewis (1986) mentioned: "re-settlement of the more marginal areas recommenced in the ninetieth century, but it has only been in the last 50 years that the extension of the area of the cultivated land and the growth of towns and villages has become rapid".

During the 18th, 19th and early 20th century, insecurity and disorder were prevailing in the region east of Aleppo. The successive Ottoman governors of Aleppo at that time were unable to protect cultivated areas and settlers against the Bedouin tribes, who were dominating the whole eastern part of Aleppo. The Russels brothers mentioned in their book; the natural history of Aleppo, London, 1794: "At the distance of 6 to 7 miles to the east of Aleppo city, the desert starts". The word "desert" was frequently employed to mean uncultivated country, without villages, abandoned to the nomads. The same circumstances were applied on the middle Euphrates too, including the study region. Lewis in his book: Population and development of the steppe in Syria, 1800-1920 mentioned that "in the 18th and early 19th century there was only one place of any consequence on the whole middle course of the Euphrates and that was the little town of Deyr Azzawr".

Ibrahim Pasha; during his invasion to Syria in 1835-1840, tried to resettle the deserted villages east to Aleppo, by availing security to the new settlers against the Bedouins and urging the merchants of Aleppo to invest in agriculture, but when he left Syria, the previous circumstances had returned into as it was before.

The Ottoman governors of Aleppo after Ibrahim Pasha sent many military campaigns against the nomads eastward of Aleppo, in aim to spread security and restore the ruined villages.

In 1858, 300 families from Waldeh tribe crossed the Euphrates to the west bank, because of the blood dispute with Shammar tribe in the east bank. These families were followed by hundreds of Waldeh families in one year later. They were encouraged by the authorities to settle north of Deir Hafer and Mascaneh (Lewis 1987). Families, belong to Bu Banna and Ghanayem tribe, were among these immigrant families. A. Wasfi Zacaria in his book; Ashayer Alsham, 1945, noted that "Bu Banna tribe is a big group of people was separated from Bu Sha'ban tribe in Raqqa province, has crossed the Euphrates and moved along its side northward, one and a half century ago, and settled on its bank in the eastward of Munboj".

Lands along the west bank of the Euphrates from the river Sajur to Mascaneh were registered in the name of Sultan Abdulhamid in 1883. Administrative offices were set up at al-Bab, Munboj and Abu Galgal to administrate the sultan's cultivation. And big areas of land were cultivated and populated by nomads or semi nomads. This helped for the creation and development of many villages.

By the end of the 19th century, there were more than 400 villages in the region of al-Bab, Munboj and Jaboul regions, comprising most of the area between Aleppo and the Euphrates (Lewis). Nearly all of them were small; an estimate in 1891 assigned an average of sixty-six people per village.

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In 1909, after Abdulhamid deposition, his estates were declared state property and after the First World War, were transferred to the Syrian department of state domains.

At the beginning of the 20th century, these new settlers started to cultivate limited areas of cereal crops that in aim to provide them with the basic family nutrition need. Gertrude Bell noted in 1909 that the plain near Jarablus was coming back into cultivation.

Wide areas of land east of Abu Galgal were classified as vacant and dead land, until the second half of the 20th century. Vacant land could be bought from the treasury. Dead land could be cultivated free of charge with official permission and if it were cultivated for five years, title could be obtained.

During the 1940s, the merchants and exploiters of Aleppo and other urban centers guided their capitals towards the Euphrates valley for investment in cotton cultivation. This helped in transforming the traditional way of life there and developing the region. In the early 1950's, a rush for drilling wells and cultivating irrigated cotton occurred in all parts of Syria, including the region east of Munboj.

In 1963, an agrarian reform law was issued, and the state lands were distributed to the households who were cultivating it since a time.

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INFORMATION BASE AND METHODOLOGY

Introduction

Archeological excavations has proved that Halula is an establishment that has begun approximately 8.700 years ago and that it would have been occupied in an uninterrupted way during 2.000 years.

MENMED project has been established to study this old found civilization from the first settlements until modern times, based on historical sources and archaeological remains. This understanding is essential for defining the ongoing dilemmas and conflicts, whether political, social, economic or cultural that is shaping the contemporary developmental processes in the region. So, a comparison between present-day and early agricultural practices in the site where the oldest civilisation occurred was needed.

As a little, has been known about the socio economic situation and attitudes towards natural resource management of the local population in this area. Therefore the MENMED project commissioned this socio economic study.

Geographic location of Halula region

Halula region is located 105 km northeast of Aleppo, and 25 km east of Munboj town. The lake, which was made because of the new "Tishrin" dam on the Euphrates River, is bordering Halula region from its eastern side.

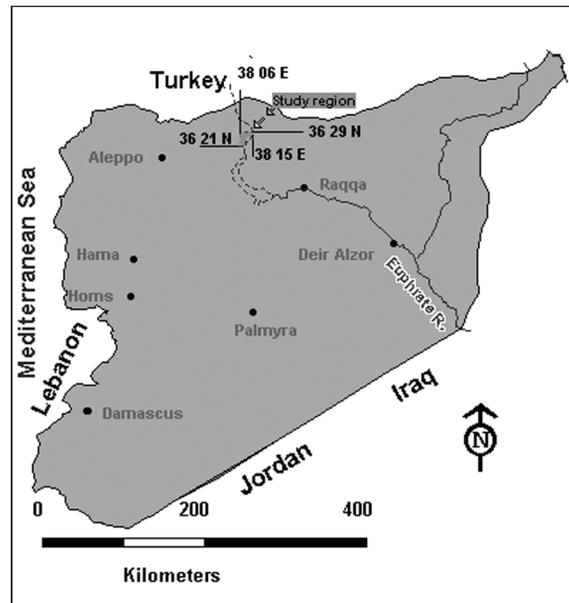


Figure 2.1. The geographic location of Halula region.

Aim of the study

The baseline information about the present Socio economics and dynamics of the contemporary agriculture in the region is limited. Therefore the main objective of this study is to come to a better understanding of the human activities and practices with respect to their resource management and their economy. Specific objectives are:

- To describe the customary land use, and resource distribution.
- To evaluate the available natural resources and their use in the production system.
- To assess the management and possible constraints of production.
- To assess the economic achievement of the farming system and factors determining the achievement.
- To assess the adoption and impact of new technologies at farm level.
- To promote traditional knowledge as a source of information.
- To describe the dynamics of the communities.
- To show the effects of present land use on the cultural heritage.

Study design

At the beginning, a field trip was made to the region, which surrounds Tal Halula, in order to be familiar with the communities of the region, its people, and resources. Available publications and information about the farming system, recent history, ethnic issues, and others, were collected from international and national research centers and other sources. These publications and information consolidated the data that were collected by two field surveys; the community and household survey.

Available topographic maps and satellite images were collected too, in addition to the collection of spatial data by the geographic position system (GPS). Maps and thematic maps were created the geographic information system (GIS), in order to come to a better understanding of the study.

Informal field trip

The aim of this survey was to understand the perceptions of the households, their problems, their decision-making behavior, and their environment. So the following formal surveys would have a better design. The contacts with the notable persons of the study region during this field trip also helped in gaining confidence, which was important for the accomplishment of the formal surveys.

Literature review

Very few socio economic or farming system studies were found about the middle Euphrates region. Many studies exist on irrigation and archeology. But many good books exist about the dynamics of land tenure, cultivation, and settlement in the study region. Travelers books during the 18th and 19th century helped a lot to understand the evolvement of agriculture in the study region. Discussions and literature review were made at several international and national institutions, including ICARDA (The International Center for Agricultural Research in the Dry Areas), the Aleppo directorate of agriculture, the Munboj farmers union and department of agriculture, and key informants. In addition, to the Internet and the national library of Aleppo.

Selection and description of the study region

The selected study region was sought to be representative for Halula community production system, resource base, customary land use, people's origin, and traditions. Barley/ small ruminant livestock farming system with some potential for irrigated production through wells and small river irrigation by private projects dominates agricultural production in this area. Also, there is slow-growing potential for growing fruit trees. The region is highly affected by rainfall amount and fluctuation. Low and erratic rainfall conditions lead to a low degree of diversification in production.

Eighteen villages were principally included in the study region at the beginning, but only twelve ones were selected to characterize the region communities, because six communities out of the eighteen ones were covered by the Tishrin dam-lake water. The households of the excluded communities are either staying on the heights of their villages without any real farming activities, or have migrated to other regions.

The twelve communities which were selected for the study are: Halula, Sekkaweyeh, Tal 'Arresh, Qana Shamali, Kherbet Bshar, Qana Tahtani, Jdaydet al- Fers, Mahsheet Asheikh 'Obeid, Mahsheet al- Tawaheen, Qana Qubli, Kherbet al- twaini, and Fers sagheer. And

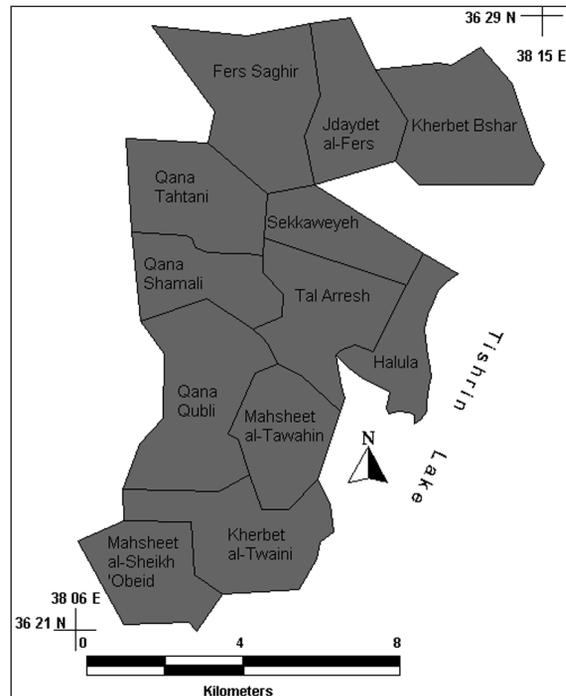


Figure 2.2. The location of the study region communities.

the six excluded communities are Hema Saghir, Sandalieh Kabira, Sandalieh Saghira, Haweejet al-Dura, Qashlet Yusef Pasha, and Kherbet Khaled.

The selected study region is located between the latitude 36 21 north and 36 29 north and the longitude 38 08 east and 38 30 east. The study region is 105 km northeast of Aleppo, and 25 km east of Munboj.

And it runs across the rainfall isohythes 250- 350 mm. Semi-nomadic Bedouin families from the east bank of the Euphrates had resettled the region during the mid 1800's. Two major tribes; Bu Banna, and Ghanayem are dominating the region.

Community survey

Visits were made to the communities of the study region, and a questionnaire was used to collect data from the old and notable persons who can answer questions concerning the historical development of the social-economical conditions and resource use, in their communities. The following main topics were surveyed:

- Infrastructure.
- Village history and population.
- Customary land use system, property rights and land ownership.
- Livestock and rangeland.
- Soils and degradation.
- Water resources.
- Institutions and conflicts.
- Well-being and education.
- Housing, traditional social habits and handicrafts.
- Nutrition and food.

Household survey

A questionnaire was prepared and data were collected from households were chosen randomly, representing the twelve communities and the different types of income sources; have cultivated rainfed land, irrigated land, have livestock, have neither land nor livestock. The objectives of the questions were concentrated on the budget and management of the crops and animal production, in addition to the off farm income, in order to understand the households management of the resources and their income. The following main topics were surveyed:

- Household composition, labor force and off farm work, and education.
- Crop production and budget.
- Animal production and budget.
- Dynamics of environment, and traditional heritage.

Thematic maps

Maps about the study region were created to illustrate the geographic location of the communities of the study region. And thematic maps were created too about the allocation and density of the resources and about the main crops are used, the education and well-being status. The GIS tool was used in creating these maps.

HISTORY AND PRESENT SITUATION

Population history (Source: An interview with Mr. Diab al-Mashi; the “sheikh” of Bu Banna and member in the Syrian parliament).

The majority of the people in the study region belong to Bu Banna and Ghanayem tribe. 150 years ago, they were nomads, moving in Raqqa Province steppe. In the past, Bu Banna was allied with Bany Sa'id, but this has finished since one hundred years.

Bu Banna and Ghanayem were 200 tents when they crossed the Euphrates from the east bank to the west bank 150 years ago, after the first famous crossing of the Waldeh. At that time, the Sultan owned the lands of the study region. The study region was not inhabited, at the time when they had come.

Each group of households captured an old Roman cistern in the old ruined villages of the region, and claimed traditionally the land that surrounds the captured cisterns. After few decades, some of the households, who got later some information about farming through their contacts with Aleppo peasants, rented lands from the Sultan and started cultivating rainfed wheat and barley.

More than 100 years ago, the households who settled alongside the Euphrates, started to drill Arabic wells, and equipped them with old traditional technology, to discharge the water (pot system pulled by oxen). At the beginning, they irrigated *Sorghum* crop only, which they used, for making their own bread.

Bu Banna and Ghanayem were considered, until 1909, the sultan peasants, so they did not have to serve in the Ottoman army like the other population.

During the French time, their lands became state lands. An official committee used to evaluate the harvested yields every year, and a 10% of the production was paid to the government as a tax for using the lands of the state.

In 1963, an agrarian reform law was issued in Syria, and the state lands were distributed to the peasants on the basis of the actual cultivated area of each household at the distribution time. No other distribution of land has occurred since then. 15 years ago, the state started the procedure for transforming the property rights type of the previously distributed state lands, into private property. By now, most of their lands have become private ones.

Until the early 1950s, the drilled wells remained nearby the riverbank, but a rush for drilling wells everywhere and away from the riverbank begun and continued until the 1980's, when the ground water sources were depleted because of the overuse. So, drilling wells has become expensive and not an economic investment. The water depth in the wells during 1950s was 10-15 meters, but now is 60-80 meters.

The contemporary irrigated farming system in the region is wheat, maize and cotton. Some villages like Halula, Sekkawayeh and Fers Saghir have irrigated areas from the river, while others from wells.

The main livestock type is sheep, but there is small dairy cows population too.

A few years ago, and because of the new “Tishrin” dam on the Euphrates, many households, in the study region, lost their lands, because the lake water covered a part or all of the lands of the neighboring villages. Halula, Sandalieh Kabir, Sandalieh Saghir, Hema, Jurn Saghir, Haweejet Aldura, Qashlet Yusef Basha, and Kherbet Khaled were among these villages. The government compensated the cultivated lands loss, by donating 3 hectares of irrigated land in Mascaneh state farm, to each household who lost land, whatever the lost area was. The people of Hema, Jurn Saghir, and Haweejet Aldura have immigrated from their villages to Mascaneh or other places. In other villages, the people have built new houses on the high lands of their villages and stayed there.

Bu Banna and Ghanayem have good relations with the neighboring villages and among themselves.

Characteristics of the population

Improving the productivity of resources and the living standards of the rural population are among the government main goals. Yet, these goals have failed to be achieved in the study region in spite of the government efforts that have been made.

The limited land resource, the dry and harsh weather conditions that make productivity unstable, and the mismanagement of the local households to their resources have led to the underdeveloped present situation. The limited land resource is defined by the fact that all the land is now under cultivation and that no more new land can be cultivated.

The phenomenon of land fragmentation is strongly obvious in the study region too. Thus, the study region is suffering from an increasing number of landless and near-landless households.

The low yearly mean of precipitation, which ranges between 250-350 mm, and its fluctuation from a year to another one, affects on the productivity and consequently on the living standards of the people. The mismanagement of the resources through the unfavorable agricultural practices like the cancellation of fallow from the crop rotation, depletion of ground water resource, and improper tillage methods has led to the degradation of the resources.

The fast growing population characterizes the study region. The population has increased 40.59% within ten years; from September 1994 until September 2004. It would be a hopeless development case if this fast growing population would not slow down or not accompanied by continuous improve to the resources. The majority of the households have an off farm income from labor work to subsidize the farm income which is not enough by itself to provide the basic family needs. The labor work is mainly unskilled and not continuous one. Migration to the nearest towns and cities like Abu Galgal, Munboj and Aleppo, has started mainly from the time when ground water decrease begun.

With respect to tribe, the main tribes in the study region are Bu Banna and Ghanayem, but other tribes like Hanadi, Haib, or others also are found but their percentage is of not much importance.

With respect to religion, the whole population is Muslims.

Features of the study region

The Sedentarization

Until the second half of the 19th century, the study region remained as a grazing area for the flocks of different Bedouin tribes that used to pass for a short time grazing and leave back to their home base in the rangelands. Groups and individuals, who belong to Bu Banna and Ghanayem tribe, were pushed out of their home base in the Raqqa rangelands, by other tribes, came to the study region and claimed the land. These pioneers continued their Bedouin life style until the 20th century when they started to be transformed from herders into farmers.

Settlement in the study region occurred mainly in the period between 1800 and 1870 mainly. By 1900, all the villages were already inhabited. But few new comers continued to join the earlier settlers until 1944.

At the beginning of the settlements in the 19th century, the total number of the pioneer households was 44 households belonged to the following tribes: Bu Banna 31, Ghanayem 5, Kurd 1, Harb 1, Haib 1, 'Mairat 1, Jays 1, Shafraat 1, and Bu Hmayyed tribe 2 households. So, 68%, and 11% of the total pioneer households belonged to Bu Banna and Ghanayem tribe respectively, while the remained 21% of the total pioneer households belonged to 9 other different tribes.

- Halula: al- Akhras, Khleif, Ajjan, 'Awazej, were four households, belonged to Bu Banna tribe; Bu Sama Fakhed¹, used to live in Sandalieh Kabira². Around 1875 they were involved in a fight against other people in Sandalieh. Because of the fight they left Sandalieh and moved to Halula, which had already been inhabited by people called "al-Bahez" from Ja'afra Fakhed; Bu Banna. Nobody from the still-alive old people at present, knows what happened between the four pioneers and al-Bahez. All what is known now, that none of al-Bahez grandsons exists in Halula now. At present, the number of the resident household grandsons of al- Akhras, Khleif, Ajjan, and 'Awazej is 75, 30, 30, and 2 respectively.

- Sekkaweyeh: 'Assaf al- Mar'i, was the pioneer who belonged to Bu Sama Fakhed; Bu Banna, came from Fers Saghir in 1900, for cultivating irrigated crops reason. Yusef Sulaiman; a Kurd, was another pioneer came from Turkey for unknown reasons in 1900 too. Hamden al- Fandi; from Ghanayem tribe, was the third pioneer who came from Tal 'Arresh for unknown reasons around 1900. Musa al- Hosein was the last pioneer who joined the others. He belonged to Bu Sama Fakhed, came from Jdaydet al-Fers for cultivation reason in 1940. At the present time, the descendant households number of 'Assaf, Yusef, Hamdan, and Musa is 30, 30, 5, and 5 households respectively. These four pioneers bought Sekkaweyeh land from its old owners, who were from Tal 'Arresh at that time. Sekkaweyeh was a piece of land belonged to Tal 'Arresh at that time.

- Tal 'Arresh: Mustafa al-Bajir from Ghanayem tribe came around 1870 and settled in the place. And when Mustafa came, nobody was living in the place. What is certain that Tal 'Arresh was inhabited by this pioneer, earlier than any other village in the study region. Mustafa escaped from the fight with Waldeh tribe in al-Khafseh³ region, which was the region of Ghanayem and Bu Banna before Waldeh came and pushed them northward to the Abu Galgal Region. All the present time households of Tal 'Arresh have come from Mustafa dynasty.

1.- Fakhed is an Arabic local term for sub tribe.

2.- It is a village north of Halula.

3.- Khafseh village is south of the study region.

- Qana Shamali: Hasan, Hammud, and Shibli al- Abdalla were three brothers, belonged to Ghanayem tribe came from Khafseh region, around 1870, running away from the fight with Waldeh tribe, and settled in the place. Hasan Dawood was a herder from 'Omairat tribe. He came from "Jazireh"⁴ looking for grazing areas for his flock in 1924. He married a girl from the antecedent settlers and settled here. A fifth pioneer whose name is unknown from Haib tribe came in 1900 from south of Aleppo, and settled here. A sixth household from Ja'abra tribe with unknown name came from al- Bab region with his flock in 1934. He married here and settled. A seventh household called Hamdosh from Harb tribe came from nowhere, in unknown year and settled here. The three brothers were the first settlers in Qana Shamali, and the land had no owners when they came. All the resident households now come from their dynasty. While the descendants of the other pioneers are immigrants.
- Kherbet Bshar: Abdalla al- Sheikh, Bshar al- Saboon, Fadel al- Abdalla, Hamed al- Jad'an, 'Abd al- Sheikh, Hammud al- Hmaid, Abdalla al- Mahmud, and Steif were eight cousins came from Hema Kabir⁵ in 1854 for unknown reasons and settled here. The land owned by nobody at the time of their arrival. At present the resident household's number of Abdalla, Bshar, Fadel, Hamed, 'Abed, Hammud, Abdalla, and Steif are 25, 30, 16, 25, 30, 8, 15, and 25 households respectively.
- Qana Tahtani: Shibli from Ghanayem tribe came from Haweejet al-Dura in 1870 for unknown reasons, Ibrahim Jum'a al- Steif from Jais tribe came from al-Bab region in 1988 looking for labor work. Mahmud Mohamad al-Faraj from Bu Banna-Bu Sama came from Abu Galgal region in 1944 to work as labor. All settled here. The land was not owned by anybody when Shibli came. The descendent resident household's number at present for Shibli, Ibrahim, and Mahmud is 27, 2, and 2 households respectively.
- Jdaydet al- Fers: 'Isa al- Rumi, Haj 'Eed, Sheikh Mohamad, Mohamad al- Haji were 4 cousins From Bu Banna-Bu Sama came from Fers Saghir after a quarrel that occurred in the village in 1910. They were followed by Ahmad al- Shaddad, 'Allawi al- Meslem, Mohamad al- Meslem, who belonged to Bu Banna-Bu Sallum, came in 1940 from Sandalieh Saghireh for unknown reasons. Nobody was living in the village when Bu Sama group settled. The number of present resident descendent households of Bu Sama group is 140, and for Bu Sallum group are 10.
- Mahsheet Asheikh 'Obeid: Mustafa al- Hemmadeh, from Bu Banna-Ja'afra came in 1870 from Abu Galgal,

to flee from taking his sons as soldiers in the Ottoman army. He and his family lived hidden in the mountains of the village for a time. Then, and for security reasons, he invited, a vulnerable and strong lady belonged to Bu Banna- Ja'afra, who used to live in "Mahdoom"⁶, to share him the rich pastures of the place. Halimeh al-Fares; the name of the lady, joined Mustafa with her family and servants. The descendents of Mustafa are now 160 resident HH, and 40 descendents from Halimeh. The land was not owned by anybody when Mustafa settled.

- Mahsheet al-Tawahin: the same Mustafa al-Hemmadeh of Mahsheet Asheikh 'Obeid and his brother Jasem al- Hemmadeh bought the land from a person called Mahsheyeh 110 years ago. Mahsheyeh himself bought the land from two unknown brothers who were called Sa'd and Sa'dieh. Mahsheyeh constructed windmills at the Euphrates River and managed some irrigated farming before selling the land to Mustafa and his brother. In 1920, two households joined Mustafa and Jasem; the first one was Jasem al-Sawadi from Shafrat tribe who came from Jazireh and married here, and the second one was Ahmad al-Akhras from Bu Banna-Ja'afra. He came from Mahsheet Sheikh 'Obeid after killing a person there, he married from the village and settled. The descendents. of Mustafa, Jasem, Jasem, and Ahmad are 20, 30, 15, and 15 resident households at present.
- Qana Qubli: Hasan al- Jolaq from Ghanayem tribe came in 1875 from nowhere. Khamis al-'Ezzo from Bu Banna came at the same time of Hasan, from no place, and both settled here. The two pioneers bought the land piece by piece from Ibrahim Hasan al- Rabi' of Abu Galgal. The present descendents of Hasan and Khamis are 130, and 40 resident households respectively.
- Kherbet al- twaini: Mohamad al- Musa from Bu Banna came in 1870 from Haweejet al-Dura for unknown reasons. The village at that time was captured by a person called al- Twaini from 'Enezeh tribe. Mohamad fought al- Twaini and kicked him away and chased him until 'Ain 'Isa⁷. At the beginning, Mohamad al- Musa and his son Haj Hosein settled 600 meter south of the present village location. Later they discovered Roman well located where the present village is located now, so they moved there and built the village in its present location. All the present time households are of his descendents.
- Fers Saghir: Khalaf al- Ghannam from Bu Banna was the first settler in the place. He came around 1800!! from Maryamin? And was followed after a short time by Hasan al- Badawi, Mohamad al- Dandan, Haj Rahhal. All

4.- Jazireh is an Arabic local name for all the part of Syria, which is at the eastern bank of the Euphrates.

5.- North of Halula.

6.- Is a place south of the study region with 50 km.

7.- It is a town in Jazireh.

belonged to Bu Banna and came from Maryamin. 'Assaf al- Raqqawi from Bu Hmayyed tribe was the last one who came. There was nobody here when these pioneers settled. The present descendents of Bu Banna group is 195, and Bu Hmayyed 5 resident households.

Natural environment

The customary land use system in the study region is the outcome of the natural forces, which constitute the system. The main forces on the system include the climate, native pastures, soil, and water resources.

Climate

The climate in the study region is of the Mediterranean type. This climate includes two main seasons, winter and summer; meanwhile spring and autumn are short transitional periods. The summer starts from May until September. The winter starts from December until March. Temperature in summer might reach over than 40 degrees, while in winter might go down below 0 degree. The rain season mainly starts in October and ends in April. The yearly amount of precipitation ranges between 250 and 350 mm in average, but it might be in some years below 250 mm. The big part of the yearly precipitation occurs in December and January, but exceptions might happen in some years where the biggest part might occur either in autumn or spring. Rainfed crops in order to give a good yield need the yearly mean precipitation to be not lower than 300 mm and that this quantity of rain to be distributed equally onto the crop life time which starts from the germination until almost two weeks before harvest. The fluctuation in quantity and distribution of the rain are two main factors, which affect directly on the yield.

Natural vegetation

Most of the land in the study region is cultivated, and only 7.3% of it is left as uncultivated range. The vegetation is in a bad status because of degradation.

