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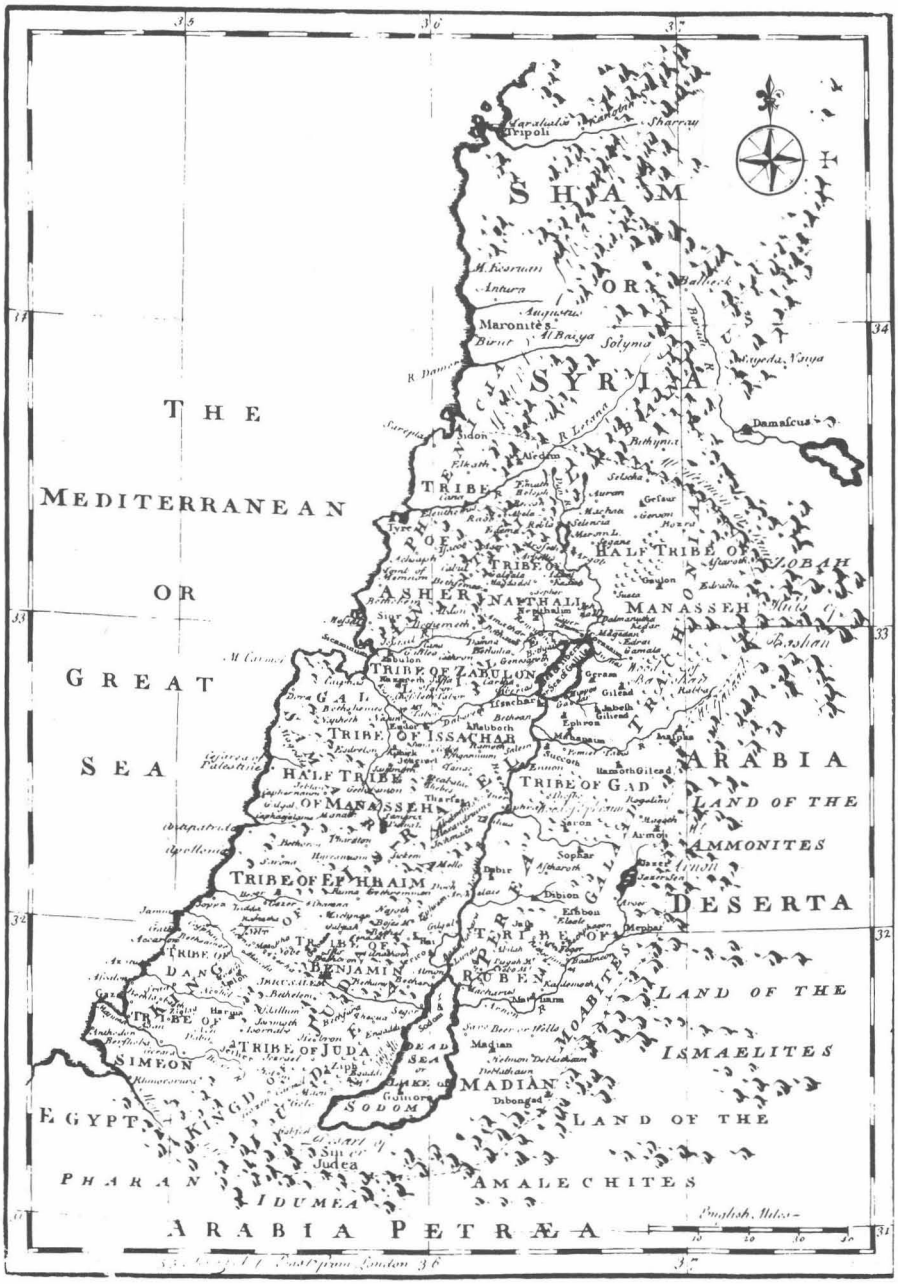

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On the cover: an 18th-century map of
the Holy Land, by Eman. Bowen.

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Editorial

Having now put the finishing touches to this volume of the *Bulletin*, I am setting off to Jerusalem where I shall be directing an excavation on Mount Zion. I shall keep members of the Society posted regarding the outcome of these excavations that promise to be quite exciting *(www.Mountziom-dig.org)*.

Three research articles are included in this issue. The first is about Grain-Grinding Households in southern Mesopotamia at the end of the third millennium BC and was written by the esteemed Sumerologist, Jean-Pierre Grégoire, Directeur de Recherche at the Centre National de la Recherche Scientifique in Paris. Within the framework of his research, he has studied a great number of cuneiform texts, including the important Proto-cuneiform tablets from Jemdet Nasr, and has numerous publications to his credit. He has also focused on the analysis and interpretation of inscriptions and administrative archives dating from the emergence of writing in Mesopotamia, at the end of the fourth millennium BC, and until the Old Babylonian period; with the aim of creating a history of Mesopotamian material culture, dealing with agriculture, irrigation, husbandry, storage and diet, in the third millennium BC.

The second article deals with the agricultural fertility of Byzantine Palestine and the diet of its rural and urban population. Professor Claudine Dauphin is a frequent contributor to the pages of the *Bulletin* and I can also personally vouch for the fact that she is a very active Editorial Board member. An extended book notice is included in this issue and it outlines the main results of the demographic studies included in her recently published monumental three-volume book, *La Palestine byzantine: Peuplement et Populations* (Oxford, 1998).

The third article by Dr David Jacobson argues that large scale geometrical planning was a hallmark of King Herod's building programme, and this paper follows on quite nicely from articles by the same author published in previous issues of the *Bulletin*, one on the plan of Herod's Temple in Jerusalem (*BAIAS* 10) and the other on the planning of buildings at the fortress of Masada (*BAIAS* 18). Dr Jacobson has recently been appointed Honorary Treasurer of the Society and we wish him much success.

Ashley Jones has contributed an obituary of the late Robert Pitt. Bob was an enthusiastic member of the Society and was always in attendance at lectures given in London even when his health was failing. Bob was one of the best archaeological photographers I have ever met, working at quite a few sites, notably Tuleilat Ghassul, Beth Shean and Jerusalem. He also joined me as expedition photographer when I was working at Sataf in the Judean Hills,

west of Jerusalem, over ten years ago. He was a raconteur with a good sense of humour, and we shall all miss him.

This issue ends with a book review, four lecture summaries and a grant report. My thanks to the Editorial Board members, Mrs Carole Maraney and to Mr Ashley Jones for making sure that this issue reached the printers safely.

Finally, an apology to Dr Gabriel Barkay over the printer errors in his article 'A Signet Ring of Alexander' that appeared in the previous issue of the *Bulletin*. The name Jonathan (p.68) should read יהונתן or ינתן and not תן יהו or תן י. In the article by de Vincenz (pp. 71–72) it should be made clear that the nominative form of the potter's name referred to there should be *(H)ermogenes*.