In the study region like in the other parts of Syria, the intervention of man drove the natural vegetation into a very low level of degradation. Many evidents, either from historic documents or from still surviving few shrubs or trees, or from archeological research, have proved that either agriculture, or the need to fuel, or over grazing, or other practices of man has led to the destruction of forests, shrubs and trees and were replaced by annual grasses and others which are of low benefit. In a paper was issued by the Constitutional Rights Foundation, it is mentioned: "Agriculture was probably the most important invention in human history. It enabled the rise of world civilizations. But many ancient societies repeatedly chose shortsighted food production practices that spoiled their environments and undermined their civilizations".

The present vegetation cover in the study region is poor and contains the following shrubs: *Anabasis hausknechtii* (Shnan)⁸, *Artemisia herba-alba* (sheeh), *Haloxylon articulatum* (Yatneh, Naitool), *Noaea mucronata* (Surr), *Peganum harmala* (Harmal), *Salsola vermiculata* (Roteh), and the grasses: *Stipa Sp.* (al- 'Adam), *Thymus syriacus* (Za'tar), *Utrica Sp.* (Gerrais), *Lathyrus sativa* (Jelban), *Centaurea Sp.* (Qandaris), *Ziziphora tenuior* (Na'na'), and *Carthamus Sp.* (Gert).

Forest vegetation in the Euphrates Basin and its environs was very dense but with time has become very poor due to years of degradation activities (International Society for Environmental Botanists Vol. 10 No. 3 - July 2004 Land).

Under the present situation, the participation of natural vegetation is not more than 7.5% in the yearly sheep diet. While the local people mentioned that 40 years ago this participation was more than 50%. It is clear that the natural vegetation in the study region has lost its importance as a diet source for the households' flocks.

Soil and topography

More than 65% of the cultivated soils in the study region are shallow, and its depth is less than 50 cm. Its fertility is poor and contains considerable amount of small stones. The rest of the soils, range between still not deep and deep soils. Its fertility ranges between medium and very fertile soil. And with respect to the stone contents, it ranges between low and stoneless soil.

The majority of the study area can be considered as plains, and some hilly areas are found too. The plains are located in most of the directions, except for a hilly strip, which surrounds the eastern and southern parts. The sediments in the low lands produce relatively high yield of crops, and it is used mainly for irrigation if it exists.

Water resources

50 years ago the study region had two main fountains composing small rivers; Abu Galgal and Al-Fers River. These two rivers were crossing the study region and flowing into the Euphrates. Their water was used for irrigating crops and fruit trees. Few other site-fountains existed too. During the 1950's and 1960's, a rush for drilling wells in Syria occurred (Wirth, 1971). In the study region as well as in the all other parts of Syria, a rush for drilling wells occurred too. And large areas of rainfed land were transformed into irrigated ones. In mid of the 1980's a drastic decrease in ground water level happened because of the widespread depletion and exploitation. This decrease led to that many wells, in addition to the rivers and fountains, dried up. Drilling new wells has become very expensive because the water table has deeply decreased, so extracting the water has

8.- All the words are between two brackets are the local names of the plants.

become expensive by the diesel pump. Water is available now only through drilling wells and pumping out the ground water. Ground water is accessible in some communities of the study region, but in some others is not.

Land tenure

Land tenure form has been changed many times since the settlement period in mid of the 19th century. During the Ottoman period a land tenure law was issued. This law gave the right to people to cultivate the land of the sultan and pay the “al-‘usher” (Arabic word means the tenth or 10%) of the production to the Sultan. After five years, the used land became a private ownership to the user. The study region households did not take benefit of the law either, because of being still not interested in cultivation or fearing to have other negative consequences if an official relation with the government would be made because of owning a land. In 1909, after Abdulhamid deposition, his estates were declared state property and after the First World War, were transferred to the Syrian department of state domains. The households extended their cultivation at the beginning of the 20th century and paid the Tenth as leaseholders of the state lands. In the late 1950's a land reform law was issued and adjusted in 1963. by the new law the state lands in the study region were distributed to the leaseholders and they were given the right to own the land and inherit it, but not the right to sell it or to rent it out to the others. 10 years ago, the state asked the beneficiaries to pay a symbolic sum of money as a value of the given land, in order to change the land title into private one. At present, 70% of the property type of land is private, while 30% is still benefit from state lands. The households who still have not transformed their land title into private the reason was either because of having no money to pay the land value or that the land is inherited and this needs complicated and long procedures.

Since the last distribution of land in the study region, no other one has occurred. Within 40 years from the time of the last distribution of land, many new households have been formed. These new households are landless as long as their fathers keep alive. The fragmentation of land through inheritance has decreased the farm size. Current land tenure system is failing to address the problems of landless households and small farmers continue to compete for limited and fragmented cropland. This problem is becoming an increasingly important issue as the number of users grows.

Land use and degradation

All arable area is cultivated. Rainfed agriculture includes barley and wheat. Barley is sown in low potential soils, while wheat in the high ones. Fallow is used on a very small scale with a percentage of 2.7%.

Olive, Pistachio, Vine, and Almond Fruit trees are planted with supplement irrigation on the hilly land of shallow soils. Irrigation is applied in the high potential soils with cotton, wheat, broad beans, sesame, maize, and a part of the land of the communities, which is bordering the lake, was confiscated for the benefit of the lake.

Even the study region is bordering the lake but there is no official irrigation scheme. There are two private projects established by individuals for pumping the water from the lake through pipes to irrigate some lands on the path of the pipe. The project owners get a percentage of the production from the households for irrigating their lands. This percentage is 33% for wheat and 35% for cotton.

Common rangeland for grazing doesn't exist in some communities but exists in other some with small areas. It has a small role for grazing.

Degradation has caused to less yield than in the past, even of the use of fertilizers nowadays.

Because of land fragmentation, the households have to cancel the fallow from the rotation, in addition to the use of monocrop rainfed farming system,

One of the households mentioned that he was used to get 20 bags of barley from one hectare in the past without using fertilizers, but no more than 10 bags under the same rain conditions, even the fertilizers are used. Another one from Halula mentioned 15 bags, 20 years ago, but 10 bags now in normal years. Some said that yiel is a bless from god. Other households said the reason for the decrease is because of using new improved crop varieties which stay in the soil less time than the local ones, so less benefit from the soil moisture. One mentioned the reason is the change from using the “Faddan”, the old traditional plowing tool to the tractor. He explained that faddan goes dipper than tractor into the soil and keeps the soil more compact. Therefore it holds more moisture than the tractor plowing. Faddan disappeared 20 years ago.

Role of livestock

Sheep has lost its importance as a main source of income, since few decades. A small percentage of the households in the study region are still depending on sheep breeding as a main source of income. The majority of households either has little flock size just for the house consumption of dairy products or have no sheep at all. In the far past, the households were Bedouin herders depending mainly on sheep for their living. Many reasons have led to loose sheep as a source of income like that almost all the land is cultivated and no range land is left for grazing, the government confiscated a good part of what is left as a rangeland for forestry purposes and for protecting the lake, the fallow is cancelled from the crop rotation which was used for grazing in the past, the households were involved in wells irrigation projects

which forced them to decrease their flock size or loose it all, and because of the free grazing of natural vegetation is very limited, breeding sheep becomes expensive as it needs purchased supplementary feed almost during the whole year.

The “Awasi” fat-tailed sheep is the lonely race in the study region. Goats are of no economic importance even they produce more milk than sheep and the milking season is longer than sheep too, but goats are considered to be destructive grazers to vegetation, trees and crops, since it is very difficult to control their grazing behavior. Their milk is used mainly for the house consumption.

Households keep small ruminants for milk, yogurt, cheese, ghee, wool, manure and meat. Small ruminant's nutrition depends in wintertime on buying concentrated feed from the market. In spring, they graze what is available from natural pastures for one month or two, in addition to the grasses, which grow because of irrigation, and supplemented with concentrated feed. In summertime, they graze the cereal stubble, supplemented with concentrated feed. In autumn time, they graze summer crop residues if it is available in addition to the concentrated feed.

Dairy cows were introduced to the study region after that sheep had started to loose their importance, in order to compensate the loss of sheep dairy products. It is easier to look after one cow than 10 sheep, because sheep need to move while cows don't. The race of the cows in the study region, is a second or third generation of a hybrid between Dutch and local cows. They produce low quantity of milk. The majority of households who own cows, they have one cow, and few have more than one. Cows are kept for providing milk and yogurt to the family, and the extra amount is sold in shape of milk and yogurt to the market. Male and female calves are sold after six months of age in order to cover the feed expenses of the mother cow. Their diet depends mainly on purchased concentrated feed and irrigation grasses if it is available during the whole year.

Infrastructure dynamics

Paved road: has reached to all the villages at present, except for Halula, Mahsheet al-Sheikh 'Obeid, Mahsheet al-Tawahin, and Kherbet al-Twaini, which are 3, 3, 2, and 0.6 km. Far from the nearest paved road. 20 and 50 years ago, the nearest paved road connection was at Munboj, which is 25 km away, in average, from all the villages in the study region.

Market: has been in Munboj since 50 years,

Vehicle maintenance workshop is available in both Abu Galgal and Munboj at present. 20 years ago, huseholds had to go either to Munboj or Aleppo for repairing their vehicles. But 50 years ago, Aleppo was the only place which existed for such actions.

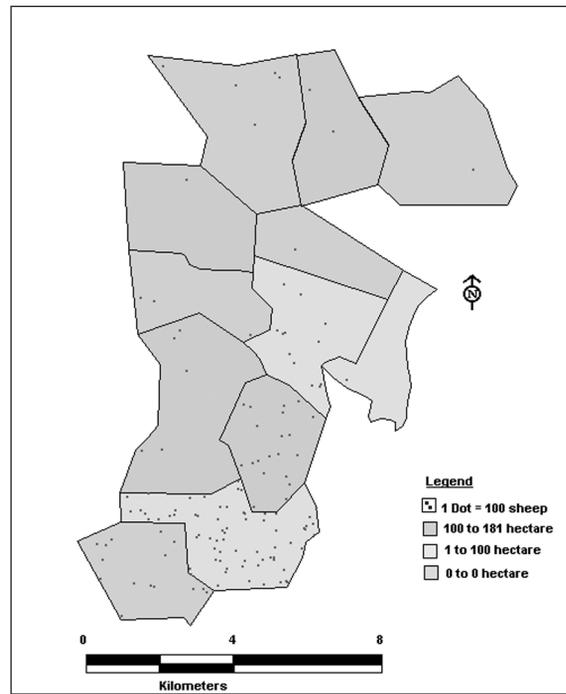


Figure 3.1. Sheep density and available rangeland areas for grazing in the region of Halula, Syria, 2004.

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Extension unit: there is one at present in Abu Galgal. They had to go either to Munboj or Aleppo 20 years ago, but to Aleppo only 50 years ago for getting help to manage for their farming animal problems.

Veterinarian: is available in Abu Galgal at present. 20 years ago Munboj and Aleppo were the places to find a veterinarian, but Aleppo was the only place 50 years ago. Many said that 50 years ago, they were not used to go to the veterinarian. Slaughtering the sick sheep was the remedy.

Pharmacy: is available now in Abu Galgal, but in Munboj 20 years ago, and Aleppo 50 years ago.

Doctor: is available now in Abu Galgal, but in Munboj 20 years ago, and Aleppo 50 years ago. Many interviewed farmers mentioned that there was one doctor in Munboj 50 years ago.

Hospital: is available in Munboj at present, while 20 and 50 years ago they had to go to Aleppo for emergency cases.

Electricity: all the villages have access to electricity at present. Qana Qubli was the first village which had it in 1980, while Halula is the last one in 2004.

“Bazar”⁹: has been established in Abu Galgal since 1994. Monday is the active day. Its clients come from the surroundings with an average distance of 0-35 km. Mainly, it's a market for sheep, goats, lambs, clothes, and house tools.

9.- Bazar is an uncovered market, which is held once a week.

Telephone line: Qana Shamali, Kherbet Bshar, Jdaydet al-Fers, and Kherbet al- Twaini have had access since 1999, while all the rest have not.

The infrastructure is reasonably in a good status in the study region. Asphalt roads reach almost to all the communities; if not to the community itself, it should be very close. Transportation services are available to all the communities.

There is at least a preliminary school in each community. In some of the communities, an intermediate school is available too. But none of the secondary schools are available in the study region, and the nearest one is in Abu Galgal.

Health center, private doctor, pharmacy, tractors workshop, veterinarian, and an agricultural extension unit are not available in the study region. The nearest location to each is in Abu Galgal. The distance from the study region to Abu Galgal ranges between 2 and 15 km.

The main market for the inputs of production and for house needs is in Munboj, but there are shops in Abu Galgal that can provide the people with simple house needs like sugar, tea, cigarettes and others. With respect to the market of dairy products, Munboj, Abu Galgal and the community itself are the markets for these products. Choosing the market depends on the marketed quantity of the product; the nearest is for the small quantity.

For marketing alive animals, the households deal with the Aleppo market in case of big numbers, and Munboj for small ones. The distance from the study region to Aleppo ranges between 105 and 115 km.

The feedstuff market for sheep is in Munboj mainly, but big herders deal with Aleppo.

On each Monday, a weekly common market (Bazaar) is held in Abu Galgal. This bazaar is mainly for selling and buying animals in small quantities, and house needs are found too. The household who needs to sell few sheep can do it in this market.

Drinking water for man and animal is available from government net, private wells, and the Euphrates.

Four communities have a government drinking water net, but it is not regularly in operation. The main source of drinking water is from private wells in the study region. Herders with big flock size transport water from the nearby lake.

Electricity is available in all the communities of the study region. The nearest hospital is located in Munboj town. The distance from the study region to Munboj ranges between 22 and 35 km. Telephones exist in four communities.

INSTITUTIONS AND CONFLICTS

Leaders and committees

Eight communities are led, by a leader, and four ones by a committee. In general, the leader is found in the communities, which are relatively small and the

households of which, come from one grand father. While committees are found in relatively big communities, and the households of each belong to more than one grandfather, where these grandfathers had no blood relation among themselves. Normally leader or committee members are not elected, but they inherit the leadership from their fathers traditionally. These persons belong to traditional notable families, which have had the leadership tribally since decades. Just 50 years ago, leaders were very powerful persons among their communities that nobody, in their communities, could object on their decisions, which might be serious ones. But things have changed and nowadays leaders or committees are representing their communities in front of the other communities or the government. The question of what are the main successful activities of the leader or committee, 11 communities mentioned that solving conflicts either in the community itself or between the community and another one is one of the activities. 6 communities said that representing them to the authorities is a second one. 3 communities added that the ability to convince the households with a collective action is a third activity. But only 2 communities mentioned that the leader or committee could take a decision on behalf of the households without consulting them.

Type	Number of communities
Leader	8
Committee	4
Total	12

Table 3.1. Type of leadership in the region of Halula, Syria, 2004.

	Number of communities	Frequency	Valid Percent
Solve conflicts	12	11	91.7
Deal with authorities	12	6	50.0
Take a decision	12	2	16.7
Convince the members to cooperate	12	3	25.0

Table 3.2. Most successful activities of leaders and committees in the Region of Halula, Syria, 2004.

Conflicts

Not many conflicts have happened during the last five years. 9 communities mentioned that they haven't had any. Three communities mentioned that they had 2 conflicts because of the land boundaries and one because a household wanted to build a house in the village, but his neighbor opposed him. The leaders and

the relatives solve the three problems already. It's known about Bu Banna and Ghanayem tribes, that they are peaceful people have no problems neither among themselves, nor with their neighbors.

Type of conflict	Frequency	Date	Solved or not	Who solved it
Boundaries	1	2000	yes	Relatives
Boundaries	1	2004	yes	Leader
No conflicts	9			
Building a new house in the village	1	2000	yes	Leader
Total	12			

Table 3.3. Details of conflicts, which occurred during the last five years in the region of Halula, Syria, 2004.

COOPERATIVES

There are 6 communities that have cooperatives, while the other 6 don't. a small quantity of supplementary feed is given to the members by the cooperative in cash and with subsidized prices, but the given quantity covers a small percentage of the needs. The rest is bought from the market in high prices.

Members, who have irrigation, receive short-term loans from the government agricultural bank, through the cooperative. These short-term loans cover the inputs expenses of the major crops as cotton and irrigated wheat. And credited members must pay back these debts as soon as they harvest. Long-term loans were mentioned in Sekkawayeh only, to cover the expenses of purchasing new engine and water pump. There are no loans for rainfed farming in the study region, but the cooperative helps in providing the seeds and fertilizers, from the governmental related organizations, in prices less than the markets, but in cash.

DYNAMICS OF TECHNOLOGY

The technologies, which are essential for agriculture production and for the social and economical development in the study region, were rare 50 years ago. And their development has been very slowly since then. 2 tractors only were in the study region 50 years ago. The number has increased to 21 and 83 tractors 20 years ago and at the present time respectively. And the mean number of tractors per community has increased from 0.2 to 6.9, 50 years ago and at present. Other technologies like combine, car, or thresher have not increased yet much.

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	Frequency	Members No.	Type of activities
Fers Saghir	1	50	Short term loans for irrigated wheat and cotton, and Barley seeds and fertilizers in cash
Kherbet Twaini	1	150	Barley seeds and fertilizers in cash
Mahsheet Asheikh 'Obeid	1	52	Barley seeds and fertilizers in cash
Qana Qubli	1	10	Short term loans for irrigated wheat and cotton, and Barley seeds and fertilizers in cash
Sekkawayeh	1	30	Short term loans for irrigated wheat and cotton, and Barley seeds and fertilizers in cash
Tal 'Arresh	1	220	Short and long term loans
Total	6	512	

Table 3.4. Cooperatives, their activities and number of members in the region of Halula, Syria, 2004.

Type	Number of communities	At Present		20 years Ago		50 years Ago	
		Mean	Sum	Mean	Sum	Mean	Sum
Tractors	12	6.9	83	1.8	21	0.2	2
Thresher	12	1.2	14	0.8	9	0	0
Combine	12	0.3	3	0.2	2	0	0
Car	12	0.4	5	0.5	6	0.3	3
Pick up	12	3.4	41	0.4	4	0	0
Lorry	12	0.7	8	0.1	1	0.1	1
Motorcycle	12	14.5	174	1.3	15	0	0
Traizineh	12	0.5	6	0.1	1	0	0
Seeder	12	2.8	33	0.8	10	0	0

Table 3.5. Dynamics of different types of technology during the last 50 years in the region of Halula, Syria, 2004.

Type	Number of communities	Minimum	Maximum	Mean
Diesel engine	9	1950	2000	1965
Water pump	9	1950	2000	1965
Developed irrigation system	6	2002	2004	2002
Thresher	8	1979	2004	1987
Television	12	1979	2002	1985
Improved seeds	12	1971	1998	1981
Fertilizers	12	1960	1989	1975

Table 3.6. First year of the introduction of technologies in the Region of Halula, Syria, 2004.

The year that the different agricultural technologies were introduced into the region for the first time vary from a technology to another; diesel engine and water pump were introduced into the region as early as in 1965, while others like modern irrigation systems (sprinkles) as late as in 2002.

CHARACTERISTICS AND DYNAMICS OF THE FARMING SYSTEM

Resources

Human resources

Family size

The average family size is 8.4 family members. Men and women are both equally represented. The average

percentage of the family members below 10 years old is 30.6% of the family.

Human population

It has increased in the study region from 7860 to 11050 people (40.59%) during the period between September 1994 and September 2004. This reflects the fast population increase in the study region.

Dynamics of households

The number of households has increased rapidly in the study region, during the last fifty years, from 341 fifty years ago to 1880 households at present time.

The average households' number per community has increased from 28.4 to 156.7 households during the same period.

Number of	Number of households	Minimum	Maximum	Mean
Children below 10 years per family	27	0	6	2.6
Women per family	27	1.0	6.0	2.8
Men per family	27	1.0	8.0	3.0
Persons per family	27	3.0	17.0	8.4

Table 4.1. Demographic features of the study region of Halula, Syria, 2004.

serial	Community name	Sep-94	Sep-04
1	Halula	408	574
2	Sekkawayeh	441	620
3	Tal 'Arresh	1.167	1.640
4	Qana Shamali	566	796
5	Kherbet Bshar	630	886
6	Qana Tahtani	515	724
7	Jdaydet al-Fers	510	717
8	Mahsheet Asheikh 'Obeid	767	1.078
9	Mahsheet al-Tawaheen	400	562
10	Qana Qubli	1.025	1.441
11	Kherbet al-Twaini	571	803
12	Fers Sagheer	860	1.209
	Total	7.860	11.050

Table 4.2. Human population increase in the region of Halula, Syria, 2004.

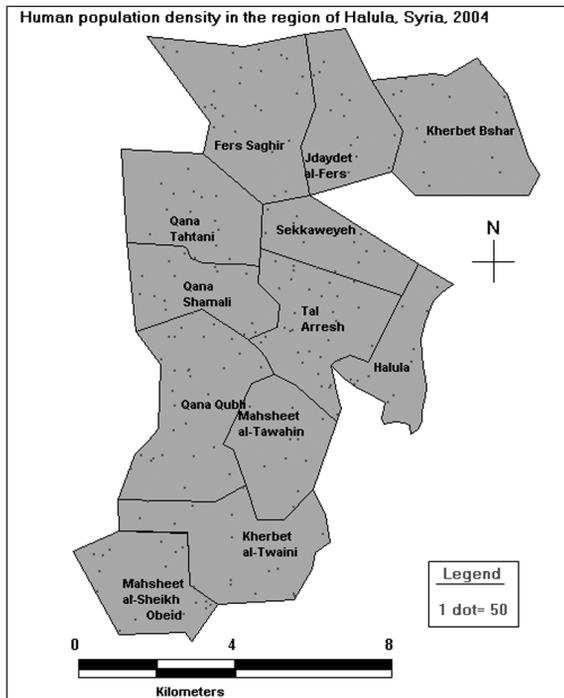


Figure 4.1. Population density in the region of Halula, Syria, 2004.

The communities are different in household's size. There are communities that have as much as 350 households, while some others have as small as 30 households at present time.

In some of these communities, a part of the households have immigrated either because of the limited resources or a dispute, which occurred among the different groups of the community. Some households immigrated recently and others long time ago.

Immigration of households is increasing through the time; the sum of the households who immigrated from

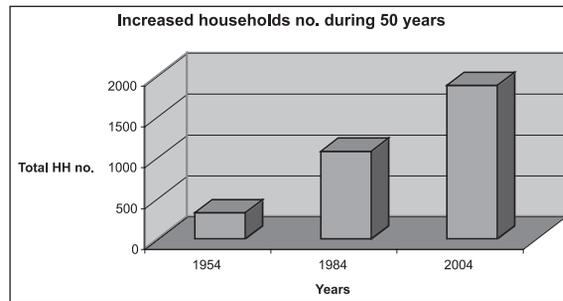


Figure 4.2. The development of the households' number during the last 50 years in the region of Halula, Syria, 2004.

the study region 50 and 20 years ago, and at present is 15, 148, and 337 households respectively.

Illiteracy

It is defined here as the inability to read and write. The percentage of the illiteracy among men and women is 42% and 71% respectively. It is higher at women than in men.

	Number of households	Sum	Percentage of illiteracy
Men number	27	81.00	
Men illiterate number	27	34.00	42%
Women number	27	76.00	
Women illiterate number	27	54.00	71%

Table 4.4. Illiteracy percentages among men and women in the region of Halula, Syria, 2004.

Education

The number of children, between the age of 5 and 14 years old, is 3303¹⁰ children in the study region. Those

	Time	Number of communities	Minimum	Maximum	Mean	Sum
	At present	12	30.0	350.0	156.7	1.880.0
Total households number	20 years ago	12	35.0	220.0	89.4	1.073.0
	50 years ago	12	16.0	50.0	28.4	341.0
	At present	12	30.0	200.0	128.6	1.543.0
Resident household number	20 years ago	12	30.0	200.0	77.1	925.0
	50 years ago	12	16.0	50.0	27.2	326.0
	At present	12	0.0	150.0	28.1	337.0
Immigrant household number	20 years ago	12	0.0	75.0	12.3	148.0
	50 years ago	12	0.0	12.0	1.3	15.0

Table 4.3. Households dynamics during the last 50 years in the region of Halula, Syria, 2004.

10.- Based on the official figures of the population statistics, which was done in 1994.

	Gender	Number of communities	Minimum	Maximum	Mean	Sum	Total
University	Males	12	0	6	2.1	25.0	
							27.0
Secondary school	Females	12	0	2	0.2	2.0	
							67.0
Intermediate school	Males	12	0	15	5.5	66.0	
							167
Preliminary school	Females	12	0	1	0.1	1.0	
							1056
	Males	12	1	30	13.3	159.0	
							1056
	Females	12	0	3	0.7	8.0	
							1056
	Males	12	8	160	60.7	728.0	
							1056
	Females	12	3	80	27.3	328.0	
							1056

Table 4.5. Males and females number who have accomplished their study in the different education stages in the region of Halula, Syria, 2004.

children must complete the basic education, which includes the preliminary and intermediate stage, but as we see below that only 1223 child are attending in these two stages. This means that 63% of the total numbers of children don't follow the basic education. Whenever the education level increases, the number of students highly decreases. The total number of male and female students in the preliminary stage is 1056 students; while in the secondary stage the number is 67 students.

There is a large difference between genders, especially when the education level is higher. In the preliminary stage, the males' number is 728, while the females' number is 328 students.

Housing

The use of modern houses in a certain community in the Syrian countryside reflects the standards of living in that community. The household whose farm and off-farm income enable him to have savings, building a modern house would be among his priorities. Therefore, the percentage of modern houses is in a certain

community, is a wealth indicator that reflects the level of the agricultural production and the status of the available natural resources.

The mean percentage of modern and traditional¹¹ houses that exist in the study region is 32.1 and 67.9% respectively. This means that almost two thirds of the households are not able to have a modern house because of their low farm and off-farm income. 45.4% and 54.6% of the total number of houses are less and more than 3 rooms. The mean percentage of the houses, which have a toilet&bathroom and a backyard, is 7.9 and 44.5% respectively. The availability of the toilet& bathroom reflects the healthy conditions under which the households are living. The percentage of the backyards tells us about the population density in the area specified for housing. And as high as the percentage is, the density would be less.

The date in which the first house was built tells us when the communities in the study region were established and started to use the natural resources there. For 5 communities the date was between 1850 and 1910, while the other communities could not answer the question.

	Number of communities	Minimum %	Maximum %	Mean %
Traditional houses	12.0	10.0	96.7	67.9
Modern houses	12.0	3.3	90.0	32.1
Less than 3 rooms houses	12.0	0.0	96.7	45.4
More than 3 rooms houses	12.0	3.3	100.0	54.6
Houses have toilet& bathroom	12.0	0.0	50.0	7.9
Houses have backyards	12.0	0.0	100.0	44.5

Table 4.6. Percentage of traditional and modern houses, less and more than 3 rooms houses, and with bathroom and backyard Houses, in the region of Halula, Syria, 2004.

11.- Which is built from mud bricks.

	Number of communities	Minimum %	Maximum %	Mean%
Percentage	12	5.00	100.00	66.0

Table 4.7. Percentage of households who still make their bread by themselves in the region of Halula, Syria, 2004.

Nutrition

Bread is a basic component of the daily food system. It is made of wheat at present. 20 years ago, the majority of the population used wheat for making bread, and some used a mixture of wheat and barley. 50 years ago, they used pure barley for making bread or mixed either with wheat, or white maize.

66.0% of the resident households are still making their bread by themselves, while the other 34% buy the bread from the market. When the communities were asked why do they still make it at home? 81.8% mentioned that oven is far from their community, and 18.2% said that baking by themselves is cheaper than buying it from the market. They still use the traditional method of baking the bread "Saj". Saj is a thin concaved metal disc. Its diameter is almost 50 cm. It would be heated over a fire, which is made of dry shrubs. The loaf is put on the heated disc and baked.

The daily breakfast in the study region contains bread and tea as basics of everyday breakfast, while cheese, yogurt, jam, "Debs"¹², "Halaweh"¹³, Za'tar, "Ka"¹⁴ek", eggs and olive oil are contained one of them or more in the breakfast depending on their availability.

Lunch is composed of cooked, either "burghol" or potato, or rice with cooked vegetables like tomato and squash, or tomato and beans, or tomato and okra. Or fried potato, and either eggplant, or squash, or cauliflower.

Dinner always is same as the lunch of the same day; what is cooked for lunch is used for dinner too.

Their diet is poor of proteins. Meat or chicken is used occasionally or in special opportunities.

Bread, burghol, potato, tomato, tea, and sugar are the main items in the diet and much more consumed than the others.

Social traditional habits

Traditional tribal habits and relations are still strong in the study region. The twelve communities still participate in paying the blood compensation.

Yes or not	Frequency	Valid Percent
Yes	12	100.0

Table 4.8. Percentage of the communities still participate in blood compensation in the region of Halula, Syria, 2004.

The "Maher" is a sum of money, or its equivalent in sheep, or land, which is paid by the bridegroom to the bride's father at one time before getting married. It is an old tribal and traditional habit among the Arabian tribes. This habit is different completely from the Islamic religion laws, which are applied in the urban areas. The table below shows that the habit is still used in the study region, and it shows the development of Maher during the last 50 years.

Among the traditional tribal habits, is that the male has the right to marry his female cousin. Due to this habit, the female has only one option of two; either to accept to marry her cousin, or to remain all her life unmarried if the male cousin insists on marrying her. This habit has been become weaker than before, during the last twenty years. Results show that the mean percentage of marriages among direct cousins, far cousins, same tribe, and with strangers are 36.1, 11.1, 30.64, 22.1% of the total marriages which occurred during the last five years, respectively. This means that the habit is diminishing in the study region.

But, still most of the marriages are happening between couples that belong mainly to the study region. The

Time	Number of communities	Minimum	Maximum	Mean
Present	12	100000	200000	152083.3
20 years ago	12	10000	70000	38333.3
50 years ago	12	1500	6000	2833.3

Table 4.9. Maher value (Syrian Lira) at present, twenty and fifty years ago, in the region of Halula, Syria, 2004.

12.- Is a sweet food made of dried grape juice.

13.- Is a sweet food made of sugar, sesame oil and a special plant called 'Aslaj.

14.- Is thick toasted bread type.

		Number of communities	Minimum	Maximum	Mean
	Number of marriages	12.0	4.0	50.0	15.7
Percentage of marriages %	Among direct cousins %	12.0	8.0	80.0	36.1
	Among far cousins %	12.0	0.0	40.0	11.1
	With same tribe %	12.0	0.0	92.0	30.6
	With strangers %	12.0	0.0	60.0	22.1

Table 4.10. Percentage of marriages with direct and far cousins, same tribe, and with strangers during the last five years in the region of Halula, Syria, 2004.

percentage of marriages with strangers is just 22.1% from the total marriages, which happened during the last five years.

Livestock resources

In general, the importance of sheep breeding has decreased in the study region since the last few decades. The households were moving Bedouins depending on sheep breeding for their living more than fifty years ago. Most of the communities in the study region have lost their common rangeland, either because of cultivation, or confiscated by the state for making a protecting zone around the new lake, or forestry activities. In addition to that the fallow system disappeared from the crop rotation, therefore limited grazing areas have remained for their flocks, and consequently the sheep flock sizes have decreased, specially for the households who were involved in irrigation. Just Kherbet al-Twaini, and Mahsheet al-Tawaheen community still the sheep have some economic importance, where they have almost 50%

and 14.3% respectively of the total sheep number in the study region which is 14050.

Goats number in the study region is small; 742 goats. Many communities have a very little number of goats as we see the minimum is just 1, and few have the most number of the goats as we see the maximum is 200 goats. Goats are bred mainly for the house consumption, since their milking season period lasts longer than sheep's and produce more milk too.

The percentage of the households who don't have small ruminants is almost 49.5% of the total resident household's number in the study region. The ones who have a flock size more than 20 sheep, which can be considered as an important source of income, are not more than 10.1%.

Dairy cows have been introduced into the study region since the time when sheep started to decrease.

Their total number in the study region is 168 cows. Their number per community ranges between 5 and 30 ones. Their milk production is used for the house consumption and market, but they are of low milk

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Number of	Number of Communities	Minimum	Maximum	Mean	Sum
Sheep	12.0	100.0	7000.0	1170.8	14050.0
Goats	12.0	1.0	200.0	61.8	742.0
Dairy cows	12.0	5.0	30.0	14.0	168.0

Table 4.11. Minimum, maximum, mean and sum number of sheep, goats, and dairy cows in the farming system of Halula region, 2004.

Flock size	Number of resident households					
	Number of communities	Minimum	Maximum	Mean	Sum	% of total residents
0	12	10.0	150.0	63.6	763.0	49.5
1-10	12	0.0	100.0	36.7	440.0	28.5
11-20	12	0.0	56.0	15.3	183.0	11.9
21-50	12	0.0	20.0	6.9	83.0	5.4
51-100	12	0.0	10.0	3.1	37.0	2.4
101-200	12	0.0	15.0	2.3	27.0	1.7
>200	12	0.0	8.0	0.8	10.0	0.6

Table 4.12. Different small ruminants flock sizes in the farming system in the region of Halula, Syria, 2004.

Dairy cows flock size	Number of communities	Number of resident households				Percentage
		Minimum	Maximum	Mean	Sum	
0	12	24	195	117.6	1411	91.4
1	12	0	30	9.3	111	7.2
2	12	0	6	1.3	15	1
3	12	0	4	0.4	5	0.3
4	12	0	0	0	0	0
5	12	0	1	0.1	1	0.1

Table 4.13. Different dairy cows flock sizes in the region of Halula, Syria, 2004.

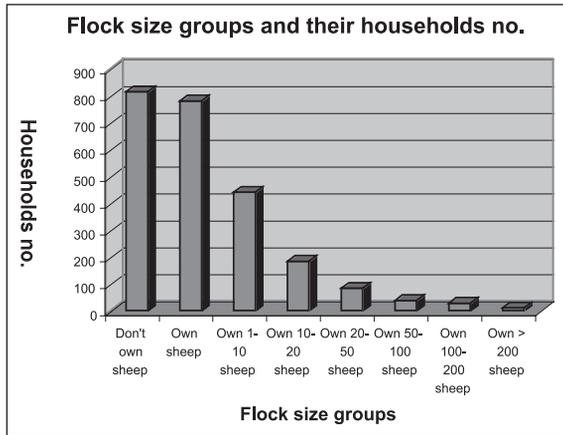


Figure 4.3. Flock size household groups of small ruminants in the region of Halula, Syria, 2004.

production as they are a hybrid between Dutch and local races. 91.4% of the resident households don't have cows, 7.2% own one cow, 1.0% own two cows, and 0.3% own three cows.

Land resources

Total area of the study region is 9318 hectares, 8019 hectares is cultivated and 1299 is not. 7165 hectares is rainfed-cultivated area and 854 hectare is irrigated. Mean total cultivated area per community is 668.3 hectares. Mean of rainfed cultivated area and irrigated area is 597.1 and 71.2 hectares respectively.

These areas vary from community to another one. And the range is really wide between small and large ones. So while we see on one hand, the minimum of the cultivated area is 94 hectare, on the other hand the maximum is 1664 hectare. With respect to the irrigated areas, some communities have 0 hectare while other some have 200 hectares.

Type	Number of Communities	Minimum	Maximum	Mean	Sum
Total area	12	94.0	1664.0	776.5	9318.0
Cultivated area	12	94.0	1664.0	668.3	8019.0
Rainfed cultivated area	12	15.0	1514.0	597.1	7165.0
Rainfed cropping area	12	15.0	1512.0	584.3	7012.0
Rainfed fruit trees area	12	0.0	50.0	12.8	153.0
Irrigated cultivated area	12	0.0	200.0	71.2	854.0
Irrigated cropping area	12	0.0	200.0	71.0	852.0
Irrigated fruit trees area	12	0.0	2.0	0.2	2.0
Well irrigated area	12	0.0	90.0	27.5	330.0
River irrigated area	12	0.0	180.0	43.7	524.0
Non cultivated area	12	0.0	472.0	108.3	1299.0
Forested area	12	0.0	150.0	23.3	280.0
Confiscated area	12	0.0	284.0	28.4	341.0
Common grazing area	12	0.0	181.0	56.5	678.0

Table 4.14. Land use and allocation of land resources in the study region of Halula, 2004.

Land size/ hectare	Number of communities	Number of households				Percentage%
		Minimum	Maximum	Mean	Sum	
0	12	10	150	94.8	1132	60.2
< 2	12	0	173	24.6	294	15.6
2.1-5	12	0	54	14.5	173	9.2
5.1-10	12	0	32	11.8	140	7.4
10.1-20	12	0	43	9.4	113	6.0
>20	12	0	14	2.5	28	1.5
Total					1880	99.9

Table 4.15. Categories of Farm size and the related percentage of households in the region of Halula, Syria, 2004.

153 hectares out of the rainfed-cultivated area, is planted with fruit trees. The rest of the rainfed-cultivated area is used for cereal crops.

Almost all the irrigated cultivated area is used for crops. 56.5 hectare is the average common grazing area per community. Some communities have 0 hectares of grazing area, and other some have as much as 200 hectares.

More than 60% of the total number of households has no land in the study region. And the majority of the ones who have land, own small areas; 9.2% and 15.6% of the total households number own land area less than 5 hectares. We have to consider the fact that the study region is located in dry areas, where such small farm size would fail to provide the households with what is needed for a minimum level of living standards. As we see, only 7.5% of the total number of households have a farm size is more than 10 hectares, which might be considered relatively more appropriate for providing

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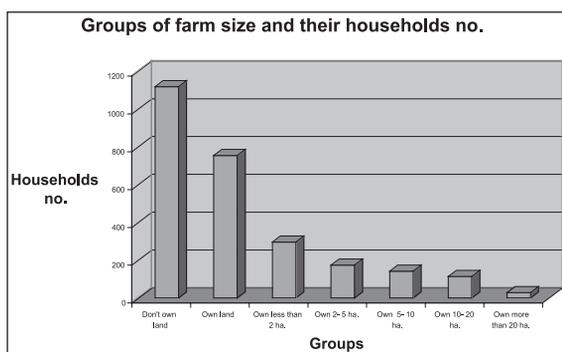


Figure 4.4. Farm size groups of households in the region of Halula, Syria, 2004.

	Number of Communities	Minimum	Maximum	Mean	Sum
Number of HH have well irrigation	8	1.0	40.0	14.9	119.0
Well irrigated area	8	0.1	10.0	0.7	
Number of HH have river irrigation	7	2.0	70.0	21.4	150.0
River irrigated area	7	0.2	20.0	1.0	

Table 4.16. Number of households have irrigation from wells and river, with their irrigated land Size in the region of Halula, Syria, 2004.

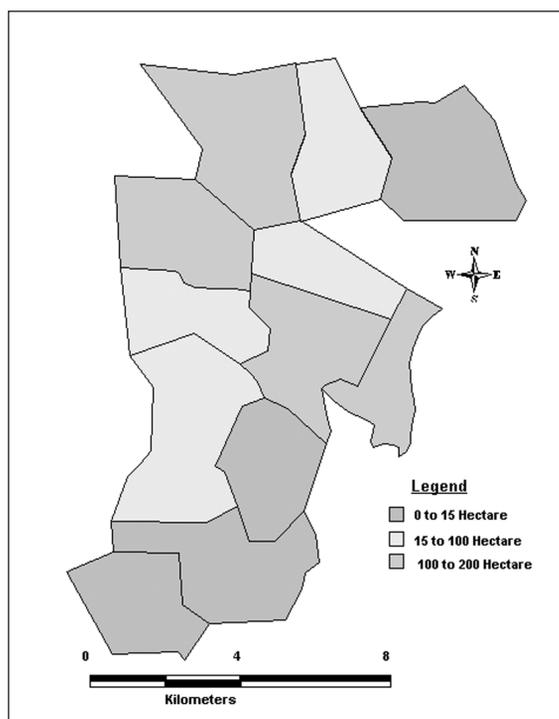


Figure 4.5. Distribution of the irrigated area in the communities of Halula Region, Syria, 2004.

reasonable living standards to the households under such harsh environmental conditions.

Eight communities have well irrigation, and seven have river irrigation. While four have no irrigation at all. 119 and 150 households have well and river irrigated area respectively. Some of the households have both, but other some have one type of irrigation.

	Good		Medium		Bad	
	Number of years	Rainfed barley yield/ kg/ ha	Number of years	Rainfed barley yield/ kg/ ha	Number of years	Rainfed barley yield/ kg/ ha
Number of communities	12	12	12	12	12	12
Mean	2.3	2420.8	3.5	1337.5	4.2	275

Table 4.17. Good, medium, and bad years, and their barley yield during the last 10 years in the region of Halula, Syria, 2004.

The mean number of well irrigators per community is 14.9 ones, but it varies from 1 irrigator to 40 ones in the communities which have well irrigation. The mean well-irrigated area per household is 0.7 hectare, and it ranges between 0.1 and 10 hectares.

The mean number of river irrigators per community is 21.4 and it ranges between 2 and 70 irrigators. The mean river irrigated area per irrigator is 1 hectare and it ranges between 0.2 and 20 hectares.

Two types of land property exist in the study region: private and benefiting from the state lands. 70.8% of the land property is private, and benefiting from state lands is 29.2%. No mixed property type is found in one community, but only one type exists. No other types like agrarian reform or renting from the state lands property are found in the study region.

Abu Galgal and its surrounding were famous with its water resources just thirty years ago, and Abu Galgal

Type of property	Number of communities	Minimum	Maximum	Mean
Rented from state %	12	0	0	0
Benefited from state lands %	12	0	100	29.2
Agrarian reform %	12	0	0	0
Private %	12	0	100	70.8

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Table 4.18. Land property types and their percentage in the Region of Halula, Syria, 2004.

In the dry areas, the mean yearly precipitation is fluctuating from a year to another. In such areas, bad, medium, and good year are local terms to describe the precipitation quantity. During the last ten years, the mean number of good, medium, and bad years was 2.3, 3.5, and 4.2 years. The average yield of rainfed barley, in a good, medium, and bad year is 2420.8, 1337.5, and 275.0 kg respectively per hectare.

Based on the above results, we can say that in each ten years of time, 4.2 years are bad and in which the rainfed barley average yield is 275 kg per hectare.

River was amongst. Fruit trees like apricot, peach, walnut, pomegranate, grape, and others were widely spread out in the study region. This river dried up in early 1980's and led to the death of these fruit trees. In table, fruit trees, pomegranate, grape, and fig trees were mentioned by seven communities. Five communities mentioned white maize, and it was used for making bread, but the wheat replaced it. Six communities mentioned Qunneb, and it was used to make bags, but the cotton replaced it in the mid 1950's.

	Category 1 depth= 0-0.5 m	Category 2 depth= 0.6-1m	Category 3 depth= 1.1-2 m	Category 4 depth= 2.1-5 m	Category 5 depth= 5.1-25 m	Total
Area/ ha	5413	700	997	266	643	8019
Fertility	3.4	3.2	2.3	2.2	1.8	
Stones content	1.6	2.4	3.2	4	4	
Percentage of the category %	67.5	8.7	12.4	3.3	8.0	100.0

*1 very fertile, 2 fertile, 3 medium, 4 poor

**1 too much stones, 2 medium, 3 little, 4 stone less.

Table 4.19. Soil categories of the cultivated area (depth, area, fertility, and stones contents) in the Region of Halula, Syria, 2004.

Soils

The communities were asked to tell, into how many plots that their cultivated area is divided, and to describe each plot in relation to area, depth, fertility, and stone contents. Category 1 whose depth is 0- 0.5 m, includes 67.5% of the total cultivated area in the study region. Its fertility varies from medium to poor, and its stone contents vary from medium to too many stones. Shallow, stony, and poor fertility- soils are used for growing barley, since it is the only crop, which can survive in such soil, and under dry environmental conditions. Recently, fruit trees like olive, pistachio, and almond have been introduced to the region. The same shallow soils are used for planting these trees.

Category 5 has the deepest and best soils, its depth is 5.1- 25 m, and its percentage is 8% of the total cultivated area. Its fertility ranges between fertile and very fertile, and it doesn't contain any stones. Mainly these fertile soils are used for the irrigated crops, or for the rainfed wheat.

91.7% of the communities mentioned that their soils have degraded in term of productivity. And when they were asked about the reasons, which have caused the degradation, 9 communities mentioned that excluding the fallow from the crop rotation is the reason for the degradation, and 2 said that the use of the barley or wheat as a monocrop is the reason. While 1 community mentioned that because of the soil has been used since a long time, the fatigue has affected on the soil.

	Frequency	Valid Percent
Yes, there is degradation	11	91.7
No, there is no degradation	1	8.3
Total	12	100
Excluding Fallow	9	75
Monocrop cultivation	2	16.7
Fatigue	1	8.3
Total	12	100.0

Table 4.20. Existence of soil degradation and its reasons in the region of Halula, Syria, 2004.

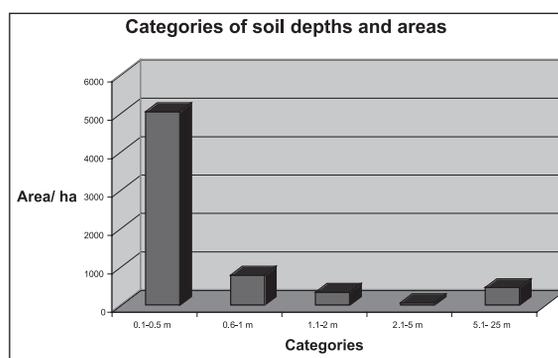


Figure 4.6. Categories of soil in the region of Halula, Syria, 2004.

Management of the resources

Labor economy

Assignment of work to gender

Men are responsible for the farm management. They do the mechanical farm work. They buy the farming inputs and house needs, and sell the farm products. Also, men do the off-farm work.

Women are doing all the hand work of the farm, like hand planting, weeding, hand harvesting, collecting the fruits from the fruit trees, watering the sheep or cows, milking, feeding. Women do sometimes, agricultural off-farm labor work, like weeding. Women are doing also all the housework.

Children from both sexes are involved in some agricultural activities, like shepherding and helping the women in farm, off-farm and house work.

The results of the household survey showed that 28.2% of the 78 women who belong to the interviewed households, work on their farm, 29.5% work with their own flock, 11.5% do agricultural labor work, 26.9% do the housework only, 2.6% do nothing, and 1.3% work as a labor at the archeological team. Men are more involved in off-farm labor work and business, where 22.3%, 3.7%, and 12.3% from 81 men, work as unskillful daily labors, traders, and as skillful labors, respectively.

The percentage of unemployment among men is higher than among women; 2.6% and 17.3% respectively.

Type of activity	Women		Men	
	Frequency	Valid Percent	Frequency	Valid Percent
Work on their own farm	22	28.2	31	38.3
Works with their own flock	23	29.5	4	4.9
House work	21	26.9	0	0
Unskillful daily labors	9	11.5	18	22.3
Does not work	2	2.6	14	17.3
Traders	0	0	3	3.7
Skillful labors	0	0	10	12.3
Works at the archeological excavation team	1	1.3	1	1.2
Total	78	100	81	100

Table 4.21. Women and men activities in the region of Halula, Syria, 2004.

Off-farm work

Off farm activities are found on a large scale in the study region. Off-farm activities are strongly needed for the households to make their living, since the farm income fails to cover the living expense by it. The reasons for carrying out the off-farm activities are the high number of landless households, the small farm size, the increasing living expenses, the dry conditions, which affect on the crop production and on its sustainability, lack of cash for investment, the mismanagement of the natural resources, and that the livestock is not exploited in the way that it should be.

Off-farm type and location

The main off-farm type is the labor work; the agricultural and the non-agricultural one.

Agricultural labor work includes the hand harvesting of rainfed crops, and weeding, planting, irrigating, and harvesting of irrigated crops, and shepherding. Mainly this kind of work is not on continuous basis, but seasonal one. And normally the wages of such works are low. The study region and the surroundings are the location of such kinds of activities. Women and young men are mainly the ones who do these activities. 645 households, in the study region, whose women and children worked in cotton harvest. This means that 41.8% of the total resident households number are working as agricultural labors.

The non-agricultural labor work includes skilful and non-skilful labors. The skilful ones are working mainly in the construction of buildings. The non-skilful labors do all

kinds of the jobs, which don't need skills, like guards of buildings, or cleaning the streets, or assisting a skilful labor, or porters. Normally, the non-skilful labor jobs are of short term, it might range between one day or few months. While the skilful ones find jobs for longer periods than the non-skilful.

The non-agricultural labor work is mainly abroad of Syria. The countries, which the labors of the study region work in, are Lebanon, Jordan, the Gulph region, Libya, and Greece. 228 households, in the study region, have at least one labor that works in Lebanon. The minimum number of households who have at least one labor working in Lebanon is 2 households per community and the maximum is 80 households.

The employment at the government, private business like trading in animal feed stuff or alive animals and having small shops as groceries, and doing services with their own machines and vehicles to the others like plowing or threshing or harvesting or transporting, are other types of off-farm work. We see that the mean number of the households who have at least one employee is 9.3 households per community. The minimum number of households who have at least one employee per community is 0 household while the maximum is 40 households.

845 households are involved in the no-agricultural off-farm activities, which make 54.8% of the total number of resident households in the study region.

From what is mentioned above, most of the resident households are involved in off-farm activities, either in the agricultural or the non-agricultural one or in both.

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Off-farm type	Number of communities	Number of households			
		Minimum	Maximum	Sum	Mean
Employment at government	12	0	40	112	9.3
Trading	12	0	10	25	2.1
Shop owners	12	0	6	29	2.4
Threshers	12	0	4	11	0.9
Combiners	12	0	3	4	0.3
Plowers	12	2	14	66	5.5
Transporters	12	0	7	32	2.7
Seasonal agricultural activities	11	0	170	493	44.8
Lebanon laboring	12	2	80	228	19.0
Jordan laboring	12	2	50	189	15.8
Gulph laboring	12	0	51	143	11.9
Greece laboring	12	0	1	1	0.1
Libya laboring	12	0	5	5	0.4
Cotton harvesting	12	0	130	645	53.8
Crop sharing	12	0	25	64	5.3

Table 4.22. Categories of off-farm activities with minimum, maximum, sum, and mean of the households of each category in the region of Halula, Syria, 2004.

Very poor		Poor		Medium		Good	
Item	Frequency	Item	Frequency	Item	Frequency	Item	Frequency
Has no land	12	Has no land or small rainfed area	12	Has small land	12	Has big area of land	12
Has no livestock	12	Works as daily labor	12	Has sheep	12	Has irrigated land	12
Has no off-farm income	12	His children are small	12	Has regular job	12	Has more than a hundred sheep	8
		Has no livestock	11	Has sons work as labors	8	Has a business	6
		Has no profession	1	Has cows	4	Has vehicles	10

Table 4.23. Characteristics of the well being in the region of Halula, Syria, 2004.

Well-being

The community defined four categories of well being in the study region; very poor, poor, medium, and good. The communities were asked what are the characteristics of each category.

According to the results 100% of the communities said that the very poor category is the one, which has no land, no livestock, and no off-farm income.

Poor category was defined by 100% of the communities with having no land or small rainfed area, working as daily labor, and the children are small so they can't do off-farm work. 92% added having no livestock. And 8% said having no profession too.

The results showed that very poor and poor households percentage is 12.7% and 35.2% of the resident households in the study region. This is almost 50% of the households. And the percentage of the households who belong to the medium and good category is 42.1% and 10.0%.

Management of the livestock resources

Small ruminants

The management of small ruminants in the study region has been objected to drastic changes during the last few decades. The flock size, the feeding and grazing system,

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	Category 1 (Good)	Category 2 (Medium)	Category 3 (Poor)	Category 4 (Very poor)	Total
Households Number	155	649	543	196	1543
Percentage %	10.0	42.1	35.2	12.7	100.0

Table 4.24. Number and percentage of the households in the different categories of well-being in the region of Halula, Syria, 2004.

Medium category was described as the following: 100% said having small land, livestock, and having a regular job. 66.7% added having sons work as labors, and 33.3% said having dairy cows too.