Shimon Gibson

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The *Grain-Grinding-Households* (e_2-ḪAR.ḪAR) of Southern Mesopotamia at the End of the 3rd Millennium Before the Common Era

MAJOR UNITS FOR THE TRANSFORMATION OF CEREALS

JEAN-PIERRE GRÉGOIRE

In Honour of Professor Dr. Max WÄHREN

The Near East is traditionally considered to have been the birthplace both of the Neolithic revolution (Childe 1928:23)[1] and of the urban revolution (Childe 1950:179–223) which produced one of the earliest great civilizations of the ancient world. Since the Palaeolithic period in South-Western Asia, societies of hunter-gatherers evolved into village communities of producers, and later into stratified urban societies. These developed in the course of the second half of the 4th millennium BCE into State societies, which, from the beginning of the 3rd millennium, gave birth to the first great Empires.[2]

The Urbanization of Lower Mesopotamia

Large urban centres, surrounded by small settlements, arose in the Near East in the course of the second half of the 4th millennium BCE. These formed aggregates of hierarchically organized sites, reflecting social, political and economic innovations. The decreasing surface of arable land brought about by a change in climate at the end of that millennium in the Near East, with lands having to feed an ever increasing population, hastened the disintegration of social structures, as illustrated by the appropriation of tillable lands and a marked social stratification. A political and religious élite took hold of the major means of production and developed into a dominating social stratum which controlled the main strategic resources. The Temple played a role of prime importance. In settlements, the community developed around and in relation to this cultic centre. It was precisely in large cities that the new State power emerged.

The Early State

Together with budding urbanization, the main centres underwent the separation and institutionalization of political and economic-religious powers. Until the beginning of the 3rd millennium, the Southern cities were ruled by a political-religious hierarchy which ensured its control over major strategic resources by being predominantly in charge of cereal production.

The alluvial plain was characterized by enclaves which became separate territorial units forming small sovereign States competing for the control of water resources. These were supplied mainly by the Euphrates river, on which almost all Southern States depended. The emergence of a new centralized political power coincided with increasing military activity.

The new State power was equated with a centralized authority based on a specialized administration and on judicial institutions. In Mesopotamia, government was identified with a *Patrimonial State*, administrative and bureaucratic, in which links of subordination were hierarchical and institutionally-regulated. The *Patrimonial Sovereign* (lugal) held power by virtue of personal attributes and by divine mandate. In the practice of power, he employed an elaborate hierarchy of officials and scribes to whom he delegated part of his power. Under this political régime, social dividing lines were the outcome of status and privileges correlated to the distribution of power and authority.

The State organized production and exchanges. This gave rise to a subordination network which was kept under control by military might, a specialized coercive instrument enabling the Sovereign to impose his decisions, both by law and by force.

At the end of the 4th millennium, the Temple played a political, social and economic role of prime importance. During the 3rd millennium, it continued to control economic life and to determine its social aspects, but it was subjected to the authority of the State, namely the *Palace* (e_2-gal), seat of central power and administration. The cultural and economic power of the religious stratum was integrated into political power, which it could strengthen through a hierarchy of specialized and highly qualified personnel.

Cuneiform inscriptions describe such major works as the construction of monumental architectural complexes and the creation of a wide network of communication lines and irrigation canals. These were made possible by collective *corvée*-labour, which became a permanent institution. The bureaucratization of administration, which originated in the Temple-Household, increased further the tendency towards strong centralization.

The Patrimonial Economic System

The patrimonial economic system may be considered a *redistributive system*. The production of large estates and economic units, contributions and tributes were gathered in large collecting centres – central granaries ($guru_7$) and storehouses

($\tilde{g}a_2$-nun) – managed by central administration. Once gathered, the goods were partly redistributed in the form of rations, gratifications or gifts. Products circulated according to a highly complex system of collecting, storage and redistribution.

The lands, above all those for grain, belonged to the gods, embodied by the Patrimonial Sovereign, who administered them, whilst their exploitation was undertaken by the Temples. This ensured the latter's pre-eminence in economic and social life. The *Palace* and *Temple-Households* were the true centres of the city. It is around these that the various town units developed, protected by ramparts. The quarters which lay beyond them (*extra muros*) comprised, apart from houses, a green belt of date-palm groves and gardens. Beyond it, there lay, as far as the eye could see, crop land, devoid of settlements and forming vast areas, themselves divided into large estates along the watercourses and main canals. Such a threefold division was characteristic of Lower Mesopotamia in the 3rd millennium BCE. Thus, each settlement was encompassed by a belt of groves and gardens (Behrens 1978: 14, l. 3)[3], and beyond them by a belt of vast expanses of crop land. The Sumerian term for this microcosm was the literary and poetic $muš_3$/muš, which also described the aureola, or halo surrounding a source of light such as a star. In our example, the source is represented by the urban centre or town, which shines in the distance and seems surrounded by several aureolas: a dark green one of groves of palm and other trees (Heimpel 1972: 286), which stands out from the second halo of cereal lands of a lighter tint ranging from the delicate green of young shoots to the gold of ripe grain, the third aureola being the ochre and brown barren land and steppe.

Rural and urban populations were not distinct. There was only a single settlement – city, town, or simple urban centre – deriving the main part of its subsistence from the surrounding lands which were exploited by the great Temple-Households. Hydro-agriculture led to a tremendous rise in grain production, which changed from an average of 410 kg/ha for dry farming to 600–700 kg/ha for hydro-agriculture. Over-irrigation, however, increased the risk of salinization. To avoid the disastrous effects of this phenomenon, intensive monoculture of barley was practised, this cereal being characterized by a quicker growth cycle, and being better adapted to saline soils. Wheat crops diminished markedly. By the end of the millennium, barley production amounted to 80% of the total production of cereals.

The two closely connected cycles of production and redistribution were managed from the centre by a plethora of officials and various categories of specialized staff, to which the considerable amount of cuneiform records currently available bear witness.

The concept most evocative of the socio-economic system of that time is no doubt that of *Household*, the Mesopotamian *oikos*[4] – a State institution, administered in an authoritarian and bureaucratic manner whose basic function was to cover the needs of the lord of the Household, the Patrimonial Sovereign. The *Mesopotamian Household* was the production unit *par excellence*, involving

estates, domains, hamlets, centres of administration, residences, manufacturers, workshops, granaries and storehouses, cattle pens, groves and gardens, as well as pastures. It had at its disposal an administrative staff, various productive forces, maintenance and surveillance personnel, all of them hierarchically organized. The most representative and important Households were the Temples, who were in charge of exploiting and managing the large estates or domains – in fact of controlling the main economic sector.

A great part of the population formed an integral part of the Patrimonial Household, from which it derived its subsistence by receiving rations, allowances, gratifications or gratuities. Household and army staff were allotted subsistence-lands ($gana_2$-šuku-re).

The absence of advanced technological means compelled central administration to employ a large human labour-force. Consequently, those who were not permanently attached to a Household depended, directly or indirectly, upon the Patrimonial Household. These were the numerous day-labourers (guruš/ ĝeme$_2$-u$_4$-1;-še$_3$) and wage-earning workers (lu_2-ḫuĝ-ĝa$_2$). They, too, received rations or allowances: grain rations (še-ba) and all kinds of food rations (sa_2-du$_{11}$, $ša_3$-gal) which were distributed on a daily, monthly, yearly or occasional basis. Therefore, on the one hand, central administration had to store enormous supplies of grain and produce, and on the other, to manage units of grain transformation in order to ensure the supply of huge quantities of rations.