100% said that rich category is characterized with having big land, and irrigated area. Also, 66.7% mentioned having more than 100 sheep, 50% said having a business or trade, and 83% said having vehicles.

and the seasonal migration of flocks were the ones, which were affected much by these changes. In general flock size has decreased in a way that breeding small ruminants has been changed from being a main source of income into a mean for providing the households with milk products for their own consumption. In the past, the participation of natural grazing in the yearly diet of small ruminants was higher than the present time, and the

	Number of cases	Range	Minimum	Maximum	Mean
Feeding cost	6	1436.4	1200.0	2636.4	1933.9
Health care cost	6	170.5	20.0	190.5	93.5
Drinking water cost	6	95.2	0.0	95.2	29.4
Shepherd cost	6	378.4	0.0	378.4	63.1
Total cost	6	1637.1	1220.0	2857.1	2119.8

Table 4.25. One ewe production cost in the region of Halula, Syria, 2004.

Season	Number of cases	Participation %		
		Minimum	Maximum	Mean
Spring	4	0.0	100.0	30.0
Summer	4	0.0	0.0	0.0
fall	4	0.0	.00	0.0
Winter	4	0.0	.00	0.0

Table 4.26. Percentage of native pastures participation in the feed diet of small ruminants in the region of Halula, Syria, 2004.

supplementary feed was use less. The diminishing role of natural grazing was because of the cultivation of the range areas until these areas have disappeared in most of the communities of the study region. And because of that the seasonal migration, especially during spring, southward to the Syrian rangelands for natural grazing, has stopped since few decades.

Animal feed sources

91.2% of the total production cost of small ruminants in the study region is for Feed cost; hand-feed and crop residues.

Hand-feed

The main types of the used hand feed stuffs are barley grains, wheat bran, sugar beet pulp, cotton by-products and cereal straw. The percentage of each type in the daily diet is not based on scientific nutritional calculations, but on their availability and prices in the market. Hand feed is used for more than 5 months in the year around, either pure or added during grazing crop residues or natural vegetation. Normally, it is used in the period from November until April.

Crop residues

Crop residues are cheap sources of feed and used for at least 5 months during the year; from May until October. The main crop residues in the study region are wheat and barley stubble, which remain after the harvest on the fields. This cereal stubble is composed mainly of the cereal stems and little amounts of grains that drop on the ground during the harvest operation. Other crop residues available in the region are cotton, maize, sesame, and vegetable residues. But they are not as important as the cereal stubble, since their areas are very small compared with the cereals.

Native vegetation

During spring, annual grasses grow on what's left from the range area of each community. Some shrubs can be found too on the range. The grazing of these grasses and shrubs is not of importance, due to the small areas available, high stocking rate, and the prevailing conditions of degradation. The mean participation percentage of the natural vegetation in the yearly feed diet is 30% during springtime in the four communities that have a range. The participation in summer, autumn, and winter is 0%.

Production system

The percentage of rams per ewe gives an idea about the fertility level of ewes during the short mating season, which last for less than one month. 9.1% of female yearlings per ewe look lower than it is needed for replacing old and sick ewes. The lambing rate, which is 1 lamb per ewe in one year, means that there is no twin production or second time of giving birth within one year. The productivity of the flock means the percentage of the ewes, which gave birth out of the ewes total number. The 2% of mortality among ewes looks normal, but the mortality of 11% among lambs is high. The milk yield per ewe is lower than the average in Syria, and it might be because of the shortage of the green gazing and protein-poor feed during the milking season.

The mating season is in the period from the mid of June to mid of July. The lambing season is in December and January. The milking season lasts mainly for 3 months; March, April, may, and ends in mid of June. The herders don't like to spend much money on the health care, but they depend on what is offered by the state for free. They don't have good knowledge of the diseases, and they say that the best remedy for the sick ewe is the knife.

Small ruminants production	Number of cases= 6
Rams per ewe	3.9%
Female yearlings per ewe	9.1%
Lambing rate	1
Productivity of the flock	81.3%
Mortality (ewes)	2%
Mortality (lambs)	11%
Milk quantity per ewe/ kg	24

Table 4.27. Characteristics of small ruminants production in the Region of Halula, Syria, 2004.

Consumed and sold milk products

The household consumed 76.9% of the total milk production in shape of raw milk, yogurt, cheese and ghee. The sold products were in shape of yogurt and cheese only. The mean consumed quantity of raw milk, yogurt, cheese and ghee per one household in the year 2004 was 16.7, 128.3, 25.8, and 15.1 kg respectively.

	Number of cases	Quantity in kg			
		Minimum	Maximum	Sum	Mean
Consumed milk	6	0.0	100.0	100.0	16.7
Sold milk	6	0.0	0.0	0.0	0.0
Consumed yogurt	6	30.0	200.0	770.0	128.3
Sold yogurt	6	0.0	450.0	450.0	75.0
Consumed cheese	6	0.0	70.0	155.0	25.8
Sold cheese	6	0.0	130.0	130.0	21.7
Consumed ghee	6	0.0	50.0	91.0	15.2
Sold ghee	6	0.0	0.0	0.0	0.0
Consumed wool	6	6.0	300.0	431.0	71.8
Sold wool	6	0.0	0.0	0.0	0.0

Table 4.28. Minimum, maximum, sum, and mean quantities of sheep milk products; the consumed and sold, in the region of Halula, Syria, 2004.

Dairy cows

Dairy cows are bred mainly in the study region for the house consumption of their milk products. The milking season duration is 200 days per year as an average. Average daily milk production per cow is 10 liters. The daily feed is composed of concentrated feed, which is bought from the government feed stuffs foundation, and straw. The cow breeders don't grow special crops for their cows as green grazing feed. Average production cost is 30000 S.L. per cow a year. The main part of the cost is for feed.

Management of the land resource

Land use

Rainfed barley and wheat are old crops in the study region, which were introduced in average in 1879 and 1895. While cotton, irrigated wheat, and olive, were introduced later in 1951, 1924, and 1982.

Barley and wheat are the only crops, which are grown rainfed. Their areas vary from community to another one. 66.1% of the rainfed cultivated area in the study region was sown with Barley, 28.2% with wheat, 2.1% with fruit trees, and just 3.6% was left as fallow.

Mean barley area was 4.9 hectares per landowner household and mean area of rainfed wheat was 1.2 hectares. The dominating rainfed crop rotation is cereal/

cereal. The reasons that were given by the households for not using the fallow were that they don't possess enough land for cultivation and the use of fertilizers, which can replace the fallow.

The main irrigated crops in the study region are wheat, and cotton. There are other crops of little importance like maize, sesame, broad beans and tomato. 22.8% of the irrigated cultivated area in the study region is sown with cotton, 67.1% sown with wheat, 5.9% broad beans, 3.4% sesame, 2.5% maize, and 0.8% with summer vegetables for the house consumption mainly. Mean cotton and wheat field area sown per household was 2.2 and 1.8 hectares.

Not many households are growing fruit trees in the study region. Such plantations are new in the region and haven't spread out much yet.

Crop production

Rainfed barley production: The mean field size is 4.8 hectares. Previous crop was barley for all the samples. 84% of the cultivation occurred in autumn. The cultivator was the only tool that was used for preparing the soil. 100% of the samples did not apply fertilizers. 90% of the samples were sown in October and November. Seeder sowed all fields. All fields were harvested by machine. And the average yield per hectare was 1077.1 kg.

Crop name	Number of communities	Introduction year		
		Minimum	Maximum	Mean
Cotton	7	1950	1954	1951.4
Irrigated wheat	8	1870	2001	1924.3
Olive	11	1870	2002	1982.1
Rainfed barley	11	1800	1910	1878.9
Rainfed wheat	6	1850	1950	1895.0

Table 4.29. The introduction year of cotton, irrigated wheat, olive trees, rainfed barley and wheat.

Total rainfed cultivated area/ hectare	Barley%	Wheat%	Fallow%	Olive trees%	Pistachio trees%	Grape trees%	Almond%	Total%
7165	66.1	28.2	3.6	1.7	0.3	0.1	0.04	100.04
Total irrigated area/ Hectare	Cotton	Wheat	Broad beans	Sesame	Maize	Summer vegetables	Olive	Total percentage
854	22.8%	67.1%	5.9%	3.4%	2.5%	0.8%	0.2%	102.7% ⁱⁱⁱ

Table 4.30. Percentage of the different rainfed and irrigated crops and trees were sown in the season 2003/ 2004 in the region of Halula, Syria, 2004.

Crop types	Number of households	Area in hectare			
		Minimum	Maximum	Sum	Mean
Irrigated wheat	11	.20	4.00	20.25	1.8
Irrigated cotton	9	.85	8.00	20.05	2.2
Rainfed barley	10	1.50	16.00	48.50	4.8
Rainfed wheat	3	.50	2.50	3.50	1.2
Olive	2	2	2	4	2.0
Pistachio	1	1	1	1	1.0

Table 4.31. Minimum, maximum, sum, and mean of the area of different rainfed and irrigated crops and trees sown by each landowner household in the region of Halula, Syria, 2004.

(Maize and some types of summer vegetables are sown after the irrigated wheat harvest; consequently the cultivated cropping area would be more than 100%).

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Barley production cases	Number= 10
Field size (ha):	
Mean	4.8
Min.	1.5
Max.	16
Previous crop	
Fallow	
Barley	100%
Wheat	
Time of cultivation	
Summer	16%
Autumn	84%
Cultivation tools	
Mold board	
Disc plow	
Cultivator	100%
Roller	
Seeding time	
September	10%
October	40%
November	50%
Seeding technique	

Seeder	100%
Other	
Fertilizer use	
Mineral	
Manure	
Harvest	
By machine	100%
By hand	
Not harvested	
Grain yield Kg/ha	
Mean	1077.1
Minimum	400
Maximum	1562.5

Table 4.32. Production techniques of rainfed barley in the region of Halula, Syria, 2004.

Rainfed wheat production: The mean field size is 1.2 hectares. Previous crop was rainfed wheat for all the samples. 100% of the cultivation occurred in autumn. The cultivator was the only tool that was used for preparing the soil. 100% used mineral fertilizers. 100% of the samples were sown in November. All fields were sown by seeder. All fields were harvested by machine. And the average yield per hectare was 1533.3 kg.

Rainfed production cases		Number= 3
Field size (ha):		
Mean		1.2
Min.		0.5
Max.		2.5
Previous crop		
Fallow		
Barley		
Wheat		100%
Time of cultivation		
Summer		
Autumn		100%
Cultivation tools		
Mold board		
Disc plow		
Cultivator		100%
Roller		
Seeding time		
September		
October		
November		100%
Seeding technique		
Seeder		100%
Other		
Fertilizer use		
Mineral		100%
Manure		
Harvest		
By machine		100%
By hand		
Not harvested		
Grain yield Kg/ha		
Mean		1533.3
Minimum		1200
Maximum		1700

Table 4.33. Production techniques of rainfed wheat in the region of Halula, Syria, 2004.

Irrigated wheat production: The mean field size is 1.8 hectares. Previous crop was wheat for 45.5% of the samples and cotton for 54.5%. 94% of the cultivation occurred in autumn. 38.3% of the samples used the moldboard for preparing the soil, 17.6% used disc plow, 26.5% used the cultivator, and 17.6% used the roller. 100% of the samples used mineral fertilizers and 9.1% used manure. 100% used the seeder for sowing the seeds. 100% were sown in November. 100% were harvested by machine, and the average yield was 3008.5 kg per hectare

Irrigated production cases		Number= 11
Field size (ha):		
Mean		1.8
Min.		0.2
Max.		4
Previous crop		
Fallow		
Barley		
Wheat		45.5%
Cotton		54.5%
Time of cultivation		
Summer		6%
Autumn		94%
Cultivation tools		
Mold board		38.3%
Disc plow		17.6%
Cultivator		26.5%
Roller		17.6%
Seeding time		
September		
October		
November		100%
Seeding technique		
Seeder		100%
Other		
Fertilizer use		
Mineral		100%
Manure		9.1%
Harvest		
By machine		100%
By hand		
Not harvested		
Grain yield Kg/ha		
Mean		3008.5
Minimum		1800
Maximum		4666.8

Table 4.34. Production techniques of irrigated wheat in the region of Halula, Syria, 2004.

Irrigated cotton: The mean field size is 2.2 hectares. Previous crop was irrigated wheat for 100% of the samples. 65.6% of the cultivation occurred in spring, 22.9% in summer, 8.6% in autumn, and 2.9% in winter. 17.1% of the samples used the moldboard for preparing the soil, 45.8% used disc plow, 20.0% used the cultivator, and 17.1% used the roller. 100% of the samples were sown in April. All fields were sown by hand. 100% used mineral fertilizers and 33.3% used manure. All fields were harvested by hand. And the average yield per hectare was 3064.8 kg per hectare.

Irrigated production cases	Number= 9
Field size (ha):	
Mean	2.2
Min.	0.85
Max.	8
Previous crop	
Fallow	
Barley	
Wheat	100%
Cotton	
Time of cultivation	
Summer	22.9%
Autumn	8.6%
Winter	2.9%
Spring	65.6%
Cultivation tools	
Mold board	17.1%
Disc plow	45.8%
Cultivator	20%
Roller	17.1%
Seeding time	
September	
October	
November	
April	100%
Seeding technique	
Seeder	

By hand	100%
Fertilizer use	
Mineral	100%
Manure	33.3%
Harvest	
By machine	
By hand	100%
Not harvested	
Grain yield Kg/ha	
Mean	3064.8
Minimum	2000
Maximum	4117.7

Table 4.35. Production techniques of irrigated cotton in the region of Halula, Syria, 2004.

ECONOMICS OF THE FAMILY-FARM HOUSEHOLD SYSTEM

Assessment of the crop income

The average yield of the rainfed and irrigated crops in the study region is low, compared with the average national number of the same crops. The average yield of cotton was 3064.8 kg per hectare in the study region in 2004. The national yield ranged between 3800 and 4200 kg per hectare during the period from 1997 to 2001.

Rainfed barley

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Item	Number of cases	Range	Minimum	Maximum	Mean
Production in kg	10	1162.5	400.0	1562.5	1077.1
Seeds quantity in kg	10	300.0	100.0	400.0	235.8
Seeds cost in S.L.	10	1950.0	800.0	2750.0	1861.6
Cultivation cost in S.L.	10	400.0	600.0	1000.0	770.0
Manure quantity in kg	10	0.0	0.0	0.0	0.0
Manure cost in S.L.	10	0.0	0.0	0.0	0.0
Nitrogen quantity in kg	10	200.0	0.0	200.0	89.4
Nitrogen cost in S.L.	10	2333.3	0.0	2333.3	924.0
Phosphorus quantity in kg	10	150.0	0.0	150.0	71.0
Phosphorus cost in S.L.	10	2300.0	0.0	2300.0	699.5
Herbicides cost S.L.	10	200.0	0.0	200.0	20.0
labors cost in S.L.	10	0.0	0.0	0.0	0.0
Harvest cost in S.L.	10	233.3	500.0	733.3	611.7
Transportation cost in S.L.	10	100.0	0.0	100.0	10.0
Bags cost in S.L.	10	937.5	0.0	937.5	390.4
Total return in S.L.	10	8200.0	2800.0	11000.0	8023.8
Total cost in S.L.	10	4550.0	2600.0	7150.0	5393.9
Net return in S.L.	10	5400.0	200.0	5600.0	2629.9

Table 5.1. Average cost/ benefit of one hectare of rainfed barley in the Region of Halula, Syria, 2004.

Rainfed wheat

Item	Number of cases	Range	Minimum	Maximum	Mean
Production in kg	3	500.0	1200.0	1700.0	1533.3
Seeds quantity in kg	3	150.0	350.0	500.0	450.0
Seeds cost in S.L.	3	680.0	4320.0	5000.0	4773.3
Cultivation cost in S.L.	3	0.0	600.0	600.0	600.0
Manure quantity in kg	3	0.0	0.0	0.0	0.0
Manure cost in S.L.	3	0.0	0.0	0.0	0.0
Nitrogen quantity in kg	3	100.0	100.0	200.0	166.7
Nitrogen cost in S.L.	3	860.0	1140.0	2000.0	1713.3
Phosphorus quantity in kg	3	50.0	0.0	50.0	16.7
Phosphorus cost in S.L.	3	570.0	0.0	570.0	190.0
Herbicides cost S.L.	3	0.0	0.0	0.0	0.0
labors cost in S.L.	3	0.0	0.0	0.0	0.0
Harvest cost in S.L.	3	1800.0	600.0	2400.0	1800.0
Transportation cost in S.L.	3	0.0	0.0	0.0	0.0
Bags cost in S.L.	3	450.0	0.0	450.0	150.0
Total return in S.L.	3	2320.0	7680.0	10000.0	9226.7
Total cost in S.L.	3	6200.0	10800.0	17000.0	14933.3
Net return in S.L.	3	3880.0	3120.0	7000.0	5706.7

Table 5.2. Average cost/ benefit of one hectare of rainfed wheat in the Region of Halula, Syria, 2004.

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Irrigated wheat

Item	Number of cases	Range	Minimum	Maximum	Mean
Production in kg	12	2866.7	1800.0	4666.7	3008.5
Seeds quantity in kg	12	365.0	110.0	475.0	313.6
Seeds cost in S.L.	12	7150.0	350.0	7500.0	4227.0
Cultivation cost in S.L.	12	7500.0	0.0	7500.0	2137.6
Manure quantity in kg	12	7000.0	0.0	7000.0	666.7
Manure cost in S.L.	12	7000.0	0.0	7000.0	583.3
Nitrogen quantity in kg	12	500.0	0.0	500.0	272.8
Nitrogen cost in S.L.	12	4600.0	0.0	4600.0	2744.3
Phosphorus quantity in kg	12	300.0	0.0	300.0	124.5
Phosphorus cost in S.L.	12	3600.0	0.0	3600.0	1200.6
Herbicides cost S.L.	12	2000.0	0.0	2000.0	428.6
labors cost in S.L.	12	4347.8	0.0	4347.8	362.3
Fuel cost	12	18000.0	0.0	18000.0	5889.0
Harvest cost in S.L.	12	2300.0	700.0	3000.0	1972.5
Transportation cost in S.L.	12	1666.7	0.0	1666.7	338.3
Bags cost in S.L.	12	2000.0	0.0	2000.0	1013.4
Total return in S.L.	12	33333.3	18000.0	51333.3	31342.8
Total cost in S.L.	12	28763.3	6370.0	35133.3	20508.5
Net return in S.L.	12	27973.3	-2833.3	25140.0	10834.2

Table 5.3. Average cost/ benefit of one hectare of irrigated wheat in the Region of Halula, Syria, 2004.

Irrigated cotton

Item	Number of cases	Mean
Production in kg	9	3064.8
Seeds quantity in kg	9	63.8
Seeds cost in S.L.	9	1051.7
Cultivation cost in S.L.	9	3040.2
Manure quantity in kg	9	1464.9
Manure cost in S.L.	9	1498.3
Nitrogen quantity in kg	9	299.2
Nitrogen cost in S.L.	9	3050.5
Phosphorus quantity in kg	9	125.0
Phosphorus cost in S.L.	9	1313.2
Herbicides cost S.L.	9	561.0
labors cost in S.L.	9	1457.2
Fuel cost in S.L.	9	14427.2
Harvest cost in S.L.	9	3505.1
Transportation cost in S.L.	9	1669.4
Bags cost in S.L.	9	1498.1
Total return in S.L.	9	72219.5
Total cost in S.L.	9	33071.7
Net return in S.L.	9	39147.8

Table 5.4. Average cost/ benefit of one hectare of cotton in the region of Halula, Syria, 2004.

Olive trees

Average net return of olive is reasonably good compared with rainfed barley and wheat. The problem with olive and pistachio, that they produce their fruits every two

Irrigated wheat

Item	Number of cases	Range	Minimum	Maximum	Mean
Production in kg	2	1236.0	400.0	1636.0	1018.0
Seeds quantity in kg	2	0.0	0.0	0.0	0.0
Seeds cost in S.L.	2	0.0	0.0	0.0	0.0
Cultivation cost in S.L.	2	0.0	0.0	0.0	0.0
Manure quantity in kg	2	0.0	0.0	0.0	0.0
Manure cost in S.L.	2	0.0	0.0	0.0	0.0
Nitrogen quantity in kg	2	0.0	0.0	0.0	0.0
Nitrogen cost in S.L.	2	0.0	0.0	0.0	0.0
Phosphorus quantity in kg	2	0.0	0.0	0.0	0.0
Phosphorus cost in S.L.	2	0.0	0.0	0.0	0.0
Herbicides cost S.L.	2	0.0	0.0	0.0	0.0
Labors cost in S.L.	2	750.0	0.0	1500.0	1125.0
Irrigation cost in S.L.	2	4250.0	0.0	5000.0	2875.0
Harvest cost in S.L.	2	0.0	0.0	0.0	0.0
Transportation cost in S.L.	2	0.0	0.0	0.0	0.0
Bags cost in S.L.	2	0.0	0.0	6500.0	0.0
Total return in S.L.	2	17250.0	12000.0	29250.0	20625.0
Total cost in S.L.	2	5000.0	1500.0	6500.0	4000.0
Net return in S.L.	2	12250	10500	22750	16625

Table 5.5. Average cost/ benefit of one hectare of olive trees in the Region of Halula, Syria, 2004.

years once. But there is a potential to increase the yield by the agricultural practices and with the use of manure and fertilizers, which were not used in 2004.

Pistachio trees

The net return from pistachio looks reasonably good compared with the rainfed crops; even neither manure nor fertilizers were used. Olive and pistachio have the potential for improving the living standards of the households in the study region.

Item	Number of cases	Total
Production in kg	1	250.00
Cultivation cost in S.L.	1	700
Manure quantity in kg	1	0
Manure cost in S.L.	1	0
Nitrogen quantity in kg	1	0
Nitrogen cost in S.L.	1	0
Phosphorus quantity in kg	1	0
Phosphorus cost in S.L.	1	0
Herbicides cost S.L.	1	0
Irrigation cost		2300
labors cost in S.L.	1	3000
Harvest cost in S.L.	1	1500.00
Transportation cost in S.L.	1	0
Bags cost in S.L.	1	0
Total return in S.L.	1	25000
Total cost in S.L.	1	7500
Net return in S.L.	1	17500

Table 5.6. Average cost/ benefit of one hectare of Pistachio trees in the region of Halula, Syria, 2004.

40.7% of the 27 households, who were chosen randomly, have no farm income. 29.5% of the average net income comes from irrigated wheat, 50% comes from cotton, 12.3% comes from rainfed barley, 5.5% comes from olive, 1.5% from pistachio, and 1.2% from rainfed wheat. The income from rainfed wheat and barley has a minor role, compared with the irrigated crops and olive trees.

Assessment of the Dairy cows and small ruminants' net income

19 households out of the 27 ones, who were chosen randomly, have neither dairy cows, nor small ruminants. The average net income of dairy cows is so small, that

cannot be considered as an income. This indicates that dairy cows are used for the house consumption only. Small ruminants average net income is more than cows, but it is still not able to support the households for their living.

Assessment of off-farm income

77.8% of the total surveyed households have off-farm income. The average off-farm income is 64126 S.L. per household. This is more than the average net farm income. Some of the households have one labor and other some have four. The off-farm income per household depends on the number of labors, how skilful they are, and on the age. The household number 18 for example has no working sons he is not skilful labor, and old. His off-farm income is 1400 S.L. in 2004.

Household code	Irrigated wheat	Cotton	Rainfed Barley	Rainfed wheat	Olive	Pistachio	Total
1	-2550	350	2300	0	0	0	100
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	24300	72600	0	0	0	0	96900
6	8535	60754	0	0	0	0	69289
7	-1750	100550	1700	0	0	0	100500
8	62850	63000	0	0	0	17500	143350
9	0	20400	11200	0	0	0	31600
10	0	0	0	0	0	0	0
11	34550	5750	14300	0	0	0	54600
12	1750	0	0	0	0	0	1750
13	37800	88285	19100	0	0	0	145185
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	9000	7800	0	0	16800
19	13630	0	0	0	0	0	13630
20	7890	0	2000	0	0	0	9890
21	126500	188600	0	0	21000	0	336100
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	2500	3500	0	0	6000
26	0	0	2500	3500	0	0	6000
27	40850	0	83050	0	45500	0	169400
Total	354355	600289	147650	14800	66500	17500	1201094
Average	13124.3	22232.9	5468.5	548.1	2463.0	648.1	44485.0

Table 5.7. Average of net farm income (S.L.) per household in the region of Halula, Syria, 2004.

Household code	Dairy cows net income	Small ruminants net income	Total
1	0	0	0
2	0	0	0
3	0	0	0
4	0	10000	10000
5	0	0	0
6	0	10000	10000
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	16500	16500
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	6400	6400
19	0	0	0
20	0	0	0
21	1000	0	1000
22	0	0	0
23	0	0	0
24	0	0	0
25	4000	0	4000
26	0	0	0
27	-3000	114000	111000
Total	2000	156900	158900
Average livestock net income per household	74.1	5811.1	5885.2

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Table 5.8. Dairy cows and small ruminants net income (S.L.) and their arage in the region of Halula, Syria, 2004.

Household code	Labor 1 income	Labor 2 income	Labor 3 income	Labor 4 income	Total income
1	35000	50000	0.	0.	85000
2	36000	0.	0.	0.	36000
3	72000	0.	0.	0.	72000
4	0.	0.	0.	0.	0
5	50000	50000	0.	0.	100000
6	24000	24000	0.	0.	48000
7	0.	0.	0.	0.	0
8	0.	0.	0.	0.	0
9	150000	0.	0.	0.	150000
10	50000	0.	0.	0.	50000
11	0.	0.	0.	0.	0
12	40000	44000	40000	0.	124000

Table 5.9. Off-farm income (S.L.) of 27 households and their average in the egiion of Halula, Syria, 2004.

Household code	Labor 1 income	Labor 2 income	Labor 3 income	Labor 4 income	Total income
13	95000	55000	0.	0.	150000
14	25000	0.	0.	0.	25000
15	60000	0.	0.	0.	60000
16	108000	0.	0.	0.	108000
17	240000	3000	0.	0.	243000
18	1000	400	0.	0.	1400
19	10000	10000	0.	0.	20000
20	0.	0.	0.	0.	0
21	0.	0.	0.	0.	0
22	66000	0.	0.	0.	66000
23	60000	0.	0.	0.	60000
24	65000	0.	0.	0.	65000
25	24000	8000	8000	8000	48000
26	60000	60000	0.	0.	120000
27	100000	0..	0.	0.	100000
Total	1371000	304400	48000	8000	1731400
Average income per household	50777.8	11274.1	1777.8	296.3	64125.9

Table 5.9. Off-farm income (S.L.) of 27 households and their average in the egiion of Halula, Syria, 2004.

Household code	Farm net income	Livestock net income	Off-farm income	Total net income
1	100	0	85000	85100
2	0	0	36000	36000
3	0	0	72000	72000
4	0	10000	0	10000
5	96900	0	100000	196900
6	69289	10000	48000	127289
7	100500	0	0	100500
8	143350	0	0	143350
9	31600	0	150000	181600
10	0	0	50000	50000
11	54600	16500	0	71100
12	1750	0	124000	125750
13	145185	0	150000	295185
14	0	0	25000	25000
15	0	0	60000	60000
16	0	0	108000	108000
17	0	0	243000	243000
18	16800	6400	1400	24600
19	13630	0	20000	33630
20	9890	0	0	9890
21	336100	1000	0	337100
22	0	0	66000	66000
23	0	0	60000	60000
24	0	0	65000	65000
25	6000	4000	48000	58000
26	6000	0	120000	126000
27	169400	111000	100000	380400
Total	1201094	158900	1731400	3091394
Average net income	44485	5885.2	64125.9	114496.1

Table 5.10. Average net income (farm and off-farm in S.L.) of households in the region of Halula, Syria, 2004.

Assessment of total net income

56% of the total net income comes from off-farm, 38.9% comes from crops and fruit trees, and 5.1% from livestock production. The off-farm income is an essential component in the household's income. Livestock importance is low, compared with farm and off-farm.

GENERAL CHANGES IN THE STUDY REGION

Environmental changes

Fountains

There was a fountain in Abu Galgal, was called the river of Abu Galgal. It was used to pass by villages eastward in the study region and flow in the Euphrates. Many villages used its water to grow irrigated crops and fruit trees. The fountain dried up during the 1970's, because of the rush in drilling wells around and close to it. Another fountain was in Fers al-Ajjour and its water was used to pass as a river through the communities of Fers Saghir, Halula and then to the Euphrates, but since 1985 it has stopped to pass because the households at the fountain used pumps to get all the water for irrigation. The river was 10 meters wide and the water depth was 30 centimeters. There were even fish in it. Another one was in the south of Halula village; the people were used to drink from. But, dried up ten years ago.

Ground water

The ground water level has decreased in the study region since more than 20 years. In Qana Tahtani the ground water table was at 7 meters deep before 1980, but it is at 40 meters deep nowadays. Up to the communities, the reasons for the decrease were that too much wells have been drilled since 1980.

But in Sekkawayeh the contrary has happened. The ground water table has increased from 55 meters into 20 meters since 1999, because of the private irrigation project from the Euphrates Lake.

Soils Degradation

The communities mentioned that the rainfed crops yield is less than before, even of the fertilizers use.

One household mentioned that he was used to get 20 bags of barley from one hectare in the past without using fertilizers, but now no more than 10 bags under the same rain conditions, even the fertilizers are used. Another one from Halula mentioned 15 bags 20 years ago but 10 bags now in normal years. Some think that the yield is a bless from god, but nothing else.

Different opinions about the reasons for the degradation were collected from the households. Some said that the fragmentation of land was the reason, so the farm size has become smaller. And consequently, the fallow has been cancelled from the crop rotation. Others said that the use of monocrop system (only cereals) was the reason for the degradation. Some think that the yield is

a bless from god, but nothing else. Some said the reason was because of using new crop varieties, which stay in the soil less time than the old varieties. And this shorter period is behind the yield decrease, because they don't benefit from the soil moisture as they should. One mentioned the reason is because of replacing the old traditional cultivation tool; Faddan, with the tractor. He explained that faddan goes dipper than tractor into the soil and keeps the soil more compact. Therefore it holds more moisture than the tractor plowing.

Birds

Many migrating birds like the Sand grouses, Bustards, geese, Cranes, and pigeons have stopped to come since more than twenty years.

Wild animals

Hyenas, wolves, rabbits, and foxes have disappeared from the study region since more than thirty years. The households explained the reasons for this change as follows: Animals and birds were used to hide among the trees and bushes, which later died because of the dry up of Abu Galgal River. Hunting these animals and birds was another reason. Some said that the forest ration of Halula Mountains by the government kicked these animals away. And that because of many families have built their houses on their own land, away from the village, therefore the animals and birds have no more a safe place away from man.

Old heritage

In Qana Tahtani, there were three Roman wells dried up in 1985, because of drilling too many wells and because of the horizontal drilling too. There are 2 Roman cisterns too, but they have been never cleaned and used.

There are Roman wells in Halula Mountains. The people used those 60 years ago, but the rain floods and the neglectation have led to fill these wells with debris.

Health care

In man

People in the study region were used to use traditional medicine 40 years ago. Ironing the sick persons with a heated metal piece was used against many diseases. A Pain in the legs was treated with a piece of tissue, which would be rolled around the leg, and leave a little part of it loosen. Then the tissue would be lit until the fire would rich to the leg. This method is called "Utba". Piercing a hot needle into the child head would be the method for treating the diarrhea among children. Also the hot needle was used to recover the part of the human body, which had pain. Bleeding the ears of either man or sheep was a common method used to treat sick people and sheep too. Another method against fever was called "al-Jeft". The method was by slaughtering an ewe, and taking off its fresh skin. Then, the sick person would be put inside the fresh skin for 24 hours.

Chamomile and Linden plants were used to treat coughing. *Utrica Sp.* plant was used to recover the pain in the stomach.

In sheep

Cutting a vein in the udder treated the hardened udder of ewe.

Since more than 15 years, the households have been used to go to the doctor and the traditional medicine has been abolished, except for the non-serious diseases. As for livestock, visiting the veterinarian in case of diseases has become a habit, since more than 5 years.

Social relations and habits

Cooperation and trust among the households have disappeared since more than 20 years, because of the poverty and population increase. In the past, if one would build a house, all his neighbors would help him, but nowadays nobody would help. Marriage among cousins has decreased very much, because of the health awareness, and that girls have now more freedom to say no. Getting all the "Maher" by the bride father was a habit, which has decreased, because of the awareness and women are claiming their rights. They now get the bride approval on the marriage, while it wasn't the case 6 years ago, because of the awareness.

In the past, men were used to meet everyday in the evening, and discuss different issues. This habit was good to strengthen the relation among the households, but it has disappeared since more than 15 years, because of the modern daily life problems.

Food

Type and number of daily meals have changed, because they have got new food habits from the Lebanese through working in Lebanon. One loaf of bread would be enough as a meal in the past, but nowadays it is important to have different types of food like olive, cheese, eggs, pickles, vegetables, marmalade, and others in the meal.

Burghol was a main daily food type, but nowadays rice and potato are also used.

Al-tarmooz, "shorba" and 'asideh were traditional food types, but disappeared since more than 20 years, because of the nutrition awareness, and the wide spread availability of the vegetables.

Baking their bread by themselves has declined very much and a part of the households buy their bread now from the market.

Housing

Their traditional houses were made of soil bricks, but they have started to replace them with cement houses since 25 years. There is no more specialists in the construction of those traditional houses.

Tribal relations

A traditional leader (al-Sheikh) of the tribe had a big influence on his tribe members 30 years ago. But the influence of the Sheikh has been almost finished since then, because of the education and the change in the living standards. The tribal relation has been weakened since 15 years, because the tribal laws are replaced with the state laws. And they depend on the state laws in their normal life at present.

Traditional old machinery

The mill

There was one mill for grinding the cereal grains in Tal 'Arresh, and another one in Qashlet Yusef Pasha. The mill was composed of wooden wheel of a diameter of one meter. Wooden small boxes were fixed on external circular surface of the wheel. These boxes were opened from the side which faced the water of the river. The wheel was connected, from its center, to a horizontal thick iron pipe of 3 meters long. The end of the pipe was connected from the other side to a big round stone, which rested on a stony flat dish. This dish had a hole, which led the flour out. The wheel was put into the river, it turn because of the water current, so the pipe was turning too, and so the round stone.

The water pumps

More than forty years ago, the few existed wells then, were Arabic (drilled by hand). There were no engines and modern pumps at that time. There was a traditional pump run by animals to discharge the water from the wells. Its name was "al-doulab". It was composed of the main following parts:

1. An iron toothed wheel, its diameter was one meter. and was put horizontally on the mouth of the well. Another iron toothed wheel, connected to the first one by the teeth, and put vertically.
2. Two sets of tin sheets, their number might reach to 30 ones in each set. The second vertical wheel could roll these tin sets.
3. Wooden pots suspended to the tin sheets. Each pot to one sheet.

The pump used to work when the animal turned around the well. The first wheel would turn horizontally, and made the second wheel to turn vertically. By their turn, one set of the pots would roll down the well, while the other set would roll up with pots full of water. A man should be waiting to take off each pot and empty it, and also to re suspend the empty pots to the descending set.

Al-Sakroujeh

It was a small metal pot that had a hole in the upper part. The households were used to fill it with Kerosene and dip a tape of tissue inside the kerosene and lit outer part of the tissue. It was the poor people's tool for getting the light in the night; even it was a bad tool that smoked a lot. It disappeared 40 years ago.

16. ÉTUDE SOCIO-ÉCONOMIQUE DANS LA MOYENNE VALLÉE DE L'ORONTE

Maamoun Abdulkarim*

LE PEUPLEMENT

Cette région est caractérisée par un aspect géographique complexe: naturels, sociaux, économiques et modes de vie. Ici, nous trouvons une différence entre le monde nomade qui se trouve dans la région située à l'est de la vallée de l'Oronte, tandis que le monde sédentaire se situe à l'intérieur de cette vallée, ici nous avons des villes anciennes comme Homs, Hama, Rastan. Celles-ci demeurent comme des centres importants au cours de l'histoire. Cette région est aussi riche par la présence des petites villes et villages.

Au cours de l'histoire, cette région a connu l'installation successive des populations d'origine et de culture différentes. Les textes littéraires d'époque hellénistique et romaine ne nous donnent pas d'information sur les origines des habitants d'Émèsène (la région de Homs et Hama). À part quelques mentions concernant les dynastes arabes de cette région, évoqués dans les textes de Diodore de Sicile (1848), Cicéron (1967), Plutarque (1977) et Dion Cassius (1991), les données sont très rares. Pour se faire une idée sur les origines de la population de la moyenne vallée de l'Oronte, nous sommes obligés de recourir aux inscriptions grecques et latines provenant de cette région, ces inscriptions nous livrent les principaux groupes, l'un araméen-arabe et l'autre gréco-latin. Il est utile de souligner que dans quelques villages entre Homs et Hama, se trouve une installation d'habitants, d'origine gréco-latine, qui portent les *tria nomina*. À travers les fonctions de ces personnes, nous pouvons penser à une installation de colons dans cette région riche grâce à l'agriculture et où nous avons relevé les traces de parcellaire antiques. Il est notable que cette région a connu une certaine hellénisation ou une romanisation de ses habitants, surtout au II^e siècle ap.J.-C., après l'annexion de la ville de Homs (Émèse) à l'empire romain. Nous savons aussi grâce aux textes, que cette ville a envoyé à Rome des empereurs et impératrices d'origine syrienne (la dynastie

des Sévères entre 193-235 ap.J.-C.) et l'influence de Homs (Émèse) fut très importante à cette époque.

Homs est l'une des grandes villes de la Syrie et elle est aussi la plus grande ville en Syrie centrale, rappelons l'importance de son rôle administratif et militaire au VII^e siècle. C'est le siège de plusieurs importantes batailles, dans la guerre entre les perses et les byzantins, comme pendant la conquête islamique. Les armées byzantines tentent de s'appuyer sur la ville après la chute de Damas en 636, et sa perte sonne le glas de leur résistance en Syrie. Cela expliquerait l'éventuelle tentative de reconquête dirigée vers Homs, par Constant II dans le milieu du VIII^e siècle. La création des *ajnâd* par Omar, vers 637-638, a placé Homs à la tête de l'un des quatre districts syriens, avec Damas, le Jourdain, et la Palestine, avant l'établissement d'un cinquième *jund*. Celui de Quinnesrin (Gatier 1992, 432). Homs présente trois avantages du point de vue militaire. La place est bien fortifiée; elle se trouve au centre d'une région agricole qui peut ravitailler les troupes; elle permet de communiquer avec l'ensemble du pays grâce à son emplacement, au carrefour des grandes routes nord-sud et de la route de la côte à l'Euphrate. L'empereur Héraclius en fait son séjour avant de fuir à Antioche. Homs reste indiscutablement l'une des grandes villes de la Syrie byzantine, un verrou que les conquérants, venus du Nord comme les Perses, ou du Sud comme les Musulmans, doivent faire sauter (Gatier 1992, 432).

À la suite de la conquête arabe musulmane en 636 ap.J.-C., la Syrie a connu des grands changements et notamment avec nouvelle installation des tribus arabes venues de l'Arabie et de Yémen (Abbas 1990). Il faut signaler qu'une partie de ces tribus arabes s'est installée dans la vallée de l'Oronte qui est riche en eau et en terre cultivable.

L'époque des Omeyyades (640-750), est considérée comme une période importante pour la vallée moyenne de l'Oronte et aussi pour l'ensemble de la Syrie, car les Omeyyades ont choisi Damas comme capitale. La Syrie

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est connue pendant cette époque un développement important dans tous les domaines: politique, économique, sociale etc. L'importance que la région a connue pendant l'époque des Omeyyades ne demeure pas pendant l'époque abbasside qui a fondé un nouvel empire à Bagdad à la suite de l'époque des Omeyyades. Au cours des époques suivantes ayyoubides et mamelouks jusqu'en 1516 régnait une insécurité générale qui provoque des replis des populations vers les montagnes généralement plus sûre et surtout vers le massif alaouite situé à l'ouest. Pendant l'époque ottomane, une nouvelle division administrative est appliquée, et la Syrie centrale est rattachée à la wilaya de Tripoli, mais en 1725, Homs et Hama sont été englobées dans l'aire de Damas. De 1831 à 1840, cette région a connu l'arrivée des troupes de Mohamad Ali venant d'Egypte, une nouvelle vague de citadins émigrèrent alors vers les massifs montagneux. Une fois la Syrie reprise, en main par les Ottomans, le sultan Abdul Majid II, soucieux de protéger le domaine sédentaire contre les incursions des nomades bédouins soutenus par les Egyptiens, promulgue en 1839 un ferman (loi): serait exempté du service militaire et du paiement des impôts tout qui s'installerait à l'est de l'Oronte et participerait à la construction des villages. A partir de 1840, on assiste à un repeuplement notable de la Syrie centrale et à la renaissance de villages et villes. Les nouveaux sédentaires, ruraux ou citadins, étaient venues du Massif alaouite, soit des bédouins qui abandonnaient leur mode de vie nomade (Al-Dubyat 1995, 27).

On trouve aussi des populations étrangères à la Syrie central tels que Tcherkesses venus de la Russie après l'échec de leurs révoltes. Ils ont fondé plusieurs villages dans cette région. Plus tard les Turkmènes et Kurdes sont venus du nord de Syrie pour être installés dans cette région. Ce mouvement s'accélère en raison de la constitution de grandes propriétés citadines favorisées par la promulgation des lois foncières de 1858. Les grandes propriétés surtout de Hama ont fait appel aux Alaouites de la montagne pour la mise en valeur des terres qu'ils s'étaient appropriées. Pendant la période du mandat français en Syrie 1920-1946 n'a pas de conséquence importante sur le peuplement de la moyenne vallée de l'Oronte. L'aménagement du Ghab, terminé en 1967, marquera la dernière grande étape du peuplement de la moyenne vallée de l'Oronte. Simultanément le mouvement de sédentarisation des nomades s'est poursuivi: il existe de moins en moins de vrais nomades, devenus plutôt semi-nomades, qui pratiquent la transhumance pendant l'hiver dans les steppes de la région, situées à l'est de cette vallée, et exceptionnellement en été et durant les années sèches, ils viennent alors avec leurs moutons dans la région du Ghab. Le nomadisme est commencé de disparaître à partir de 1958 avec la promulgation d'une loi présidentielle "annulant toutes les législations tribales qui régissaient le statut des bédouins et les soumettent

désormais au droit commun". Cette loi est donc accélérée le mouvement de sédentarisation encouragé par l'État (Al-Dubyat 1995, 28).

L'évolution démographique, entre 1970 et 1981, a connu des changements de grand ampleur: émergence de petites villes, mouvement de sédentarisation, migrations, taux d'accroissement annuel élevé dépassant souvent le taux national (3,34%). Cette évolution est due au maintien d'une fécondité élevée, le taux de mortalité régresse grâce au développement des services médicaux. La croissance démographique est plus élevée dans les villes surtout à Homs qu'à la campagne parce que les populations urbaines accueillent les migrants fournis par l'exode rural. Depuis les années cinquante, Homs a connu une croissance démographique plus importante que celle de Hama, en 1991, sa population représente le double de celle de Hama. L'économie des petites villes de la région ne leur permet en aucun cas d'avoir la même influence que Homs. Elles forment des centres à vocation plutôt résidentielle. Enfin, les analphabètes sont nombreux (34,5%) surtout parmi la population féminine et dans le monde rural. La participation de la femme au travail reste faible (moins de 15% de la population active) (Al-Dubyat 1995, 28).

L'ÉCONOMIE ET LES AMÉNAGEMENTS DANS CETTE RÉGION

Cette région est marquée par la présence de tous les domaines économiques: l'agriculture occupe une place importante, grâce au terres cultivables et aussi par le développement des industries liées à ce domaine. Le commerce est aussi considéré comme domaine important et surtout dans la ville de Homs qui tirait ses richesses pour ce domaine et surtout par le commerce lointain. Tandis que Hama était marquée par l'économie agro-pastorale. L'industrie est une activité récente liée à l'existence, depuis les années cinquante, d'une raffinerie de pétrole. Il faut signaler que Homs est importante par l'industrie tandis que Hama est importante dans le domaine de l'agriculture.

Les grandes villes de la moyenne vallée de l'Oronte bénéficient de la présence de l'Oronte, ce fleuve présent, un débit, le second en importance après l'Euphrate. Et aussi que la proximité de vastes zones pastorales, ces raisons donnent à l'économie dans cette région un caractère agro-pastorale plutôt que agricole. Dans cette région, l'agriculture, occupe environ 40% de la population active dans la *mohafaza* de Hama et 21,5% à Homs, cela s'explique par l'importance du potentiel agricole de la région de Hama (Al-Dubyat 1995, 107).

Nous avons plusieurs facteurs naturels qui donnent l'importance à cette région, comme l'ouverture à la Méditerranée par la trouée de Homs et aussi la présence des steppes à l'est.

Il faut signaler que depuis l'Antiquité, plusieurs interventions ont été faites sur l'Oronte pour l'utilisation de ses eaux. Le plus ancien ouvrage reste le barrage de Qattiné¹, ensuite le barrage de Rastan et Cheizer. De plus, nous avons, un autre système de l'utilisation de l'eau par le moyen des norias qui aident d'élever de l'eau depuis le lit jusqu'au niveau du plateau (Zaqzouq 1987, 337-366). Ces dernières ont été créées après l'époque romaine, actuellement, plusieurs de ces structures sont restaurées pour favoriser le développement du tourisme.

Les aménagements hydrauliques sur l'Oronte commencent dès l'entrée du fleuve dans le territoire syrien, au village de Rableh où naît une série de canaux (5 au total). Ces canaux permettent l'irrigation de 3920h². D'autres aménagements ont été entamés en 1934 avec la construction d'un canal d'une longueur de 66,4 km dont 48 km dans la région de Homs, le reste dans celle de Hama (Al-Dubayat 1995, 110). En 1944, le canal a été prolongé dans la section de Hama et il permet l'irrigation de 20 000ha dans la région de Homs (Zaim 1986, 40). Le canal principal est alimenté par le lac de Qattiné, grâce aux travaux successifs de surélévation du barrage en 1934 et vers 1960, cela a permis l'alimentation régulière des canaux d'irrigation (Al-Dubayat 1995, 110). Les travaux, de F. et J. Métral, mettent l'accent sur l'importance des systèmes gravitaires fonctionnant à partir des sources dans la région méridionale du lac de Qattiné (Métral 1987, 171-191). Construits en souterrains, des canaux, comme ceux de Joussiyé. Rablé, et Qousseir, sans doute romains, ont été remis en usage. Il y a environ un siècle.

Nous avons observé nous-mêmes cette réutilisation des eaux provenant d'anciennes constructions romaines (canaux souterrains), notamment vers Hassyé au sud de Homs, où actuellement les agriculteurs utilisent ces anciennes structures pour alimenter leur village. Il apparaît donc que ces structures ont dû jouer un rôle important dans l'Antiquité. Malheureusement, les recherches systématiques de ces réseaux n'ont pas encore été effectuées. Il est donc nécessaire d'en faire le bilan le plus rapidement possible pour compléter le schéma des systèmes hydriques susceptibles de converger vers Homs.

L'aménagement hydro-agricole le plus important a été le projet de Ghab. Il a englobé plusieurs types de travaux: barrages (Rastan, Mahardeh, Acharneh), assèchement de la plaine du Ghab, canaux de drainage, canaux d'irrigation, etc. Ce projet est mis en chantier en 1953 et en 1968, la plaine est complètement exploitée et 11000 familles paysannes ont bénéficié de l'attribution de lots de terre (2,5 ha par famille): "Le

Ghab a joué le rôle d'un creuset pour des populations rurales affamées de terres ... le Ghab est le premier projet de développement intégré en Syrie; il a constitué une sorte de laboratoire; c'est la que l'État a expérimenté sa politique agricole" (Métral 1989, 41-45). Il est important de signaler que la surface limitée, des lots de culture accordés au départ, à chaque famille et les moyens limités des agricultures poussent la nouvelle génération à quitter la région pour des villes voisines notamment Homs (Al-Dubayat 1995, 111).

Dans l'Antiquité, Strabon décrit la vallée de l'Oronte au niveau de la ville d'Apamée (la région de Ghab):

"qu'on se figure en effet une colline abrupte s'élevant du milieu d'une plaine très basse, et qui, ceinte déjà de très belles et de très fortes murailles, se trouve protégée en outre et convertie en une véritable presqu'île par le cours de l'Oronte et par un immense lac dont les débordements forment des marécages et des prairies à perte de vue où paissent en foule les chevaux et les bœufs" (Strabon, XVI-II,10).

En revanche, au Moyen-Âge, le géographe arabe Aboulféda, au XIV^{ème} siècle, décrit cette région: "On donne le nom de lac d'Apamée à une quantité innombrable de marais séparés les uns des autres par des forêts de roseaux. Le plus grand de ces marais forme deux lacs situés l'un au midi et l'autre au nord. L'eau de ces deux étangs est fournie par l'Oronte, qui s'y décharge du côté du midi, et qui donne naissance aux marais. L'Oronte sort ensuite du côté du nord. Celui des deux lacs qui se trouve au midi est le lac d'Apamée; son étendue est d'environ un demi parasange; pour sa profondeur, elle n'égale pas tout à fait une taille d'homme; le fond consiste dans un sol argileux sur lequel il serait impossible de marcher" (Aboulféda 1985, 50).

Plus récemment, L. Dubertrait décrit encore un lac, mais de profondeur de plus en plus faible (Dubertrait 1933). Ainsi au cours de l'histoire, la tendance régulière à l'abaissement du niveau du lac d'Apamée tend à se développer. Rappelons qu'aujourd'hui grâce au projet Ghab signalé ci-dessus, le lac ne constitue plus finalement qu'une immense plaine alluviale argileuse où les sources karstiques sont toutes drainées ainsi que la vallée de l'Oronte elle-même.

Sans doute le couloir de l'Oronte bénéficie d'un climat plus favorable aux cultures sèches que la partie orientale de la région. En ce qui concerne la région de Homs qui possède des caractéristiques climatiques légèrement différentes de l'ensemble, car elle est située dans une plaine largement ouverte vers l'ouest par la trouée, qui est formée par les Monts Liban et les massifs côtiers syriens. En particulier, des vents forts présentent une direction nettement dominante Est-Ouest, correspondant

1.- Actuellement, l'ouvrage constituant le barrage de Homs est formé de deux structures bien distinctes. Le barrage récent, construit entre 1934-1938, et l'ancien barrage, situé en aval de ce dernier et que sa situation permet encore d'étudier. Cet ancien barrage a fait l'objet de nombreuses descriptions réalisées soit avant la construction de la nouvelle digue, soit après la mise en service de cette dernière. Voir: M.Abdulkarim, Recherches sur la cité d'Émèse à l'époque romaine, Thèse de Doctorat, Université de Versailles-Saint-Quentin, 1997.

à la direction de la trouée de Homs. Comme le fait remarquer J. Weulersse, si on compare, pour les années pluvieuses, la répartition mensuelle des précipitations à Tartous et Homs, on constate que durant toute l'année, que ce soit en période hivernal ou en été, la région de Homs présente un déficit hydrique important (par exemple en 1933, année réputée pluvieuse), il est tombé 916 mm d'eau à Tartous et seulement 296 mm d'eau à Homs (Weulersse 1940, 27-28).

Parallèlement, la température de l'air à Homs s'accroît considérablement dès avril en raison de coups de Khamasin qui peuvent faire monter la température à 30 et parfois même au-dessus. De plus, la violence et la constance des vents produisent aussi une évaporation intense des eaux apportées par l'Oronte. Ainsi, l'aridité relative de la ville de Homs est due au fait que les forts vents qui arrivent de la côte chassent les nuages pluvieux et favorisent l'évaporation immédiate des eaux superficielles météoriques. On comprend la nécessité d'organiser une très bonne irrigation des terres de la région afin de profiter pleinement des ressources hydriques de l'Oronte qui, elles, demeurent beaucoup plus stables, quelle que soit la saison.

Dans divers secteurs, l'agriculture irriguée dépend beaucoup du pompage de la nappe phréatique. La surexploitation de cette nappe a entraîné des catastrophes notamment dans les années cinquante où le coton atteignait alors des prix très élevés mais, la baisse de nappe phréatique ont souvent déterminé l'abandon de certaines activités agricoles et, parfois, le départ des paysans vers les villes (Al-Dubayat 1995, 111). La mécanisation de l'agriculture a renforcé le rôle des villes: financement, association et commercialisation. L'Oronte a attiré les industries, surtout celles qui sont de grandes consommatrices d'eau. Il est clair que la plupart des établissements de Homs ou de Hama sont installés à proximité de son cours. Malgré l'étendue de la région de Homs, celle de Hama possède une superficie agricole plus importante: 514927ha contre 378600ha. En terre irriguée, le même phénomène se répète grâce à la plaine du Ghab: 78149ha dans la région de Hama contre 44040 ha dans celle de Homs. Dans les deux cas, il faut noter l'ampleur des terres irriguées par pompage, à partir des puits: 42% de l'ensemble des terres irriguées pour Hama et 42,8% pour Homs (Figure 1A-B, Figure 2A-B-C-D).