The Great Production Units

During the 3rd millennium BCE, some bodies which were autonomous production units and depended on central administration, that is on the *Sovereign's Palace*, separated from the *Household*, in particular, from the *Temple-Household*. These could reach enormous sizes and had to ensure a large-scale supply of manufactured products, notably textiles and foodstuffs. Their function was to transform raw materials, essentially produced by agriculture and cattle-breeding. They were structurally associated with the Patrimonial Households, such as Temples, which were identically organized. The best-known production units were textile-manufactures or *Weaving-Households* (e_2-uš-bar), and *Grain-Grinding-Households* (e_2-ḪAR.ḪAR).

Weaving-Households or Textile-Manufactures

Cuneiform records from various Southern Mesopotamian urban centres reveal the existence of large production units, notably on the territory of Lagaš. The productive labour-forces of these units were mainly female, weaving being traditionally, though not exclusively, women's work. Up to 1,097 women weavers, assisted by 626 youths and children have been recorded, working daily in a production unit at $\tilde{G}ir_2$-su^{ki} (Waetzoldt 1972). These productive forces were divided into teams of 5 to 12 people each, directed by master-weavers acting as

team-heads. The productive staff consisted of waged women, of *corvée*-labourers, and, in some cases, of prisoners of war, viewed as slaves, as well as of ordinary prisoners (dumu-gi_7), forced to work as *Textile-Manufacturers*. An as yet unpublished cuneiform document[5] reports 6,466 women weavers working in Weaving-Households at $\tilde{G}ir_2$-su^{ki} (1,051), at Ki-nu-nir^{ki}-Ninâ^{ki} (1,143) and at Gu_2-ab-ba^{ki} (4,272). They received yearly rations of oil and dates, at the rate of 1 *measure* ($sila_3$), or 1.07 litres of vegetable oil and 5 *measures* ($sila_3$), or 4.63 litres of dates *per* person.[6]

The lexeme for 'manufacture' used here, means, within the historical context of cuneiform records, a specialized unit with an economic dimension – either an architectural unit or a complex of scattered installations – where raw materials were transformed into manufactured products on a large scale. Consequently, it was an establishment whose production exceeded in quantity the production-capacity of a non-specialized Household such as the Temple-Household. The use of modernist terminology such as 'industry' or 'factory', would be anachronistic and inadequate, since these types of installations, characterized by their size, their technology, the concentration and division of their work-process into specialized workshops, as well as their capital, did not exist in antiquity.

The archaeological excavations undertaken at Tell Asmar have uncovered a large building, dubbed the Northern Palace, which appears to date from the Akkadian period and could be identified with an e_2-uš-bar, a 'Weaving-Household' or 'Textile-Manufacture' (Frankfort 1932/33: 23 ss.).

Neo-Sumerian Grain-Grinding-Households

Another type of production unit, of remarkable size, appeared in the Neo-Sumerian period, in relation with the foundation of the Patrimonial Empire of the IIIrd Ur Dynasty (2113–2006 BCE). These were great specialized production units : e_2-ḪAR.ḪAR or, in other words, the *Grain-Grinding-Households*.

e_2-ḪAR.ḪAR does not refer to a simple 'mill', *stricto sensu*, but to a far more complex installation, this compelling us to adopt here the English *Grain-Grinding-Household*[7], that is, a large installation devoted to the transformation of grain into flour products, and also of flour products into various foodstuffs and drinks. Such a definition lies outside the realm of modern dictionaries, which underline the industrial nature of an installation specialized in the transformation of grain into flour. Some specialization of Neo-Sumerian Grain-Grinding-Household is expressed in the differentiated reading of e_2-ḪAR.ḪAR, where the lexem ḪAR/ḪAR.ḪAR may be read : ar_3, ara_5, kin_2 or kikken, this referring to various milling techniques or processes.[8]

The cuneiform records[9] from $\tilde{G}ir_2$-su^{ki}-Lagaš^{ki} provide us with most precise and explicit data. The territory of Lagaš^{ki} included several Grain-Grinding-Households, the largest of which must have been situated at $\tilde{G}ir_2$-su^{ki} or in the immediate vicinity of this urban centre. Two other main production units – much

smaller installations whose importance resulted without doubt from their strategic geographical position – were situated at Sağ-da-na^{ki} and Ugnim^{ki}.

Several documents enable us to define the structures and organization of the *New Grain-Grinding-Household* (e_2-ḪAR.ḪAR gibil), situated at G̃ir$_2$-su^{ki}, which constituted a two-unit complex: the *Main Grain-Grinding-Household* (e_2-ḪAR.ḪAR gu-la) and the *New Grain-Grinding-Household* (e_2-ḪAR.ḪAR gibil). It is impossible to decide whether this was a single architectural unit, which was enlarged at some stage, or a complex which incorporated a variety of scattered installations.

The structures and organization of the Grain-Grinding-Household

These installations essentially included the following 12 main departments, each with one or several offices:

1) A granary or silo (guru$_7$), under the responsibility of a granary/silo-keeper (ka-guru$_7$), this being an architectural complex where grain – destined to supply the various offices with raw materials – was stored. The granary or silo also served as a storehouse for central administration, which drew from it the necessary grain for the rations of various categories of staff, for the functioning of household offices, for feeding cattle as well as for different forms of exchange.

2) Installations allotted to the preparation of grain and its grinding. These buildings housed milling installations and included all the tools necessary for grinding.

3) Structures for the storage of products: storehouses and cellars.

4) Bakeries (muḫaldim (e_2-muḫaldim(a)), for the production of bread and other flour-based products, for instance pastry and beer bread (babbir).

5) Malt-houses, for the preparation of grain in connection with beer-brewing.

6) Breweries (e_2-babbir), for the production of various sorts of wort and beer.

7) Hand 'oil-presses' for the production of vegetable oil, notably linseed oil, as well as unguents and perfumes.

8) Weaving workshops (e_2-uš-bar).

9) Workshops of craftsmen connected with this complex, notably the cutters of saddle querns and handstones, which were used for crushing and grinding grain and linseed; potters who supplied specific pottery for various types of products (flour produce and beer); basket weavers who made containers, notably baskets, for storing products such as crushed grain, hulled grain, groats or coarse semolina (they also made the mats which were used to cover the containers during transport); curriers who supplied leather bags to store and carry flour; joiners-carpenters and masons who erected and repaired the buildings where products were kept; porters who carried raw materials and products inside the Grain-Grinding-Household; and, a specialized team of flour-carriers (zi_3-IL$_2$).

10) Buildings for the breeding of hogs[10] and poultry (essentially fattened with

grain, and with bran or waste from grinding workshops, Malt-Houses and Breweries).

11) An arsenal (mar-sa), consisting mainly of a building and maintenance site for barges or lighters which carried products; various categories of specialized craftsmen were connected with this arsenal, whose activities were recorded by a specialized scribe (dub-sar mar-sa).

12) Finally, palm groves and gardens (ǧiš-giri$_{11}$), which employed a permanent and specialized staff.

No precise information is available on the architecture of these complexes and installations, since no production unit of this type has yet been excavated. However, archaeologists and architects believe that it would not have been technologically difficult to erect such complex and impressive architectural units, where hundreds of people (even over a thousand) would have worked in a comparatively restricted space without hindrance to each other, whilst allowing for a rational production which would have covered the needs and requirements of central administration.

The management and administration of the Grain-Grinding-Household

From an administrative point of view, the Grain-Grinding-Household was controlled in the first place by the *Household-Prefect* (šabra-e$_2$), a high official who was in charge of a constituency – the administrative unit of that period – and managed various Temple-Households, the central granaries and storehouses, the production units, as well as everything connected with them. He supplied the grain and food necessary for the rations, which were distributed between the various categories of staff and the military personnel. The management of both sections of the *New Grain-Grinding-Household* was entrusted to two overseers (nu-banda$_3$).

The administrative office included, on the one hand, officials, notably specialized scribes of the production unit and chief book-keepers, scribes for flour production (dub-sar-zi$_3$-da) and, perhaps, the 'head book-keeper' (šа$_{13}$-dub-ba), the granary/silo-keeper (ka-guru$_7$), the official in charge of weighing flour products (KA-la$_2$-a-zi$_3$-da), scribes (dub-sar), as well as various assistants (šeš-tab-ba), and minor officials, such as agronomists (?) (gu-za-la$_2$). On the other hand, it also included the heads of the various departments mentioned above.

Subjective productive forces

As a whole, the available sources provide us with a precise idea of the different categories of staff or productive forces employed in the Grain-Grinding-Household. Although there is little data concerning the head officials and the members of the administrative bureau, the subjective productive forces of the various departments and offices are comparatively well-known.

In Year 48 of the reign of ^{d}Šul-gi, second Patrimonial Sovereign of the IIIrd

Ur Dynasty, the complex of the *Grain-Grinding-Household* of $\tilde{G}ir_2$-su^{ki} employed on a daily basis 1,256 people, of whom 1,145 were direct producers, divided into 15 teams directed by *head-grinders* (ugula-ḪAR.ḪAR). The production unit was principally managed by two people, one, Lu_2-^{d}Nin-šubara, responsible for the *Main Grain-Grinding-Household* (e_2-ḪAR.ḪAR gu-la), and the other, Ur-^{d}En-gal-DU.DU, responsible for the *New Grain-Grinding-Household* (e_2-ḪAR.ḪAR gibil), thus suggesting a complex consisting of two distinct architectural units.

Regular staff

Regular staff ($\tilde{g}ir_3$-se_3-ga), permanently attached to the Household, numbered 134 people in Year 48 of ^{d}Šul-gi's reign, namely:

– 2 accountant scribes, who were responsible for flour production (dub-sar-zi_3-da);

– 1 arsenal scribe (dub-sar mar-sa);

– 1 main head-grinder (ugula-ḪAR(.ḪAR)), responsible for the various teams directed by the head-grinders;

– 6 supervisors or gate-keepers (i_3-du_8), who held positions of reliability and responsibility. Their number is indicative of a more important architectural complex;

– 10 maltsters ($munu_3$-mu_2), thus emphasizing the importance of the brewing department;

– 6 basket weavers (ad-gid), who made baskets and other wood or reed containers for the transport and preservation of products;

– 1 joiner-carpenter (nãgar);

– 2 curriers (ašgab);

– 6 potters (baḫar$_3$);

– 1 main head-baker (muḫaldim), who was responsible for the baking of bread and pastry;

– 1 hog breeder (sibad-šaḫ$_2$);

– a team of 45 haulers (lu_2-ma_2-gid_2-da), 18 of whom were $eren_2$-soldiers, in charge of transporting flour, bread and beer daily;

– 2 masons (šidim), who specialized in building in *pisé*, and in particular were in charge of erecting grain silos;

– 1 person in charge of the team of porters ($u\tilde{g}_3$-IL_2);

– a team of 49 arboriculturists who tended the date-palm groves belonging to the *Grain-Grinding-Household.*

This list may be completed thanks to a text dating from Year 2 of the Third Dynast, ^{d}Amar-^{d}Suena:

– 8 boatmen (ma_2-laḫ$_5$), in charge of the Grain-Grinding-Household's flotilla;

– 5 gu-za-la_2 – officials with an ill-defined function, perhaps agronomists;

– 2 saddle quern-cutters (na_4-ḪAR-gul-gul), in charge of the grinding tools;

– 4 reed purveyors (gi-ze_2), who supplied the installation with raw material and fuel, notably for baking ovens;

– 1 barber (šu-i);
– 1 official who handled exchanges (dam-gar$_3$), and ensured the supply of raw material from outside the Grain-Grinding-Household;
– 3 men with indeterminate functions[11].
– Other sources mention musicians (nar), to whose tunes women ground grain rhythmically.

Waged staff in charge of production

This staff comprised various categories of workers, such as:

1) Male and female labour-forces, male grinders (guruš-ḪAR.ḪAR) and female grinders (ĝeme$_2$-ḪAR.ḪAR), the latter being predominantly assisted by youths and children of both sexes (dumu, dumu-nita$_2$ and dumu-mi$_2$), thus 86 men, 669 women, and 103 youths and children, totalling 858 people employed in the two installations of the complex, or 491 people for the *Main Grain-Grinding-Household* and 367 for the *New Grain-Grinding-Household*. Eight teams worked in the first unit, and six in the second, under the management of 14 head-grinders (ugula-ḪAR.ḪAR).

2) 6 KA-gaz, apparently specialists in the husking of hulled grain such as barley and emmer. Their main working tools were the mortar (naga$_4$ (GUM)) and pestle, of stone or wood.

3) Labour-forces, notably female, which produced vegetable oil. The hand 'oil-press' employed 4 women and 7 youths.

4) The *Grain-Grinding-Household* maintained a weaving workshop where 40 women-weavers and 4 youths worked, directed by a head weaver (ugula-uš-bar). A team of 21 women and 2 youths were employed in the *Main Grain-Grinding-Household*, and another of 19 women and 2 youths in the *New Grain-Grinding-Household*.

5) The arsenal staff numbered 23 men and 2 women, but this installation seems to have been architecturally separate from the complex of the *Grain-Grinding-Household*.

These subjective productive forces worked throughout the year in the *Grain-Grinding-Household*'s various departments and received monthly grain rations. Part of this staff were seconded from the departments of other Households, which were therefore responsible for their subsistence. While most of the productive forces worked full time, some were employed on a half-time (a$_2$-$\frac{1}{2}$) basis. It is notable that these categories did not belong to a regular staff, but were waged labour-forces.

The latter consisted on the one hand of waged men and women (lu$_2$-ḫuĝ-ĝa$_2$) hired for defined periods of time which are not specified further in the textual sources, and male and female day-labourers (guruš-u$_4$-1;-še$_3$, ĝeme$_2$-u$_4$-1;-še$_3$). The former were often specialized workers, but the latter were totally unqualified. The above forces constituted the basic and predominant labour-force in all

Households and institutions of the Patrimonial system. They were hired in fully-fledged groups, in particular the day-labourers who were already assembled into teams, each with its own foreman (ugula). They were allowed either regular rations of grain and/or food.

Maintenance and surveillance personnel

The various installations – buildings, workshops, granaries/silos and storehouses, outbuildings and groves – were guarded by a military detachment of men fulfilling their military-*corvée* ($eren_2$), this numbering 57 soldiers under the supervision of the Palace guard. Surveillance of the area was also undertaken by gate keepers (i_2-du_8).