Il faut noter que la plupart des céréales sont obtenues en culture sèche: elles concernent le 50% des terres cultivables de la région de Homs et le 56% dans celle de Hama. Ces cultures sèches sont souvent risquées notamment dans les années de mauvaise hydraulité et dans ces conditions, ces champs cultivés se convertissent en pâturages (Al-Dubayat 1995, 114).

En résumé, la zone côtière et surtout les sommets des chaînes bordières, avec des moyennes pluviométriques assez élevées, sont les zones humides où le climat favorise la présence du maquis sur les zones calcaires karstiques (absorbant donc beaucoup d'eau) et de forêts

sur les zones les plus élevées. Dans la zone intermédiaire, la pluviométrie et le climat sont relativement doux et favorisent la culture, en particulier celle des céréales et des arbres fruitiers, oliviers et vignobles. Plus à l'est, on passe progressivement d'une steppe cultivée (ou cultivable) à une steppe désertique et enfin au désert. Homs et Hama qui contrôlaient déjà, à l'ouest, une région consacrée depuis l'Antiquité à une agriculture sédentaire, ne pouvaient demeurer indifférentes aux activités pastorales qui déroulaient à l'est. De fait les liens entre ces villes et les bédouins existent depuis l'époque où le commerce à longue distance se mit à jouer un rôle important dans l'économie urbaine (Al-Dubayat 1995, 127). "Le nomade ne peut vivre uniquement de laitages et, exceptionnellement, de viande; il lui faut des grains et de la farine. Il a même besoin des cités et de leurs artisans pour les piquets de fer de sa tente, pour ses harnachements, pour ses armes, et pour ce que l'on peut appeler le luxe de la vie du désert: café, thé, et sucre" (Weulersse 1946, 62). Actuellement, ses besoins sont bien plus nombreux: pièces détachées et réparation pour le camion ou le tracteur, produits alimentaires pour le bétail, services vétérinaires.

L'effectif ovin, en Syrie centrale, est très important relativement au cheptel national: en 1984 il en représente 30%. L'extension de la *badia*, incluse dans la Syrie centrale, et l'importance de la population d'origine bédouine qui s'y est sédentarisée sont à la origine de cette situation. Il y a aussi la proximité de centres urbains capables d'assurer la commercialisation de la production ovine: il existe en effet des marchés aux moutons quotidiens à Hama et Homs (Al-Dubayat 1995, 127).

En commerce, Homs et Hama constituaient des étapes importants pour les caravanes qui suivaient l'itinéraire sud-nord, reliant Damas à Alep. Au début du XIX siècle, on comptait trois caravanes par mois, Homs, bénéficiant de sa position géographique, s'offrait aussi comme étape pour les caravanes qui venaient de Tripoli (Liban). A côté du commerce, il existait aussi une activité artisanale, destinée pour une grande part à l'exportation; notamment pour la soie. Cet artisanat bénéficiait de plusieurs débouchés: à côté de leurs marchés intra urbains, Homs et Hama répondaient aux besoins manifestés par les paysans et les pasteurs. Il a tout de même connu certaine décadence à partir du XIX siècle, à cause de la concurrence des produits venant des pays d'Europe. L'activité commerciale est actuellement très importante (Al-Dubayat 1995, 132). Les deux grandes villes de cette région regroupent l'essentiel des activités commerciales de la Syrie centrale et surtout elles possèdent des services liées à ces domaines. Homs est plus réputée par son artisanat et son commerce de gros, bien que Hama l'emporte dans la commercialisation des produits ruraux, notamment les produits ovins (Figure 3A-B, 4A-B-C et 5A-B-C). Depuis l'indépendance, en 1946, Homs et Hama ont connu un développement rapide de toutes les branches de l'économie urbaine.

Taux d'accroissement annuel en %		1981	1970	1960	Ville
1970-1980	1960-1970	population	population	population	
4.44	4.61	346871	215423	137217	Homs
2.33	3.5	177.208	137.421	97390	Hama
6.58	–	15091	7509	–	Rastan
–	–	12816	–	–	Mhardeh
4.39	–	14801	9240	–	Qosseir

Figure 1A. Croissance de quelques villes de Syrie centrale entre 1960-1970 et 1981; M. Aldubayat 1995.

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Figure 1B. Population de quelques villes de Syrie centrale en 1981.

Densité agricole	Densité absolue	Superficie cultivable en km ²	Superficie totale en km ²	population	Ville et sa région
281	61	1900	8720	534458	Homs
270	129	1182	2486	319634	Hama
186	159	290	340	54053	Rastan
151	111	803	1098	121191	Ghab
166	161	419	433	69544	Mahardeh
121	87	420	580	50608	Qossein

Source: Annuaire statistique de la ville de Homs et sa région 1984 (M. Aldubyat 1995).

Figure 2A. Densité agricole par région en 1981.

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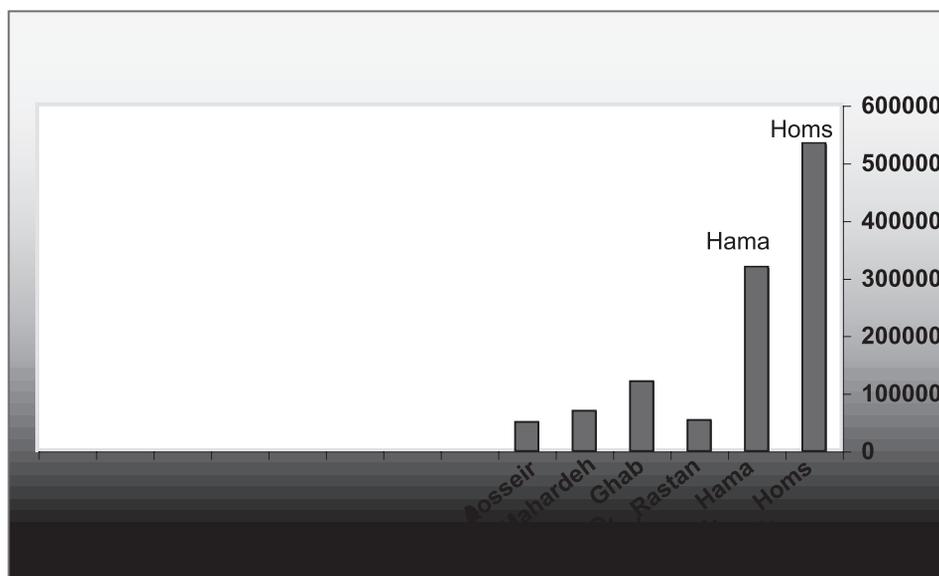


Figure 2B. Densité agricole par région en 1981 —population—.

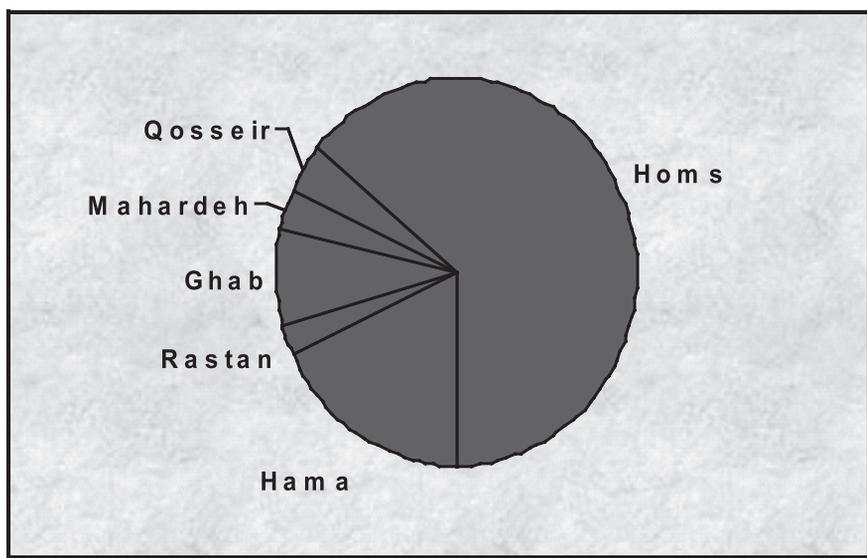


Figure 2C. Densité agricole par région en 1981 —superficie totale en km²—.

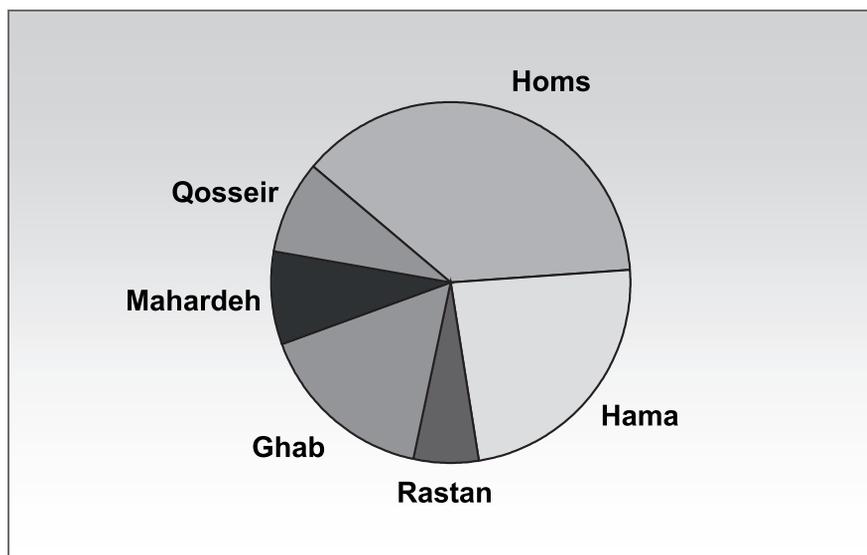


Figure 2D. Densité agricole par région en 1981 —superficie cultivable en km²—.

1988	1980	1970	1963	Année
24	25	24	35	Agriculture
19	14	18	12	Industrie et mines
3	6	4	3	Construction
26	23	23	24	Commerce de gros et de détail
10	8	11	10	Transport, stockage et communications
5	7	7	6	Finances, assurances et affaires foncières
1	2	2	2	Services sociaux et personnels
12	15	11	8	Services gouvernementaux
100	100	100	100	

Source: Annuaire statistique 1990

Figure 3A. Évolution des secteurs de production en %.

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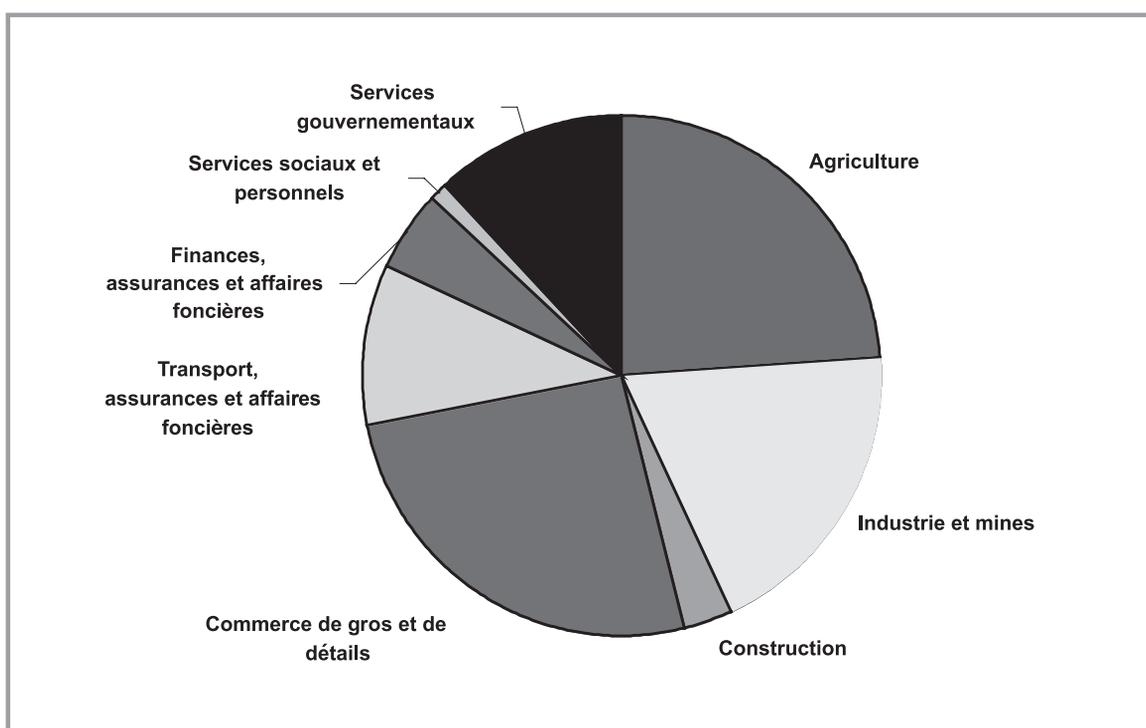


Figure 3B. Évolution des secteurs de production en % 1988.

Hama				Homs				Activité des établissements
Emplois		Entreprises		Emplois		Entreprises		
%	Nombre	%	Nombre	%	Nombre	%	Nombre	
5.5	168	5.2	41	34.8	2288	38.7	663	Textile
29.6	903	38.0	301	10.9	714	15.6	267	Alimentation
32.6	995	22.9	181	24.5	1614	15.7	269	Mécanique
7.2	219	9.2	73	6.6	431	8.7	150	Chimie
25.1	765	24.7	196	23.2	1531	21.3	365	Métallique
100	3050	100	792	100	6578	100	1714	Total

Sources: Direction de l'industrie de Homs et Hama et Al-dubyat M., 1995.

Figure 4A. Répartition des entreprises privées par branche d'activité dans les villes Homs et Hama en 1989

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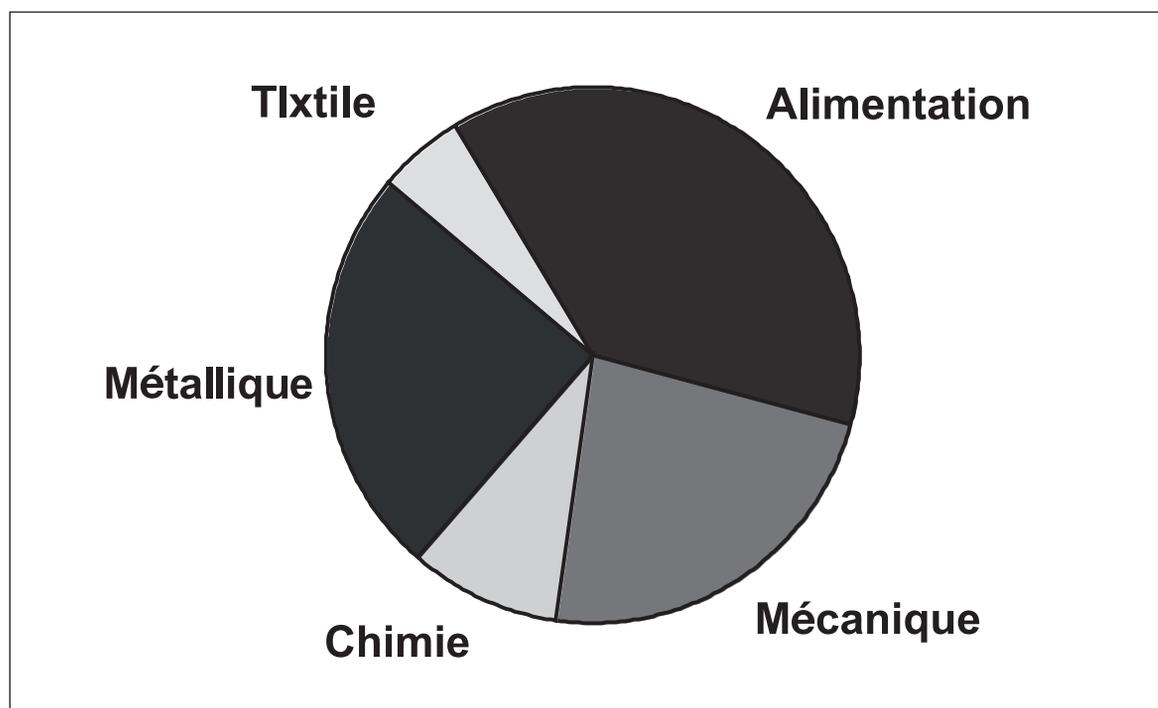


Figure 4B. Répartition des entreprises privées par branche des activités dans la ville Hama.

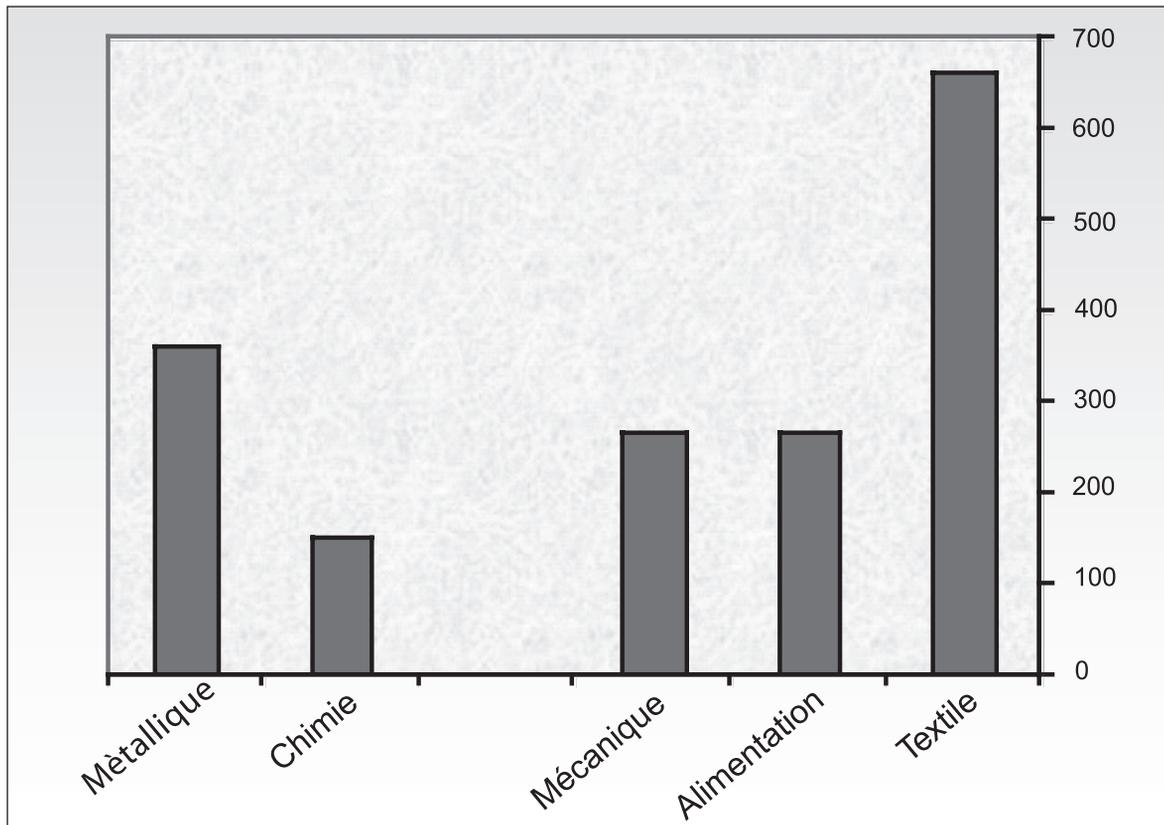


Figure 4C. Répartition des entreprises privées par branche des activités dans la ville Homs.

1987				1978				établissements
Hama		Homs		Hama		Homs		
%	Nombre	%	Nombre	%	Nombre	%	Nombre	
29.4	1835	26.2	2773	30.3	1588	27.7	2254	Alimentation
10.2	6.39	11.9	1259	11.3	591	11.5	936	Habillement
11.7	733	12.0	1271	9.4	492	11.2	911	Équipement
5.0	313	3.7	391	5.2	277	4.6	374	Produits ruraux
2.9	179	3.2	339	4.4	229	4.9	398	Artisanat traditionnel
40.8	2549	43.0	4551	39.2	2064	40.1	3262	Artisanat, services et loisirs
100	6248	100	10584	100	5241	100	8135	Total

Mairie de Hama et Homs, I.A.Moussly 1981; M. Aldubyat 1995.

Figure 5 A. Répartition des activités commerciales, artisanales et de services à Homs et à Hama en 1978 et 1987.

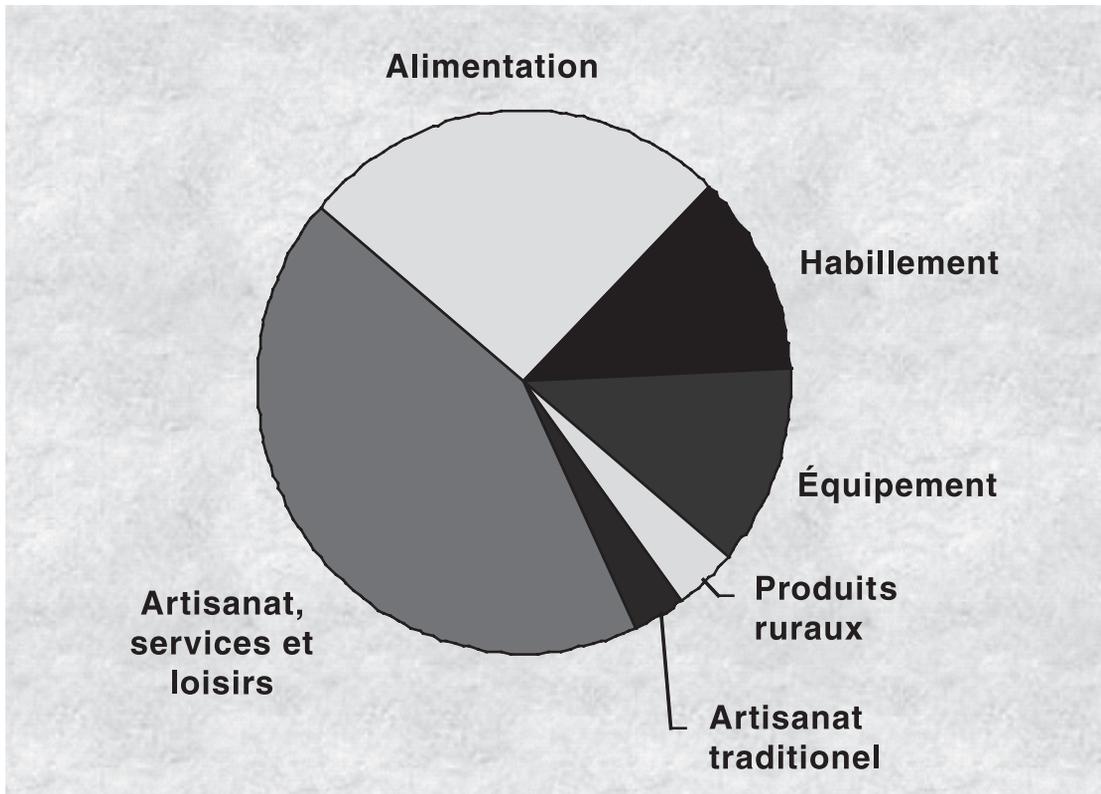


Figure 5B. Répartition des activités commerciales, artisanales et de services à Homs en 1987.

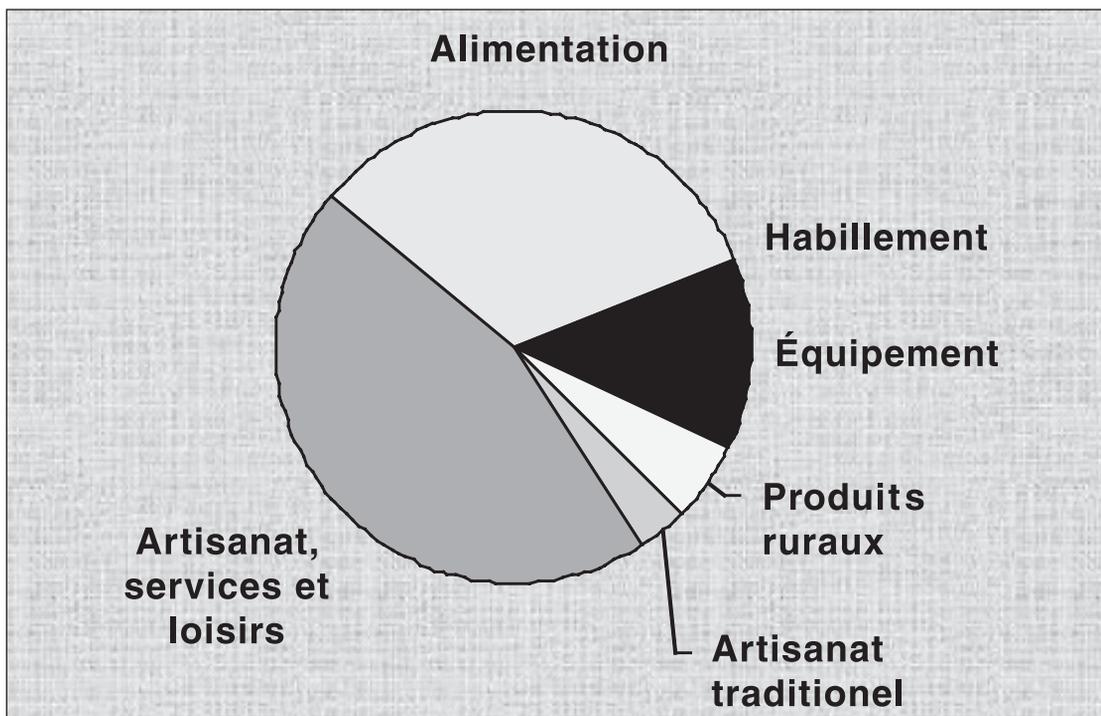


Figure 5C. Répartition des activités commerciales, artisanales et de services à Hama en 1987.