Cleaning and maintenance were entrusted to a team of specialized employees, who were part of the regular staff ($ĝir_3$-se_3-ga).

Corvée-*labourers*

Lack of elaborate technical means was compensated by the summoning up of the greatest number of available labour-forces. Thus, a high, (if not the highest) percentage of population was subjected to *corvée*-labour. In the daily census-lists, *corvée*-labourers, waged workers and day-labourers were carefully distinguished. *Corvée*-labour was connected above all with the main seasonal agricultural works, notably those related to irrigation, ploughing and harvesting, great architectural projects, the hauling of boats along the main waterways and canals, as well as all heavy work, which required particular efforts, this being the case in the great production units such as the Grain-Grinding-Households.

Corvée-labourers ($ḫe_2$-dab_5) were the responsibility of the particular household or of the institution, and received grain and food rations, delivered by the central granaries or by the various Households.

In the case of lack of manpower, and if the situation required it, men or women were seized in the open street (sila-a dab_5-ba). Naturally, they attempted to avoid forced labour through flight ($zaḫ(a)_3$), and their cases were carefully recorded. It frequently happened that a labour-force was levied by the army (ĝiš-tugul-e dab_5-ba (ĝiš-e dab_5-ba)). These were *corvée*-labourers who are repeatedly mentioned in the census-lists of the Grain-Grinding-Households. A great number of these were levied in the various departments of the Households and institutions of the district.

The Grain-Grinding-Household listed daily its labour-force. Individuals were recorded by name, the category of ration which they deserved being recorded, as well as their origin or provenance, occupation or function and their administrative or personal dependence. Those most senior (libir) were first recorded, that is those already listed in the registers of the previous year (im-e tag_4-a), followed by the newcomers (gibil). Entire families were thus press-ganged into *corvée*-labour. The lists also included members of the regular staff ($ĝir_3$-se_3-ga) of other Households or

Temples, this demonstrating that all *political subjects* were liable to general *corvée*-labour. Cases of illness, flight and death were also scrupulously recorded.

The most explicit *census*-lists are connected with the *Old Grain-Grinding-Household*, at Saĝ-da-na^{ki}, in the district of G̃ir$_2$-su^{ki}, in which *corvée*-labourers on the one hand and hired specialized labour-forces on the other were registered day after day. Comparatively complete sequences are thus available for several months of Year 9 of ^{d}Amar-^{d}Suena's reign and Year 1 of ^{d}*Šū*-^{d}*Suen*'s reign. These records supply precious information concerning the length of these collective *corvée*s (whole teams being forced into labour for over a year) and indicate the social status, the administrative connection and the geographical origin of various *corvée*-labourers holding certain positions in various offices of the Grain-Grinding-Household. Since those in charge were also mentioned in these lists, it is possible to reconstruct the organization of most departments in this particular Grain-Grinding-Household. The number of persons listed varied between 31 and 49 individuals, thus implying that each list concerned a single department.[12]

A particular category of soldiers (eren$_2$) should be included in *corvée*-staff, notably those performing their military-*corvée* and who were levied for the most part in the different departments of the Households and institutions, over the entire territory.[13] These conscripted soldiers were in charge of keeping watch over buildings and installations or of supervising certain categories of *corvée*-labourers, but they could also be entrusted with other tasks. Thus, a text informs us that, at harvest time, 21,799 eren$_2$-soldiers had been made to compensate for labour-shortage. During this period, the subsistence of this additional manpower was handled by the administration of *Local Sovereigns* (en$_5$-si) and by the *Household-Prefects* (šabra-e$_2$) in charge of district administration (Genouillac 1932 *TCL* 5, pl. 31, AO 6041).

Dependent staff

The Grain-Grinding-Household employed (besides regular staff, waged workers, day-labourers and *corvée*-labourers) another labour-force whose social status was characterized by dependence. This particularly category included:

1) All male and female servants (ir$_{11}$ and ĝeme$_2$), who were, however, limited in number. These were obviously people personally subjected to another or others, who had not been enslaved, but frequently had been brought into bondage through debt.

2) Slaves, proper (saĝ-nita$_2$ / saĝ-mi$_2$), whose economic role was insignificant due to their small number. Besides, they did not belong to the Household, but were attached to single individuals. Some production units employed a greater servile manpower, but these were prisoners of war (saĝ-ḫi-a nam-ra-ag(a)). They were mainly women and children working in specific Temple outbuildings and most often were a personal gift from the Patrimonial Sovereign after a victorious military campaign. The death rate of these deportees was extremely high (Genouillac 1932 *TCL* 5, pl. 27–28, AO 6039, and Gelb 1973: 70–98).

3) Dependent staff also comprised a category of people dubbed as *vowed* (a-ru-a) in the textual sources (Gelb 1972: 1–32). Their status was one of complete subjection to an institution or an individual. These labourers were mainly employed by Temples, since they had often been *vowed* to the god, Lord of the Temple-Household. They may have been dropouts, underprivileged, handicapped or socially undesirable beings, to whom the temples had extended hospitality out of charity.

Production

The *Main Grain-Grinding-Household* employed 8 teams in charge of preparing and transforming cereals, totalling 420 people led by 8 head-grinders. Six teams consisted exclusively of female labourers, one of male labourers, and one of labourers of both sexes. The eighth team seems to have worked for the brewery in the production unit.

The *New Grain-Grinding-Household* had only six teams, one of which consisted exclusively of men, and the other five of women, totalling 377 people.

Thus, 811 individuals worked daily and exclusively in grinding workshops.

The monthly production of flour products in Year 48 of ^{d}Šul-gi's reign, amounted to 148,369 litres[14], thus an average daily production of 4,946 litres, approximately 6 litres (or 3.850 kg) *per* person. These figures should be treated with caution, for daily production varied according to man, woman or youth. Moreover, the staff of the Grain-Grinding-Households was often put onto other tasks, notably in agriculture or irrigation, boat hauling or reed cutting. Female labour was used for weaving fabric in Weaving-Households, while female spinners and weavers were seconded to Grain-Grinding-Households for flour production, to the bakery or even brewery. Numerous documents supply infinite details as to the work of the head-grinders (ugula-ḪAR.ḪAR).

A cuneiform tablet (AO 5670, Genouillac 1932 *TCL* 5, pl. 4, Umma Š 48 / U. 03 / 23 – AS 01 / U. 02 / 07) from Umma reports on Ur-^{d}Šara$_2$, a head-grinder (ugula-ḪAR.ḪAR), who was responsible for 36 women in charge of grinding grain, one of whom died during this period. His office was supposed to grind 91,878 litres (60,801.638 kg) of cereals into 67,667.35 litres of flour products; for this task, he was allotted 10,304 working days, that is, the number of working days of 36/35 women for 12 months of 30 days each (thus, 12,960 days, once holidays and sick leaves had been deducted). In fact, the office had used 10,715 working days, this implying the temporary hire of additional labour, in order to ensure the production of 51,822.51 litres of barley flour, 15,153.87 litres of semolina, 650.21 litres of emmer groats and 40.77 litres of first-rate barley groats. The average daily production *per* woman amounted to about 3.50 litres (2.250 kg) of flour (zi_3) and 24.72 litres (16.700 kg) of groats. However, female labour was not used in grain-grinding only, but in various tasks in the course of the same year, notably unloading cereals and transferring flour products into baskets which were then loaded onto boats. Judging by this text, the office produced mainly

pounded grain, groats and coarse flour, since these products were transferred into baskets, and not into pottery vessels or leather bags destined for fine flour. These 36 women were also employed variously in agriculture and irrigation. They also handled the transport of straw to a Temple-Household and wove fabrics in a Weaving-Household.