17. SOCIO ECONOMICS OF URFA - BIRECIK REGION / SOUTHEAST ANATOLIA (TURKEY)

Nurcan Kayacan, Günes Duru*

The legend tells that “*The plain of Harran is the place where Adam and Eve meet when they come out of heaven. They cannot believe the beauty of the plain with colourful flowers which seem like a part of heaven. The first thing they remark is the lack of trees. Adam brings a pomegranate and a branch of a rose. He plants them in the middle of the plain. Quickly blossomed pomegranate gives red flowers, the rose white. After a while they both feel hungry. Eve opens her hand holding wheat. They start with hope... Adam makes a plough out of the rose tree and put himself in front of the plough instead of an animal. However it is such an exhausting job that he cannot continue. At that moment an ox appears as if it says “here I am for working”.*

Harran plain in Urfa is the place where mankind first settled, where the soil was first cultivated, where plough and cattle were first used in agriculture (Kürkçüo lu *et al.* 2002, 271).

INTRODUCTION

Birecik-Urfa region, the focus of our research, is located in a vast geography on the northwest part of the Fertile Crescent. Topographically it is in between the northern part of the Saudi Arabian Platform and the south of the East Taurus Mountains. In general, the relief is even all over the region. Euphrates basin and the micro-niches on the southern slopes of the Taurus Mountains offer an favourable environment for plants and animals as well as for humans.

The region was first settled around 13.000 years ago. Göbekli Tepe (Schmidt 2007) the earliest site so far known, Yeni Mahalle – Balklıgöl (Çelik 2007), Nevalı Çori, Gürcü Tepe (Hauptmann 2007) and Akarçay Tepe (Arimura *et al.* 2001; Özbaşaran/Molist 2006; Özbaşaran/Molist 2007) are the first permanent settlements, dating to Pre Pottery Neolithic.

Lately the district of Birecik in the province of Urfa was affected by the Carchemish dam construction and salvage excavations were undertaken. These excavations exposed the succeeding periods in various settlements, lying along the bank of the Euphrates: Mezra Teleilat, Fıstıklı Höyük, Şaraga, Gre Virike, Şavi, Mezra Höyük, Harabe Bezikan and Akarçay Höyük (Tuna 2001, 2002, 2004). Akarçay Tepe dates to 8th mill cal BC and the latest occupation phases of the multi-period sites of Akarçay Höyük and Zeytinlibahçe, date to Middle Ages (Fig. 1).

Researchers agree that the region concerned is one of the main centers of agricultural activities as most of the plants, the cereals, were first domesticated here and where their wild forms still do exist at present. Large and natural, wild wheat fields are still visible today. Hackberry, pistachio, nuts and almonds also exist in wild and domesticated forms. The region is also the motherland of some of the early domesticated animals as goat and sheep, pig and cattle.

Akarçay Tepe (Arimura *et al.* 2001, 309), located within the borders of the town of Birecik, on the east bank of Euphrates, provides one of the earliest data on the domestication of plants and animals in Pre Pottery Neolithic (Fig. 2). Another site, north of Akarçay Tepe, Mezra Teleilat is well known with its Pottery Neolithic Period. Fıstıklı Höyük, the early Chalcolithic site following Mezraa in chronology, are the sites recently excavated and under detailed study. Research in Fıstıklı, shows that the einkorn and emmer wheat, barley, legumes as vetch, lava bean, fenugreek (*Trigonella foenograecum*), fruits like grape (*Vitis vinifera*), olive (*Olea europaea*), *boraginaceae*; chenopod (*Chenopodium* sp.), mallow (*Malva* sp.) and *labiate* were consumed densely in the 6th/5th mill, in Halaf period. *Bos taurus* (cattle), *Sus* (pig), *Ovis* (sheep), *Capra* (goat), possibly *Gazella* (gazelle) and *Cervus elaphus* (red deer) were the consumed animals as well as turtle and small rodents, few fish and crab and birds. Except the wild species,

* Istanbul University, Department of Prehistory.

such as gazelle and red deer, all animals were in domesticated status in the Halaf period. The cattle, significant in number, were possibly used in agricultural activities by the inhabitants of Fıstıklı Höyük (Bernbeck/Pollock 2003, 68-69).

Irrigation was fully adopted in the following Ubaid and Uruk Periods, as observed in a number of settlements such as Zeytinlibahçe, Mezra Höyük, Şavi Höyük, Gre Virike and Şaraga, are all located on the bank of the Euphrates. They became capitals of small political unions during the Uruk Period and continued in the Early Bronze Ages (Frangipane *et al.* 2004, 57). The succeeding Middle Bronze Age gives evidence of an intensive trade between Assyrians and Anatolia. Most of the settlements inhabited from earlier periods on, continued to be settled and they were developed into cities of the Carchemish Kingdom during the Hittite period. Written records dating to 550 BC, mention that "...Edessa was under the control of the Persians and the fields in the vicinity were under cultivation...". During the Emevi Caliphate, around the 8th century, records mention the newly constructed irrigation channels whereas 19th century Ottoman records¹

provide lists of cultivated plants in the region, referring the localities, eg. "...cereals at Suruç, olives and cotton at Rumkale...".

All these above mentioned data show that agriculture in the region has its roots going back to the prehistoric times and it is a well established activity, with the methods and the species consumed, being similar to the present-day agricultural characteristics.

The strategic position of the region of Birecik-Urfa, the Euphrates providing a link from Anatolia to Mesopotamia, causes a continuous movement and traffic in the area. It becomes domain of different civilizations. During the Middle Ages, Byzantines, Crusaders, Artuks and Memlüks were the settlers, until the Ottomans, who create a 700 year long stability.

Farming, started thousands of years ago, has become the main subsistence of the region all along these periods. At present agriculture constitutes the main sector in the economy where approximately 70 % of the population is involved. Even though this ratio started to decrease in the recent years, agriculture is still the significant sector for the region concerned, as well as the whole of the Southeast Anatolia.

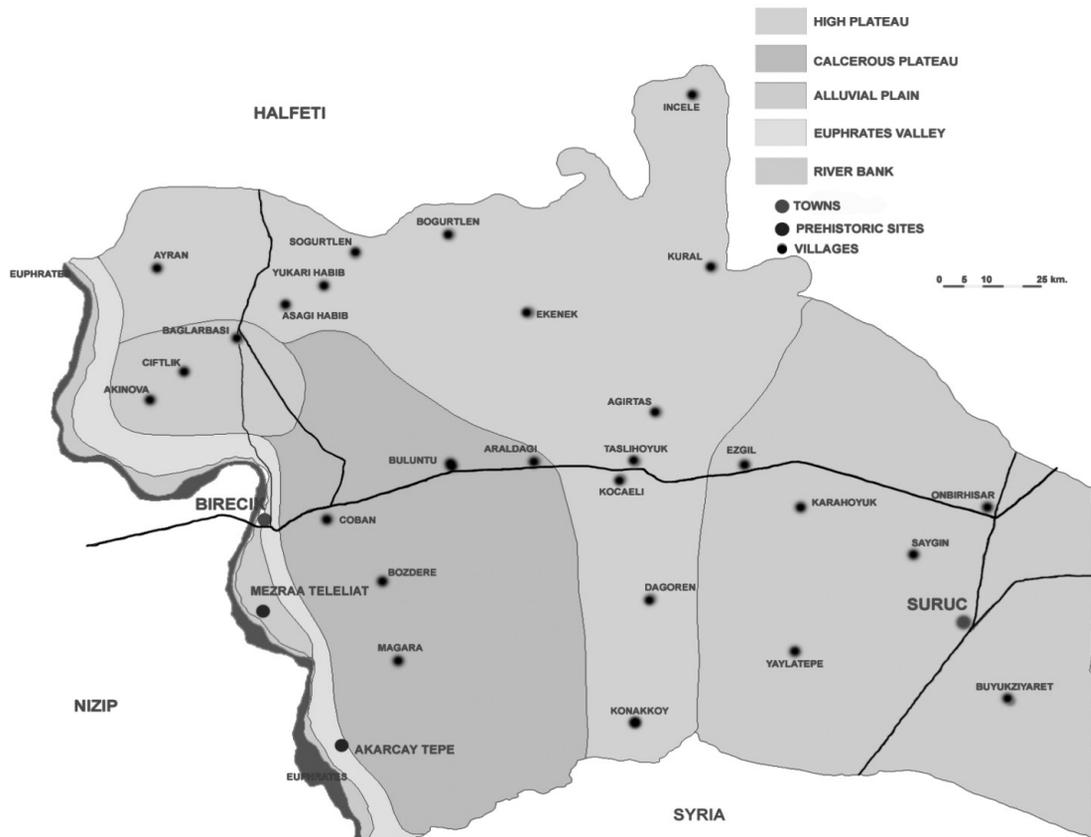


Figure 1. The location of the study region communities.

1.- 1867 Halep Vilayet Sahnamesi/Annals of the Aleppo Province.

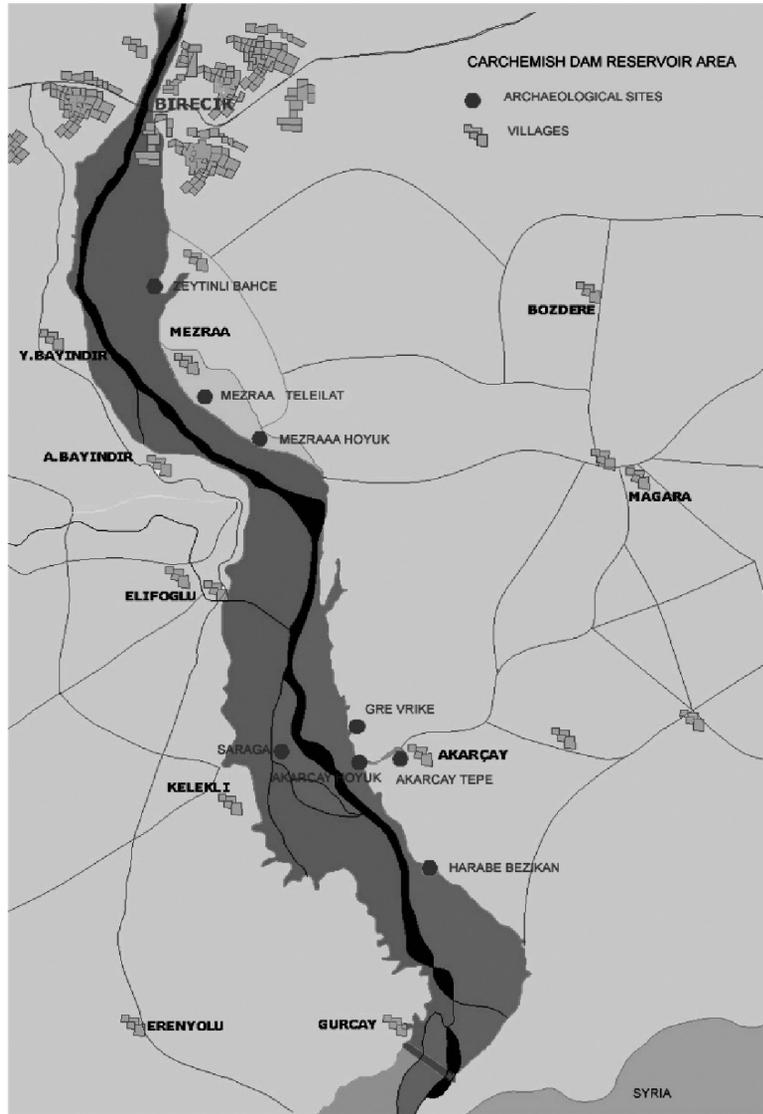


Figure 2. The geographic location of Akarçay region.

BRIEF NOTES ON THE PRESENT-DAY CONDITIONS OF THE REGION

GEOGRAPHICAL AND TOPOGRAPHICAL PROPERTIES

The province of Urfa² covers an area of 18.584 square km, constituting the 2.4% of Turkey. It is 549 m above sea level. It is surrounded on the east by the Province of Mardin, the gate opening to the Mesopotamian plains, on the north by Diyarbakir and Adiyaman provinces and on the west by Gaziantep province. South of Urfa is the Turkish-Syrian border. Mountains

cover 22% of the land of Urfa. The mountains on north, i.e. the southern slopes of East Taurus, declining towards south are not high and they do not stand as obstacles for contact with the northern regions. On the other hand they hinder the winds coming from north which affect the climate. The volcanic mountain of Karacadağ, on the northeast stands as the highest mountain, 1938 m. There are plateaus and wide plains between the mountains where the agricultural activities are concentrated. Bozova, and Hilvan plains on north and Suruç, Harran and Viranşehir/Ceylanpınar on south are the fertile plains, under cultivation at present. The

2.- The oldest name of Urfa is Edessa. This name had been given to the city by Selevkos, the founder of the Seleucuses, who were controlling the area after the fall of Macedonian Empire. The name of Urfa is believed to be originated from the word 'vurhai' in Arabic which means 'water abundant'. Another option is the word 'osroene' in Greek, 'orpei' in Latin, meaning 'fortress' or 'spring'. In 1984, the word "Şanlı", meaning glorious, was attached to Urfa, by the decision of the Parliament, in remembrance of the citizens of Urfa, who participated to the Independence War. Nonetheless, Urfa is widely used among the local people.

region is not rich in rivers except Euphrates. Its length within the province reaches to 270 km (Hartavi/Akçar 2002, 32), it enters from the Mektalan Passage near Siverek District on the north, lines up the border between Ad-yaman and Urfa and flows southwest. Three small tributaries coming from west (Gök, Kara su and Nizip Su) join Euphrates here. The small rivers and creeks of the region are seasonal, they dry up in summer. Most of them are sufficient only to water small scale fields and gardens.

CLIMATE

The continental climate dominates the region. The temperature difference between day and night and summer and winter is high. The highest temperature measured in July is 46.5 °C (at Ceylanpinar) and the lowest is - 12.4. °C (in February). The summers are hot and dry; the winters are rainy and temperate. The annual rainfall in average is over 450 mm (462 / 473 mm), however it differs within the province. At Birecik it drops to 368 mm. Average temperature is 18.6 °C, humidity is 48 %. Frosty and snowy days are rare, in average it does not excess 10 days. The dominating winds blow from northwest – west directions, wind speed is 2,8 m/sec. (Hartavi- Akçar 2002, 36).

The district of Birecik on the other hand, located at the intersection point of continental and Mediterranean climates, differs somehow. Annual average temperature in the district is 17.6°C with highest 45.2°C and lowest -10.3°C. Annual average days with frost are 32.1 and average humidity is measured as 56 %. Rainfall is similar to Mediterranean type regime. It rains in winter and spring; the months of June, July, August, and September are totally dry. December has an average of 70.5 mm rainfall. Average number of days covered with snow is less, it is ca. 3.1 days. The dominating wind direction is the northwest. Winds that blow from east at winter and from southwest at spring bring rain. The average wind speed is 2.3/sec. However, these values, the climate and specifically the ratio of humidity and rainfall started to change after the construction of the dams in the recent years.

SOIL CHARACTERISTICS

The topographical characteristics of Urfa are mild and even, extensive areas on northeast are covered by volcanic lava and ash produced by the Karacada mountain. The area is basaltic. The rest of the land is karstic in formation and there exist many caves, hollow and doline, as the characteristic features of these karstic terrains.

The soil characteristics on the other hand show "reddish brown" type of soil as the dominant type. The ratio of clay is high (43-60 %), whereas organic substances and phosphate is low.

The Euphrates basin is alluvial, the amount of sediments carried sums to 1.167 tons in 1 km² per year.

Urfa province has a great potential for agriculture. The agricultural land it owns constitutes 4.2 % of the country. The land suitable for agriculture measures ca 1.036.040 hectare (Soil type, Grade I-IV). This amount is 55.75 % of the total land of Urfa.

"1st grade" type of soil covers an area of 500.660 hectare and it is app. 26.44 % of the cultivated land in the province. 90.3 % of this land is reddish brown soil; 6.0 % is basaltic, 1.2 % alluvial, 1.3 % colloidal and 1.2 % is brown soil. The inclination measured is less than 2 % in 98.5 % of the 1st grade soils. 76 % of them are deep soils; 23.4 % is middle and 0.6 % has a shallow depth. 192.676 hectare of this type of soil is used in dry farming with fallowing; 228.569 hectare in dry farming without fallowing; 655 hectare by insufficient irrigation; 4.988 hectare in dry vineyard farming; 189 hectare for gardens with irrigation; 5.057 hectare to grow pistachio; 8 hectare to grow orange, citrone, lemon, etc. 315 hectares are being used as forests and 3477 hectare for contemporary settlements.

The "IInd grade" type of soils cover 225.905 hectares and it is 12.16 % of the total. 0.4 % of it is alluvial, 2.3 % is colloidal, 2.9 % is brown soil, 44.2 % reddish brown and 50.2 % is basaltic soil. 32.4 % of them have a 0-2% of inclination and 67.4 have 2-6. 18 % are deep; 81.4 % of them have an average/middle depth and 0.4 % has shallow depth. 66 % of the total, erosion is not effective; it is in middle ranges for 32.9 % and quite important for the 0.9 %. 0.4 % of this type of soil has drainage problems.

Land for agriculture covers 64 % of the total, pastures cover 8.5 % (157.991 ha) and woods and forests cover only 0.84 % (15.667 ha) of the total.

VEGETATION

The natural vegetation is quite poor all over the region. Steppes dominate. The north and north-eastern section is richer than the south as it is mountainous and higher. Oak (*Quercus*) grow mainly on Karacadağ, the volcanic mountain lying northeast of the city between Diyarbakir and Urfa. Vegetation does not survive year-round due to the extremely hot, long summers and drought. Flowering plants as *Papaveraceae*, *Matricaria chamomilla*, *Tulipa* and *Viola*, edible plants as *Rumex acetosella*, *Sinapis arvensis*, *Apium graveolens*, *Portulaca oleracea* and *Malva* constitute the natural vegetal landscape. At Tektek Mountains there are forests of wild pistachia, locally called *menengiç* (*Pistachia terebinthus*).

The climate is warmer in south of the region. Vegetation is directly bound to precipitation; plants are alive only in rainy seasons. Weeds, wild wheat, *Crocus*, *Thymus*, *Alhagi pseudalhagi* and licorice (*Glycyrrhiza*), *Erica* are part of the vegetation cover.

The region is very poor in terms of forests too due to the climate conditions rather than the human destruction at present. Nevertheless, in the past it is known that on and around the mountains, forests covered much larger areas than today. Uncontrolled grazing was one of the reasons of the poverty of the tree cover. At present there are micro niches as Halfeti and the valley of Euphrates which are rich in natural vegetation and even woods. At the Euphrates Valley, willow trees, known as Euphrates poplar, specific to the region, grow. Trees of nut, apricot, palm, eucalyptus, plum and fig; almond, caper, cumin are the common plants.

FAUNA

The fauna includes bald ibis, partridge, rabbit, turtle dove, gazelle, fox and a type of owl, *Otus brucei*. The gazelles live at the Tektek Mountains; however, their numbers are declining (Birecik 2003, 78-79).

DEMOGRAPHY

Urfa is one of the highly populated provinces in Turkey. The population census in 1927 evidenced more than 200.000 people living in the province. From 1940's to 1960's, the growth rate was much higher than the

country's average. Its economy could not meet the demands of this fast increase in population which resulted with unemployment and migration. However, migration did not decrease the population, in 1997 it was the second fastest growing city with the growth rate of 37.09%. At present, there are more than 1.440.000 people living in the Province of Urfa; 840.000 in the city and 601.000 in villages.

The population is quite young. The distribution of the age groups shows that majority is the 0-4 year-old children, followed by 0-19 year-old group. The number of members of a household is 7 in average, where in Turkey it is 4. The distribution of the economical activities shows that agriculture/farming is the principal sector in the region and in the province of Urfa as well. 71.2 % of the population is involved in agriculture. While women constitute 36.4 % of the working population in Urfa, 96.7 % of them are involved in agriculture.

The level of education among the work groups in Urfa is quite low, especially the women. The ratio of the illiterate men is 25.6 %. It rises to 77.2 % when women are considered.

People working in the sector of agriculture who are uneducated make up 57 % in total. 34 % are graduated from the elementary school. These percentages indicate the low level of education which have direct influence on the development and the sustainability of agriculture.



Figure 3. Agricultural activities near Birecik in the Euphrates valley.

AGRICULTURE IN THE REGION

Agriculture, with a background of thousands of years, is the principal economical sector of the region at present. The agricultural census dated to the earliest years of the Republic shows that 95.000 people, which constitute 47 % of the population, were working in the agriculture sector. 61.000 hectares of the land were under cultivation, where 97 % of this area was for cereals, 2.5 % for legumes, and 0.5 % for industrial plants. The inequality in the distribution of the landownership, led the government to choose Urfa as the pilot area for the application of the land reforms in 1945. In 1950's, mechanized agriculture and irrigation projects started. Since the land for agriculture is even in general, the use of tractors was quite easy. However, the unbalanced distribution of income and the insufficient capital were the basic obstacles for the modernization process. In this case, for the majority of the farmers, the labour cost became more economic and practical than purchasing agricultural appliances (Fig. 3).

The region has wide and fertile soils that could be irrigated by the Euphrates and its branches. However, evaporation is high and the humidity level during summer goes down rapidly. The small creeks and rivers dry up in summer and they are not well fed by underground sources.

Insufficiency in irrigation appliances and channels do not allow the irrigation systems to operate fully for wide areas. As a result, dry farming and traditional methods dominate the area and carry on in the majority of the region.

It is not common to use fertilizers in the region. Natural fertilizers, the dung cakes of cattle, are used as fuel for heating. The high rate of water erosion, on the other hand weakens the soil and urges to use fertilizers³. Synthetic fertilizers became prevalent in the mid of 1970's. In 1975, the usage level started to increase and it reached to its peak in 1979. The dramatic price increase in 1980's, had decreased the usage of the synthetic fertilizers in the region as well as the whole country. The consumption rate of fertilizers fluctuated between 1987 and 1999 where it started to increase again especially after the year of 1995. However, when the scale of agricultural land is taken into account, the usage level of fertilizers is too low, which causes the fertility of the soils drop.

The total agricultural area in Urfa, represents 4.2 % of the total agricultural area of Turkey. 81.54 % are the fields for cereals, 8,12 % for fruit orchards, 1,80 % for vegetables. 29,80 % of the cereal fields and 1,12 % of the fruit orchards and 86,03 % of the vegetable gardens are irrigated (DIE 2000-2003) (Hartavi/Akçar 2002, 77).

Cereals make up 66.25 % of the field products in the region. Legumes are 13.62 %, industrial plants 17.98 %, oily/fatty seeds 2.09, tubers 0.04 and plants for fodder 0.03 %. Among cereals, wheat is on the first row (64.35 %), barley (35.10 %) and corn (0.56 %) follow them respectively (YA 1984, No. 132). Legumes are planted in wide areas, lentil and chick pea production being dominant. The facilities of irrigation increased the plantation of the industrial plants compared to the former years. Cotton takes the first place among them.

Vegetables such as cucumber, tomato, pepper/paprika, eggplant, melons and fruits like pistachio, plum, apricot, mulberry, walnut, almond, and grape are important products. The first three among the fruits are pistachio, grape, and plum. In general, the fruit production in the region is for self-consumption rather than marketing (Hartavi/Akçar 2002, 201) (Fig. 4).

THE SOCIAL STRUCTURE OF THE REGION

Aşiret is originally an Arabic word (*aşira*) and at present it is used as a social, political and economic association. *Aşiret* consists of minimum two sub-groups, called *kabile* (*qabilah*). They are nomadic or half-nomadic groups of people. They believe that they stem from the same origin; they explain their relationship and the liaison by sharing the common blood-kinship. They speak the same language, but may have different dialects (Emiroğlu/Aydın 2003). They get organized under the control of a leader.

Such an organization has its roots going back to the Anatolian Seljuks (*Anadolu Selçukluları*) times. *Aşirets* were highly important to the state to provide security. The duty of keeping the stability, providing peace and security for the agricultural lands was given to the *aşirets*. With such an aim, the transfer of the *aşirets* to the borderlands was an important policy. On the other hand, by the Ottomans, *aşirets* were one of the main units that constitute the nation. They were moving seasonally between mountain pasture (*yaylak*) and winter place (*kışlak*). At mountain pastures they used to deal with animal husbandry, while at winter place they were also making agriculture; however they were mostly engaged with the exchange of the animal products, their the main activity.

The leader of an *aşiret* is called bey, same as *sheikh*⁴ at Arabs. Assigning a leader was usually done by the elders of the *aşiret* and it had to be approved by the government. There were times when the leader was selected by heredity (Bozkurt 2003). In such cases the family of the leader constituted the *aşiret* aristocracy.

3.- Pers. comm. by Mehmet Güzeltaş, the agricultural engineer, August 2004, Birecik, Urfa.

4.- *Sheikh* is originally an Arabic word meaning the elder. In some regions it is used as the *Aşiret* Chief, *Ağır*, and *Mollah*. Today, there is the "Seyhan Asiret", living between Hilvan and Viranşehir that was evolved from the *sheikh* bounded to the city of Urfa (Bozkurt 2003, 30).



Figure 4. Fruit production of pistachio in Akarçay region.

Aşirets at Anatolia in Ottoman times were organized specially for military and administrative purposes. They were providing animals for civilian and military land transportation and animal products through their vast herds⁵. They also had additional tasks and responsibilities like protecting mines, mountain passes and gates, extraction and transportation of minerals, carrying out the transportation affairs of the army, and suppressing inner rebellions. They were not taxed like farmers and not due to the number of family members, but as a community and according to the number of animals they owned.

Aşirets did not present any problems at times when the Ottomans had a strong, centralized authority; however the situation changed with the weakening of the state, and *aşirets*, which had a social function, started to gain political power and the leaders started acting like regional leaders. The ones with high population gained advantages and started to have power on the others which caused rebellions. In 1800s, Ottomans sent

administrators to the region from outside to suppress the rebellions and to end the dominancy of the *aşiret* leaders. The failure of the administrators to provide the consistency allowed *sheikhs*, who were functioning as religious leaders, to gain political positions. Since then, *aşiret* leaders and *sheikhs* became important in the political life (Bruinessen 1993, 37).