This evidence is corroborated by another text (AO 5668, Genouillac 1932 *TCL* 5, pl. 2, Š 48 / U. 04-12 / 20)[15] from Umma, which states that the daily production of a woman was about 9.25 litres (6 kg) of barley flour. Another text (AO 5665, Genouillac 1932 *TCL* 5: Š 36 / U. 01-13 / 00), also from Umma and dating from Year 36 of ^{d}Šul-gi's reign, records a labour-force of 141 and $\frac{1}{3}$rd units per day, in charge of grinding grain for the 13 months of the year, hence, 55,120 working days. Of these, only 45,933 had been used for actual work, since $\frac{1}{6}$th of the total corresponded to women's holidays and sick leave. This labour-force had produced *in toto* 203,502 litres of barley flour, the average daily production of a female labour force amounting to 9.50 litres (6.120 kg).

A balanced account (Chiera 1922 *STA* 5: AS 02 / U. 01-12 / 00), again from Umma, under the name of Lu_2-diĝir-ra, chief-accountant in a production unit and scribe of flour products (dub-sar-zi_3-da), reports that, out of a total of 93,781 working days, 202 women had worked for 86,331 days, of which 27,451 and $\frac{2}{3}$rds were devoted to the production of 500,498.77 litres of flour and 65,381 litres of bread products. This labour-force also fulfilled agricultural and irrigation work, dealt with the subsistence of guards, prepared the pittance of war prisoners, pressed oil, carried the Grain-Grinding-Household's products to the wharf, and wove textiles.

A tablet (Lambert 1953: 141-142) from Lagaš^{ki} enumerates the working days accomplished from 05 / 10 / Š 47 to 15 / 06 / Š 48 in the *New Grain-Grinding-Household*, under the management of Ur-^{d}En-gal-DU.DU, this totalling 62,134 and $\frac{5}{6}$th days of work, of which 50,265 by women and 11,690 and $\frac{5}{6}$th by men, this resulting in 386,431 litres of products.

Such examples suffice to establish that the average daily production amounted to about 7 litres (or 4.500 kg) of sundry products from milling. However, daily production varied according to the fineness of the final product. Thus, it did not much exceed 3.50 litres (2.250 kg) of fine flour, whereas a female grinder was able to produce, by the end of the day, up to 9.50 litres of groats. We should remember that these production units provided mainly barley flour, pounded grain, hulled grain and groats, thus relatively coarse maslins, and a small amount of fine flour.

Several texts[16] indicate the global production of a year to have been 1,473,363.10 litres of sundry products, among which 1,421,744.10 litres (912,759.710 kg) of barley flour, 34,323.09 litres of semolina, 7,118.59 litres of fine bolted flour and 10,177.36 litres of groats. These figures bear witness to the importance of the production units and the role they played in feeding the community. It is not easy to imagine precisely the total production of the Lagaš^{ki} territory, since there were small production units beside the large organizations

under scrutiny here.[17] We should not forget either that all *Households* (*oikoi*) and institutions had their own teams of female grain-grinders. Even teams of porters included one or several women in charge of grinding grain.

Techniques of Transformation

Teams and their work

Male and female grinders worked in teams, led and supervised by one or several head female grinders (PA.GIŠGAL(!))[18], and managed by a foreman (ugula). Thus, the sixth team of the *Main Grain-Grinding-Household* was directed by foreman Lu_2-^{d}Utu, who had a labour-force of 52 people under his command: 2 PA.GIŠGAL (head female grinders), 43 women working full time ($geme_2$), 3 women working only half-time ($geme_2$ a_2-$\frac{1}{2}$), 3 youths or children (dumu), and 1 *reformed* individual (šu-ge_4).

The administrative office carefully recorded the working days of the various labour-forces in charge of production. For example, in Year 47 of ^{d}Šul-gi's reign, during the 12th month of Lagaš^{ki} calendar, in the *New Grain-Grinding-Household*, under the management of Ur-^{d}En-gal-DU.DU, 4,395 working days of female grinders and 1,490 and $\frac{5}{6}$th days of male grinders were allotted to flour production, fulfilled by:

- 3 PA.GIŠGAL for 30 days;
- 120 female grinders for 30 days;
- 30 female grinders for 30 days, but half-time;
- 17 female grinders for 15 days;
- 13 male grinders for 30 days full time;
- 3 male grinders for 30 days half-time;
- 56 male grinders for 15 days;
- 7 male grinders for 15 days half-time;
- 15 male grinders for 10 days;
- 1 male grinder for 10 days half-time.

The above summary shows that the various members of a team did not produce only flour, but that this task was allotted to them solely in order to ensure the production required by central administration. The administrative office of the production unit organized the work and decided upon the number of grinders necessary for daily production. Apart from such grinding work, the same staff performed other tasks, as previously described.

Transformation work: grinding

The transformation of grain into flour products and foodstuff involved several stages and was undertaken in various specialized offices.

Grain was taken from the granary ($guru_7$), which was part of the Grain-Grinding-Household, weighed under the control of the weighing official (KA-la_2-a) and carried by a team of porters to the workshop in charge of husking.

The cereals of ancient Mesopotamia were essentially hulled cereals, such as barley and emmer. Before grinding, it was advisable to remove hulls, glumes and glumellas adhering to the grain.

To this end, there were several techniques: in one, the grain was slightly roasted, and in another, it was moistened with water before being pounded with pestles in mortars (še sa: 'roasted grain/barley'). Cereal roasting was an ancient technique which, in certain circumstances, preceded the storing of grain in silos. After harvesting, the stacks of ears of grain were set up to dry. After being threshed on the threshing-floor, they were roasted, this having the advantage of drying out the grain towards its preservation in mud silos. Roasting had the additional advantage of converting part of the starch into dextrine, which gave flour a sweet taste. This operation also involved some risks, as some of the grain might be charred, and thus unfit for grinding.

The grain was then sent to the grinding workshop, where it was ground by various teams of workers. It was first cleaned of impurities, dust, straw, pebbles, rotten grain, insects, and glumes. In the various installations, naked grain was reduced to sundry products by pounding, breaking or crushing, and grinding, using a variety of techniques which resulted in different products of greater or lesser coarseness and fineness. These differences are reflected in the Sumerian terminology.