At present, the system survives having effects principally on social life. The change in economic life, from nomadic way of living to settled life and migration from villages to cities weakened the structure where they function basically as a kinship, offering support and solidarity among its members. *Aşirets* who lost their effectiveness, keep their names. However, Urfa is one of the regions in East and Southeast Anatolia where they are still dominate and have power on all domains of social life. Their strong elements are the blood and kinship relations. Today, *aşiret* leadership does not pass from father to son. The one among the sub-group leaders, who distinguishes, gets the leadership. The members

5.- The four essential items for *aşirets* are, animals used for transportation- like camels, donkeys, and horses; the tent, produced out of goat hair; animals that provide meat like goat, sheep, and cattle; and dogs for protection.

are strongly devoted to the leader. They have oral rules stemming from the past on the concepts of behaviour, courage, honour, authority, endogamy, and vendetta, etc. (Bruinessen 1993: 106). Marriage and birth traditions continue as they were in the past, custom values and religious structure preserve their importance. Marriages are mostly done between cousins. Not only economical reasons like to ensure that the wealth be kept inside the family, but also the will of the family to strengthen itself by ensuring continuous political, social, cultural, and economic solidarity are among the reasons for such a high rate of marriages between relatives. On the other hand, city life creates differences in social aspects such as nourishment, clothing where the difference becomes clearer between rural and urban areas.

The present-days *aşirets* of Urfa are as follows: Berazi, Beziki, Milan, Geys (Kays), Karakeçi, Dümbüllü, Zırkan, Mirdesi, Döğeri, Şeyhan or Şeyhi, Melik or Melikan, Canbeyli or Canbeğ, Mersavi, Acem, İzol, Beni İcil, Köran or Goran, Okh, Karakoyun, Khartavi, Kejan, Reşi, Karaçi.

The other characteristic of the region that defines the way of life is the system of land ownership, known as “*Ağalık*”. *Ağa* is the person who organizes the production by his absolute control on land. He devotes a part of the production to the labours, just enough to survive, and keeps the rest. The strength and influence of the *ağa* is due to the size of his land and the number of people working for him. Therefore, there is always a fierce competition among the *ağas*. The relationship between the *ağa* and the worker depends on traditions and it does not get affected by efficiency and/or marketing mechanisms.

The *ağalık* system is a form of a control and an organization on agricultural production that states the relationship between the *ortakçılar*⁶ and the landowner. The land (of the landowner) is processed by the people, called “*azap*”. *Azap* do work for the landowner and landowners and *aşiret* leaders may have social, political and economic influence on “*azaps*”. There exists another group of people who also works for the landowner. They may not even have the right of the *azap*, they do not have any land and they are the poorest and the powerless of all. They are not bound to any land owner, they only do the jobs given.

The roots of this system go back to the Seljuk times. When there was an economical crisis and the problem in paying the salaries, the solution was found as giving authorization to the soldiers to take tributes from the lands of the country. During the period of Anatolian Seljuks, similar authority was given to the conquerors and *beys* and *aşirets* who accepted the sovereignty of the government. By the Ottomans, the autonomy had

been given to *aşirets* and *beyliks* in east and southeast regions, in this way their devotion to the central government was achieved. These leaders became legal through their agreement with the government and started to strengthen.

In 1926, with the admission of the Turkish Civil Law, the land ownership gained a legal base. Precautions (eg. land reform) were tried to be taken, but the manipulation of the landowners could not be prevented. Furthermore, in 1950s, when the agricultural equipments started to be used and agricultural products started to be appreciated, the landowners increased their range of influence by controlling of the hayfields and pastures, which were the common public properties of the villages. This led to a rapid losing land process and caused *azap* and *ortakçı* to leave their villages and migrate.

Ağalık is generally established on a clear economical basis. However, in case of a combination of *aşiret* leader and *ağa*, or when a blood relation between the *ağa* and the members of the *aşiret* is concerned, the relations become complicated socially and politically. *Ağalık* provides the missing link between local people and the government as a social institution, especially at the remote places where power of the government is weak and the public services do not exist. Hence, dependence on *ağa* becomes not only economic but social and political as well.

The Southeast Anatolian Project, (Güneydoğu Anadolu Projesi - GAP) which was initially planned by the State Water Affairs (DSİ) was constituted by 13 large projects, whose priority was irrigation and hydroelectricity production (Akın 1999). However, it is not just a technological development project but also a social and economic transformation project. One of its objectives is to end the traditional system and to minimize the differences between the people and between the different regions in the country.

THE ETHNOGRAPHICAL STUDY

The information obtained from the case study below is the result of an ethnological study in the region. It was conducted in five villages of the town of Birecik. The questionnaire, used on the field constituted the main frame of the study. It was originally designed by the ethnologist and economist G. Arab, for Syrian villages where it was modified due to the conditions in Urfa region. The village of Akarçay was the center of the study and the remaining four villages were complementary for the history of the region. The villages visited and studied were, Adacık, Çiçekalan, Duyduk and Ziyaret.

6.- By *Ağalık* System, the land is processed through the *ortakçılık* method. The share of the *ortakçı* receiving from the yield changes according to the production equipment he has and his participation level to the operating expenses. At some places renting was also valid for processing the lands of the *ağa*.

The current residents of all of the villages under study, first came to the region 200 years ago and settled in the villages which were first founded by families of Arab origin. The new comers were Kurdish; however both groups lived together in peace for a couple of decades. Their subsistence economy was dependent on animal husbandry where agriculture was secondary. The property of the lands belonged to a wealthy person, the *ağā*, who used to live in the town and the villagers without land used to work for him. This system continued for a long time until gradually some of the contemporary villages has overcome the system and managed to buy the lands and work mainly for their own families. However, the difficulties and the inequalities of the system in time caused the Arab families to leave their villages to the Kurdish families.

Agriculture became dominant for the last five decades where dry farming prevail, however irrigation from wells and from the river was also practiced. After 1980s, the construction of a series of dams on Euphrates at first caused the formation of new alluvial fertile soils for agriculture; however these fields were later flooded by the artificial lakes of the dams which caused an entire change in the subsistence economy and the way of living.

The ethnological study in the region also documented the facilities and the problems of the present day villages. Social needs in villages such as medical treatment, veterinarian problems, consumption needs are being fulfilled in the nearest district/town. None of the villages have a health center or a hospital; serious affairs like health problems (in need of a hospital) and/or car repairs and purchases have to be fulfilled and supplied at the city center, the closest being approximately 80 km far. All of the villages studied have an elementary school and a mosque, but no other public services. The daily household needs (eg. food and cloth) are provided from the *çerçi*, which could be described as a mobile merchant, visiting each village once in a week. *Çerçi* usually have a wide variety of items ranging from cooking pans to candies and he exchanges these items with the local products of the village.

The regular and official visitors of the villages are the cotton traders visiting the villages twice a year, the agricultural engineers during natural disasters and health and medical practitioners. All of the transportations, e.g. for health or for shopping, are made through the private vehicles of the farmers. There are a few public transportation means, once a day, between the villages and the town center.

AKARÇAY

Its original name is Tibil. The residents of the present village stem from the family of Mir Muhammed, who is Kurdish. When they first came to Akarçay, there were already 80 people living in 12 houses, all from the Arafli

family, Arab in origin. Two different ethnic groups lived together until 1970s. They were mainly herders but gradually they started to be agriculturalists. The lands were the property of *ağā*, a Turkish man from the town of Birecik. In 1974, some of the families left the village mainly because of the conflict with the landowner. Those were mainly the Arabs and some of the Kurdish villagers, belonging to Mir Muhammed, Siyah Ali and Sıcıklı *aşirets*.

At present there are 380 people living in 40 houses. They all belong originally to the Mir Muhammed family, with five different sub-families, therefore different surnames, Kılıç, Karayazgan, Arslan, Savaş, and Yavuz. They are all farmers.

ADACIK

The original name of the village is Şavi in Kurdish. The residents of the village belong to the family of Mir Muhammed, Kurdish in origin, as in Akarçay. Initially actual Kurtalan region of Siirt province belonged to this family who first moved to Syria, and then to the village of Akarçay. The reason of this migration, which took place about 200 years ago, is not known and/or remembered by the present members of the family. In 1970's, the troubles and the inconvenience generated by the *ağā* caused some of them to move to another place which is the present day village of Adacık. *Ağā* of Adacık and Akarçay used to live in Birecik, the closest town, and not in any of the villages. In such cases in general, an old, admired person from the village replaces him and works as his deputy, which is the case at Adacık.

The village consists of seven households and has a population of 60 persons. All of them belong to the same (Mir Muhammed) family and therefore share the same surname.

ÇİÇEKALAN

Its original name is Zehra. Residents of the village are from Aleppo first moved 300 years ago. They came to settle at the village of Çeloğlu. It is one of the southern villages in the region, divided by the political border of Turkey and Syria. One part of the village is currently in Turkey, while the other part is in Syria. 100 years ago they came from the village of Çeloğlu to Çiçekalan. When they arrived to Çiçekalan there was already an Arab community of 45 people living in seven houses. Some of the residents were urged to leave the village 70/80 years ago by the landowner, Mirkelam, who lived in Birecik. In 1958, 30 more households, all belong to the Kurdish Karyanlı family, also decided to move to another village, namely Çoğan. Between 1980 and 2000, because of economical reasons, 55 households, all from Aliibik family, migrated to the city, to Gaziantep. The rest of the villagers managed to purchase the lands

from the landowner in 1982 and became full farmers and work for themselves. However, in 2000 most of these lands were flooded by the artificial lake of Birecik and Kargamış (Carchemish) Dams. At present, 550 people are living in 77 houses.

DUYDUK

Its original name is Harabe Bezikan. The inhabitants of the village come from the same Kurdish family of Mir Muhammed. They were the same group first moved from Siirt to Syria and finally settled at Akarçay. In 1969 they migrated to Duyduk Village. When they arrived there were six houses and families with 30 members in total living in Duyduk. These families are known to have come from the north of the town of Birecik. They shared the same village for about 10 years, without any problem. Nevertheless economic problems recently forced them to leave the village. The current villagers- from the family of Mir Muhammed- bought the lands from the landowner in 1981. Today there are three main families, Kılıç, Karayazgan and Savafı, 300 people in total, living in 40 houses. All of them have the same origin.

ZİYARET

It keeps its original name. Half of the village is in Syria. In the past they used to deal with trade between Syria and Turkey where they could earn good money and managed to buy the land from the ağa. The former landowner was Mirkelam, the same person who owned the lands of the village of Çiçekalan.

Today they are 52 people living in seven houses. All of them belong to the Ketiken family and have the same surname of Kılıç.

THE TRADITIONAL HANDCRAFTS IN THE REGION

Within the scope of the ethnological study, the traditional handicrafts of the region were recorded as well. Although most of them had lost their prevalence with the developing technological innovations, there are attempts to refresh them. A project developed by GAP, with the objective of protecting the cultural values, is being supported by local administrations, municipalities and some non-governmental organizations.

The main handicrafts in this region which are disappearing gradually are as follows:

hemp production (*kendircilik*), packsaddle production (*çulculuk*), leather goods (*saraçlık*), (*derbağlık*), felt making (*keçecilik*), copper smithing (*bakırcılık*), wood carving (*ağaç oymacılığı*), cloth weaving (*çulhacılık*), heavy cloth cloak making (*abacılık*), silk yarn processing (*kazzazlık*), comb making (*tarakçılık*), furriery (*kürkçülük*). Production of hemp constitutes an important field of work. Hemp was used to be planted on the banks of Euphrates. The thick fibers are used to make rope and

strings. Since it is water-resistant and may be produced in any thickness, it was used in the ships, which were constructed at the dockyard of Birecik (Birecik 2003, 91). Women were also involved in its production at the first stage of processing, where the main procedure was done at the workshops, located on both sides of Euphrates.

The production of packsaddle was another important craft when camels, horses and donkeys were the principal means of transportation. The packsaddles were called *palan* and the craftsmen dealing with this craft, *çulcu* or *palancı*. Since transportation nowadays is dominated by motorized vehicles, this craft also lost its importance.

Leather-working was one of the essential crafts of the region. Leather goods used to be produced especially for the special equipments for horses. Production of belts and items for horse riding were important in Urfa since the famous Arab horses had been grown here. The craftsmen were called *saraç*. *Derbağlık* is the name of the craft which deals with processing the skins of big and small sized animals. The craft of processing the skins of big sized animals is called as *gön derbağlığı* where *gön* stands for thick leather. These were used for the surface and lining of boots and shoes.

Felt making is also an important handicraft. The best felts were produced from the wool of 3-4 months old lambs, grown mainly at Harran Plain. With the factory type of felts today, the craft lost its importance, but there are still small workshops producing felt for chair cushions, wall carpets, prayer rugs, saddlebags, hats and boots for tourism purposes.

The history of copper working is quite old in Urfa. Copper equipments, to be used in the kitchen, have a wide range of form from cauldron to simple cooking pans. Decoration on cups is famous with its pounding/hammering technique which is replaced by a relief technique nowadays for tourism purposes.

Wood carving, mainly for building activities, to produce windows, boards, mirror frames, ceiling of the rooms and wall covers; the craft of processing wool fiber, cotton fiber and floss silk to produce head scarves are some of the handicraft rarely seen nowadays. *Kazzazlık* is the method of obtaining silk yarns by bending with hand. 100-150 years ago sericulture was an important sector in the region. There were mulberry trees intentionally grown for the silkworms. Today, *kazaz* tradesmen bring silk yarns either from Bursa or from the neighbouring city of Diyarbakır. Comb making was another traditional handicraft where they were made up of either from the long bones of a camel, or out of pear or walnut tree. But the walnut trees in Urfa are not preferred, therefore the black quality walnut trees of Elazır and Diyarbakır were chosen.

Fur production, as one of the oldest handicrafts has a special place among others. The clothes are produced from the hair of lambs which die at the mother's uterus

or at maximum 5 month old. The cloth is typical with its form, a big and warm cover, it is coated from outside by a black cloth called *sakaf*. This cloth is unique to Urfa and is not produced anywhere else. It used to be worn at winter by elderly or middle aged people. 25 % of furs produced in the city is sold in the city center and the neighbouring cities while the rest is exported to Syria, Iraq, Kuwait, Qatar, Saudi Arabia, and Iran which have cold desert climate at winter. This craft is one of the rare, still active crafts of present-day.

All of these mentioned craftsmen were used to be trained according to the “master and apprentice” tradition. A young boy learns the craft from the experienced one, the “master”. The young one practices for years under the control of his master. The masters are used to be closer to the boy than his father, teaching the “life” and transferring all the information and the practical details about the craft and all the experiences to the young one. When the boy reaches the level of maturity, which is defined by his master, he starts working by himself as a “master”.

CONCLUDING REMARKS

The agricultural activities have a long history in the region, possibly longer than elsewhere. Recently excavated sites in the region have evidenced full farming, the earliest starting from 8th mill cal BC. The characteristics of the soil structure, climate for dry farming, and the naturally grown wild forms of some species seem the suitable physical conditions for the early farmers.

Agriculture is still the main economical activity in the region providing substantial income not only for the region, but for the country as well. This aspect led the state to subsidize agriculture in the region, since the first years of the Republic. However, the traditional social structure, inequality in the distribution of land, the landownership (*ağalık*) system and the insufficiency of opportunities and funding posed serious problems in developing sustainable agricultural programs. The problems still continue today although some improvements were achieved by the regional development programs of the “Southeast Anatolian Project- GAP”.

The high rate of birth, migration and resettlement, education are the actual issues under study by the Project. On the other hand, the problem of insufficient income and lack of adequate capital, stand as the major obstacle for the development. Moreover, agriculture being undertaken by workers without land, in other words lands being processed by people who do not work for their own properties- the situation which is caused by the *ağalık* system- hinders the future developments. Another important issue is due to the level of education of the farmers. The irrigation problems, which are aimed to be solved by the GAP, carry on in another dimension. The absence of adequate social training programs or the insufficient cooperation with the local farmers led to the salinity and aridity and therefore infertility of the soils, resulting from the rapid and intensive irrigation. Such a problem has happened in the plain of Harran where “...excess irrigation than the required caused to raise the base water, the eroded soil to fill the gaps avoiding the plant roots to breath. Afterwards, the loss of water increased, basin water rose, plant productivity reduced, food capacity lowered, air circulation in the soil obstructed, roots covered with water, land structure and formation disrupted, salinity and aridity increased...” (Akbaba 2001, 51).

To conclude, the region is distinguished with its history, identity and socio-economical structure. It is apparent that any kind of innovation for the development and modernization of the region is an achievement on one side, but an intervention to its unique and original structure on the other.

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VII. CONCLUSIONS

18. CONCLUSIONS

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The MENMED project aimed to increase international scientific collaboration in the field of cultural heritage by covering a wide range of domains including archaeology, archaeobotany, demography and geography. It is hoped that this will contribute to ensuring the sustainability and socio-economic development of the study area (Middle Euphrates valley –Syria/Turkey– and Orontes valley –Syria–). The compilation of present information from different sources and comparison of this to past conditions may be helpful for management policies.

Our multidisciplinary approach to the management of cultural heritage promotes interaction between people and their environment. Our research has focused on the qualitative and quantitative aspects of the dynamics concerned, to the detriment of temporal and spatial aspects. The archaeometrical methodologies used in this project constituted a relevant scientific contribution to the valuation of archaeological remains, while contributing to a better understanding of the current landscapes.

All information acquired to determine the main differences between ancient and present conditions will be used to compare the coastal and inland areas in the framework of the Mediterranean, Syria and the Middle Valley of the Euphrates:

- a. The climate was slightly wetter than that found under present-day conditions. The wetter climate would have enabled the vegetation zones to descend to a lower altitude and this effect would have been reinforced if temperatures were lower, which may well have been the case. The differences compared with the present-day situation undoubtedly made the area more favourable for human occupation than it is at present. But it should be noted that all sites remain close to permanent sources of water, which implies that water availability for human use was similar to that of today.
- b. The composition of the past vegetation has been highly degraded over the 10,000 years. This

degradation occurred most rapidly at times of increased drought and at times of increased population. Most of the plants that we have found can still grow in the area, once human pressure is removed. It would appear that the dominant factor which led to the degradation was human impact rather than climatic change.

- c. Degradation of the vegetation led to increased aridity because the removal of plant cover resulted in greater evaporation and run-off after rain. It might also have led to higher temperatures. Finally, soil erosion may have further intensified the process of aridification.

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RECOMMENDATIONS FOR FUTURE ACTIONS

The situation has been aggravated over the last thirty years due to demographic expansion in the area, and it is now time to attempt to reverse the process of aridification. We recommend that the data we obtained for past species be used to reintroduce and restore a more favourable habitat. However, this effort would be totally wasted if grazing were allowed to continue. Given that for the local villagers grazing is an important part of their economy, an efficient alternative to traditional pasture would have to be found and villagers would have to be convinced to use it.

PAST AGRICULTURE PROVIDED THE MORE FAVOURABLE CLIMATIC CONDITIONS DURING THE EARLY NEOLITHIC

The cereals examined from this period show no signs of having been cultivated using irrigation; indeed, at this time it would not have been possible to use the waters of the Euphrates for irrigation:

- 1) Because the topography of the valley above the flood plain had not been adapted;

2) Because the flood plain itself would have been totally inundated just at the time that the cereals were coming to maturity, which coincides with the annual floods brought about by the combination of spring rains and the melting of the snow in the mountains of Eastern Turkey.

WHERE DID THESE EARLY FARMERS OBTAIN THEIR CEREALS?

- a. Today, large-scale wild habitats of einkorn and rye are to be found north of the Syrian/Turkish border. Barley is found throughout the region. Palaeoclimatic evidence suggests wild wheat and rye grew may have grown further south nearer to the sites than they do at present. However, they may not have been growing at a convenient distance to the sites because sites are often situated in areas where edaphic and climatic conditions are not suitable.
- b. We cannot establish with any certainty at what distance the stands were from the sites; they could have been situated 5, 10, or even 100 kilometres away. Whatever the distance, the inconvenience of wild stands being situated far away from the sites created an incentive to cultivate, which may have been facilitated by socio-cultural factors. It would

have been a major advantage to have the crops near the sites. Villagers could protect them from grazing animals, of which we know there were a great many, but may also have been in competition with other villages for wild cereals. If they were to plant them near to the site, they could not only claim them for themselves but also defend and tend them.

The beginning of the Holocene brought warmer climates, and villages on the Euphrates became more dependent on farming and less on gathering. It was at this time that barley first appeared in the Euphrates sites. It was rare to begin with, but its frequency soon increased. The appearance of barley probably resulted from the combined effect of warmer climates and increased intensity and reliance on cultivation. Barley is better adapted to the region's climate than wheat. The inhabitants progressively abandoned the use of grains of small grasses, preferring cereals and pulses, which had bigger grains. Then, with time, the diversity of cereals increased with the introduction of one-grained einkorn, emmer and naked wheat. These new crops came from elsewhere.

The data cannot be used to estimate yield. Indeed, early farmers would not have been concerned with quantity per hectare for the simple reason that land availability was not a limiting factor as it is in modern societies.



Figure 1. General view of the Euphrates River near Birecik (Turkey).

INTERPRETING PRESENT CONDITIONS FROM A HISTORICAL POINT OF VIEW

A problem arising among Mediterranean countries is that of land use and water management, especially in the context of potential climatic changes and increasing desertification. Moreover, extensive irrigation work is being developed in these regions with the expected consequences (soil impoverishment, diminution of the water table, changes in social uses, etc).

The present day conditions in the studied area are determined by two main points:

1. social structure of the region
2. impact of dam projects

Dam Projects are highly important for the region, and were planned and established as a solution for hydro-electrical and irrigation problems. They were not only

established as technical projects but also as social and economic transformation projects. One of their objectives is to minimize such differences. However, at the same time, the dam's projects involved technical and economic problems.

The dams caused environmental problems related to climatic changes. Such changes affected the flora and fauna. Moreover the threat of erosion and high sedimentation as well as practical problems such as the inundation of the fertile flood plains, lack of financial support to supply equipment to the locals for irrigation, indiscriminate use of fertilisers/chemicals, etc. caused problems rather than improvements. Together with the problems of the present system in terms of land-use and inequality; there are other problems involving political attitudes, governmental politics, unemployment, migration and education.

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ABBREVIATIONS

- AAAS = Annales Archéologiques Arabes Syriennes.
- AHA = Annales d'Histoire et d'Archéologie.
- AfO = Archiv für Orientforschung.
- AnTard = Antiquités Tardives.
- AS = Antiquités syriennes.
- BAR Int. = British Archaeological Reports, International Series.
- BAAL = Bulletin d'Archéologie et d'Architecture Libanaises.
- BAH = Bibliothèque Archéologique et Historique.
- BARB = Bulletin de l'Académie Royale de Belgique.
- BCILL = Bulletin des Cahiers de l'Institut de Linguistique de Louvain.
- BEO = Bulletin d'Études Orientales.
- BTS = Beiruter Texte und Studien.
- CAAS = Chronique des Activités Archéologiques en Syrie.
- CRAI = Comptes Rendus de l'Académie des Inscriptions et Belles Lettres.
- DÉPM = Documents Épistolaires du Palais de Mari.
- EQ = Excavating Qatna.
- HANE/S = History of the Ancient Near East/Studies.
- LA = Levantine Archaeology.
- LAPO = Littératures Anciennes du Proche-Orient.
- MARI = Mari, Annales de Recherches Interdisciplinaires.
- RA = Revue d'Assyriologie et d'Archéologie Orientale.
- ZDPV = Zeitschrift des Deutschen Palästina-Verains.

IX. APPENDIX

20. APPENDIX

PUBLICATIONS AND PAPERS

Araus, J.L., Ferrio, J.P., Buxó, R., Voltas, J. 2007, The historical perspective of dryland agriculture: Lessons learned from 10,000 years of wheat cultivation. *Journal of Experimental Botany* 58, 131-145.

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CONGRESS CONTRIBUTIONS (CONFERENCES AND MEETINGS)

2006

Ferrio J.P., Willcox G., Buxó R., Alonso N., Voltas J., Araus J.L. Reconstruction of climatic and crop conditions in the past based on the isotope signature of archaeobotanical remains. *BASIN-SIBAE stable isotope meeting - Isotopes as tracers of Ecological Change* (March 2006, Tomar, Portugal). Type: invited talk.

2005

Ferrio J.P., Alonso N., Buxó R., Willcox G., Araus J.L., Voltas J. Preservation of the original carbon isotope signature of wood in charcoal: implications for palaeoenvironmental studies. *Annual meeting of the Stable Isotope Mass Spectrometry Users' Group - SIMSUG* (April 2005, York, U.K.). Type: talk.

Ferrio J.P., Alonso N., López J.B., Araus J.L., Voltas J. Carbon isotope composition of fossil charcoal reveals aridity changes in the NW Mediterranean Basin. *PAGES second open science meeting: paleoclimate, environmental sustainability and our future* (August 2005, Beijing, P.R. of China). Type: poster.

Willcox, G. Haute-Mésopotamie: la crise de -2100 av. J.-C. A-t-elle eu lieu? Lyon.

Upper-Mesopotamia: did the 2100 BC crisis take place?
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2004

Canterbury, England (13/06/2004 - 17/06/2004): The
International Society of Ethnobiology - Ninth International
Congress (participants G. Willcox).

Girona, Spain (16/05/2004 - 22/05/2004): 13th
Symposium of the International Work Group for
Palaeoethnobotany (participants R. Buxó, G. Willcox,
S. Fornite, L. Herveux, N. Rovira, P. Ferrio).

* Berlin, Germany ICAANE (29/03/2004 - 03/04/2004):
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ACADEMIC RESEARCH

1. Borrell, F. (2006) Gestion de matière première et technologie d'outillage agricole dans les sites archéologiques de Akarçay Tepe et Halula, UAB. Tesi Doctoral.
2. Guerrero, E. (2006) Inhumation studies: paleodemography and paleoeconomy approaches, UAB. Tesi Doctoral.
3. Cruells, W. (2005) Origines, Emergence et développement de la céramique Halaf en Syrie, UAB. Tesi Doctoral.
4. Ferrio J.P. (2005) Reconstruction of climatic and crop conditions in the past based on the isotope signature of archaeobotanical remains, ETSEA-UdL. Tesi Doctoral.

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