Pounding with a mortar

The quality of the end-product resulted from the grinding techniques which had been applied. Pounding ($nağ_3$ (GAZ)) yielded only a coarse product: either crushed, or hulled grain[19] (ar-za-na; eša), bruised grain, or groats[20] (ni_3-ḪAR-ra), of various sorts (sig_5: good, us_2-sa: second-rate, DU: ordinary). This was obtained by striking perpendicularly, with a pushing gesture, or obliquely with beaters, crushing hammers and, naturally, pestles ($naga_4$ (GUM)). Mortar and pestle were of stone[21] or wood[22] ($naga_4$-ğiš), cylindrical mortars being fashioned from a hollow trunk and wooden pestles reaching 1.50–2 m in height. Mortar and pestle were used worldwide and were essential not only in cereal preparation, but also in the preparation of all kinds of food, of plants, minerals and sometimes even of meat. The mortar was used mainly to separate the glumes and the glumellas from the grain before grinding. It was not always used solely for husking, but also for polishing (as for hulled grain).

Some specialized mortars were used to crush ingredients: $naga_4$-gazi, grapes: $naga_4$-ğešdin, salicornia: $naga_4$-nağa, onion: $naga_4$-sum, $naga_4$-sum-bur, spices: $naga_4$-še-lu_2 (mortar for crushing coriander), or for breaking bitumen: $naga_4$-$esir_2$.

Lexems ar_3 and kin_2 refer in Sumerian to the two main techniques of grain-

grinding. While the former appears to have provided coarser products, the latter probably resulted in a finer maslin, which is grain reduced to flour proper.

From the Epipalaeolithic period onwards, in the entire Near East, cereals were ground[23] on a quern or saddle-quern[24], with a handstone.

Grinding querns

Maslin was obtained through grinding, by repeatedly striking two tools, one active (percussive), the other passive (repercussive). Therefore, grinding querns consisted of two elements, the lower flat stone, called the saddle quern[25], and a smaller stone of a different shape, the handstone[26], its length being frequently equal to the width of the saddle quern, in order to avoid 'edges' on the lower stone. These devices are not characteristic of a particular civilization, but belong rather to a particular technological level. By operating the handstone (positioned transversely on the saddle quern) with a pushing movement, the grain was crushed and ground. The person performing the grinding stood behind the tool, in a slight bent forward posture and took his bearing with his knees on the rim of the base supporting the saddle quern or in which it was embedded; the quern was slanted slightly, downwards at the front and upwards at the rear. The worker pushed the handstone forward. His posture allowed him to devote all his energy to this pushing movement. Then, by raising very slightly the handstone, he drove it back to its initial position and propelled it again, whilst rubbing hard on the lower stone and grinding the material between quern and handstone. In a second phase, to obtain a finer product, he modified his technique, by operating the handstone with a continuous *circular* movement, and no longer by pushing. This second phase of the grinding technique has been identified by Professor Dr. Max Währen. A fine flour product is obtained *only* with this particular technique. This could lead to the invention of other forms of grain-grinding tools, and effectively resulted in the rotary quern. The latter seems to have appeared at the end of the 2nd millennium, but it only came into general use during the 1st millennium BCE.[27]

To facilitate this task, the saddle quern was embedded in a lump of clay; it was thus heightened and at a greater slant. An edge at the back of the bench lent support to the grinder's knees, but compelled him to take a posture, body bent forward, which optimized the power of propelling or pushing. In the Near East and in Asia Minor, clay benches have been found in which rows of querns were embedded. The grinders stood at the rear of the bench, in the usual position, harmonizing their work of grinding according to a common well-marked rhythm, which was sometimes emphasized by musicians whose role was to regulate and punctuate movements as well as to increase productivity. Such an installation was found at Ebla-Tell Mardikh[28], in a room of the Western Palace (L. 3135), along the three walls facing the entrance, a stone bench had been set at right angles, supporting 16 basalt querns. They were all *in situ* (except one which had been moved next to the door of another room), together with their handstones.

The bench was plastered, and the characteristically convex bases of the querns were partly embedded in the upper surface of the bench. This type of quern was usual in houses and sanctuaries of that period, measuring fairly regularly 70 cm in length, 45 cm in width and up to 15 cm in thickness. This very simple type of crusher is well known. It resembles the Hamā type as well as that prevalent in Northern Syria from the Early Bronze IV to the Late Bronze Age.[29] Neo-Sumerian Grain-Grinding-Households included similar, though obviously larger, installations.

Querns were not used only for grinding grain, since in breweries, malt was reduced to flour for the preparation of beer bread. Besides, linseed was crushed on querns in order to extract oil. It is appropriate to recall here that 2 gur (556.14 litres) of linseed produced 2 bariga (129.40 litres) of oil, hence an extraction ratio of about 23%.[30]

These grinding tools would not have changed much since the Epipalaeolithic period in the Near-East. Saddle querns were simple trays, flat or slightly concave work tables, predominantly in basalt, sandstone, granite or even limestone. They could be repeatedly pecked: the roughening[31] producing a gritty surface which was particularly suited to grinding grain. The handstones could be made of a different material, for instance a stone softer than the one of the saddle quern. The handstone, or crusher, exhibited either one or several abrased face(s) and was regularly-shaped (cylindrical, plano-convex and oblong) or irregularly-shaped. In the distant past, it was a simple, more or less round pebble, often serving both as pestle and crusher. In the 3rd millennium, querns were mainly of basalt, regular and oblong, the surface of their trays being slightly concave and measuring on average 60 × 35 cm. The handstone was shaped either like a long loaf of bread, with a plane rather than convex lower surface. There is also evidence for the use of wooden crushers, this enabling for instance the husking of hulled grain on saddle querns (Foxhall 1982: 41–90, App.: 75–81).

The stone of Mesopotamian handstones may have come from the Ǧebel Sinjar (Stol 1979: 83–100).[32] Saddle querns (na_4-ḪAR-šu-nu-tug(u)) were frequently cut from basalt, but the handstones (na_4-ḪAR-šu-se_3-ga or na_4-ḪAR-šu-gul-gul) could be of a softer stone. Cutting and roughening querns and handstones[33] were the tasks of a specialized labour force which included a quern cutter (na_4-ḪAR-gul-gul).

There is less archaeological evidence for the historical periods than for the pre- and proto-historic periods.[34]

Grinding

Flour production is primarily dependent on the proportion of grain to ground product, for, in fact, in antiquity until the invention of the rotary quern, grain was *ground* and not *milled*. This proportion varies according to the quantity of cereal; the weight of a hectolitre is equivalent to the percentage of starchy endo-

sperm, this meaning that barley, for example, weighing 74 kg yields 74% of starchy endosperm and 26% of hulls, glumes or glumellas (Rabuté 1909: 18).

In general, and until a relatively recent date, it was believed that grinding on a quern could supply only a comparatively coarse product. This opinion was shared by Lindet (1899: 413, 427), Blümner (1912, Bd. I: 11–23), Neuberger (1919), Jasny (1944: 149 ss.), Curwen (1937: 133–151; 1941: 15–32) and even Moritz (1958: 144 ss.). It was thought that only wholemeal bread could be made with flour from which bran had not been removed (Blümner 1912, I: 71–75) and that finer flours from which less than 20% of bran was removed (Blümner 1912, I: 50), was obtained through sieving. Besides, it was emphasized that such flour contained stone particles, owing to the wear of the querns, and to sand from the crushing of small stones in badly-cleaned cereals. These particles become a nuisance only when exceeding 15–20 g per 100 kg of flour. Even nowadays, flour is considered unfit for consumption if it contains over 20% of impurities (Amman 1914: 30). It is thought that ancient flours greatly exceeded this ratio. The above scholars also believed that, even if the best sieves possible were used, flours would have contained a high percentage of pulverized bran. Finally, neither the grains from weeds nor ergot – which is admittedly rarer in wheat, emmer, spelt and barley than in rye – were removed.

Nowadays, these considerations have to be revised, notably as the result of Max Währen's important research (Währen 1984: 2–6). The results listed below sum up the experiments carried out by Währen.

Cereals

The commonest cereals for making bread were:

– *Triticum dicoccum Schrank*: emmer-wheat;
– *Triticum monococcum L.*: einkorn;
– *Triticum aestivum s.l.*: wheat;
– *Hordeum vulgare L.*: barley.

Grinding

The grinding process has been reconstructed in an experiment undertaken with a prehistoric grinding quern, consisting of a saddle quern and handstones, both of stone:

– saddle quern:	length	38.5 cm
	rear width	12.5 cm
	front height	6.0 cm
	middle height	4.5 cm
	rear height	8.7 cm
– handstone	width	10.0 cm
	height	5.5 cm

First experiment. In order to obtain fine flour, it is necessary to:

– grind 15 times the same quantity of grain, this producing a flour which contains: fine bran elements of 1–2 mm (±20.2% = 20.2 g); even finer bran elements mixed with fine flour (7.46% = 7.46 g); and, fine flour (72.46 % = 72.46 g).

Second experiment. In order to obtain fine flour in the course of a timed operation, it is necessary to:

– grind 15 times the same quantity of grain: 102 g in 60 mn, yield 73.44 g of fine flour.

The difference between the first experiment and the second was 0.98 g, and thus insignificant. However, we may conclude that the process yields a maslin with an average extraction ratio of 70%, which is a very fine flour. Flours obtained from a 67–70% ratio were already mentioned in ancient Mesopotamia (Währen 1967: 2; Meissner 1936: 7).

Third experiment, for comparative purposes:

– grinding the same quantity of grain 5 times yields a rather coarse product (234 g ground in 60 min.), of which fine flour constitutes about 25% and is not fit for baking bread.

Fourth experiment, for comparative purposes:

– grinding the same quantity of grain 9 times yields a less coarse product, which contains fewer large particles (150 g ground in 60 min.) and about 60% fine flour.

All experiments involved two processes of sieving or bolting. The quantity of flour thus obtained is sufficient to make leavened bread. When comparing the product obtained by grinding to modern flour, no difference is visible from a macroscopic point of view, between this product and flour used for modern wholemeal bread.

Währen's experiments and analyses prove that fine flour was produced as early as the European Neolithic period. More time was needed in order to obtain fine flour. The grinding process had to be repeated several times, while modifying the technique of handling the handstones. To crush and pound grain, an oblong handstone was pushed forward while rubbing the quern, thus grinding the grain between the quern and the handstone. After repeating this operation several times, the same quantity of crushed or pounded grain was ground, but this time by operating the handstone with a rotating movement. Grinding had to be repeated up to 15 or 16 times to produce ultimately a fine flour with an extraction ratio of about 70%. For coarser ordinary flour, grinding had to be repeated 9 to 10 times, which required, for 3 to 4 small loaves, about 150 g of flour ground in 2 $\frac{1}{2}$ hours.

Another experiment was carried out by L. Foxhall (1982: 41–90, app. 75–81), who undertook a number of experiments relating to the transformation of barley and wheat, in order to attempt defining ancient grinding techniques, particularly those prevalent in classical antiquity. Given quantities of naked wheat and hulled

barley were ground on a type of grinding quern – characteristic of PPN Jericho – from the collection of the School of Archaeology of Liverpool University.

Results of L. Foxhall's experiments:

RAW MATERIAL	WEIGHT	VOLUME
1) wheat		
before grinding	270 g	0.345 l
after grinding	255.65 g	0.50 l
extraction ratio: 94.6%		
2) barley		
before grinding	*ca.* 75 g	0.10 l
after grinding	*ca.* 75 g	0.15 l
after sifting and bolting	*ca.* 45 g	0.07 l
extraction ratio: 60%		

Comparative weights

FLOUR/GRAIN	VOLUME	WEIGHT
1) wheat		
whole grain	0.5 l	391.100 g
flour	0.5 l	255.650 g

255.65 g (weight of flour) correspond to 65.4% of 391.10 g (weight of grain)

2) barley		
hulled grain	0.5 l	375 g
flour, after grinding	0.5 l	250 g
flour, after sifting and bolting	0.5 l	321.43 g

250 g (non-sieved flour) correspond to 66.6% of 375 g (whole grain)
321.43 g (bolted flour) correspond to 85.7% of 375 g (grain)
According to this experiment, 1 litre of barley yields 0.643 kg of flour.

In the ancient Near East, barley flour was widespread; it was sometimes mixed with wheat flour. Even though naked barley was known (Renfrew 1973: 70–71), the peoples of antiquity essentially used hulled barley, from which glumes and glumellas had to be husked before grinding. Coarse barley flour, without glumes and glumellas, weigh less than hulled grain.

L. Foxhall had to repeat the experiments, which had been at first unsuccessful, before removing glumellas without damaging the grain. Roasted and non-roasted

grain was husked in a mortar with a stone pestle, and then ground on a quern. On another occasion, grain was husked in a pottery mortar, using a pestle also made of pottery. In all these experiments, only some of the glumes and the glumellas were removed. They had been ground together with the grain, so that Foxhall found it impossible to discard particles of glumellas and grain-hull from the flour, without losing a great part of the endosperm. After a few more experiments, L. Foxhall was able to recreate the process by husking non-roasted barley in a mortar, followed by grinding grain on a quern with a wooden crusher. It was only by using this specific tool that glumes and glumellas could be removed from the grain without crushing the hull, and thus without losing the endosperm. Grinding resulted in a coarse flour, from which part of the bran and other particles could be removed by sieving.

In attempting to remove glumes from einkorn in the course of a similar experiment, J. Harlan (1967: 199–200) used a wooden pestle to husk grain in the mortar, but *after* roasting it. It should be noted that roasted grains easily risk fragmentation.

Another method consists in moistening the cereal before husking, sometimes by heating it over a fire, and then by drying it in the sun. After drying, glumellas and hull may be removed more easily by winnowing the cereal.

L. Foxhall used English barley, but, since ancient people used above all *alphita* to produce flour, the barley/flour ratio should probably be modified. According to indications given by the FAO (Food Composition Tables for International Use, Table 2, item 16), the extraction ratio of hulled barley is 60 to 70%, whereas L. Foxhall's experiment produced a ratio of 60%. Foxhall's advice is to pursue experiments in the future by relying on the works of Pliny the Elder (*Naturalis Historiae* XVIII: 72 ss.).

All these experiments have also shown that it is not easy to determine the weight of grain for the following reasons:

1) the volume of a given quantity of grain increases with grinding: the volume of the product is greater than the volume of the original grain, as was confirmed in fact by cuneiform texts;

2) the weight of a given volume of flour varies according to whether the flour is more or less compressed.

Thus, the volume of flour is greater by 50% than the volume of whole grain, but the weight remains constant. Even after sieving and bolting, the volume of the product remains 70% that of the volume of the grain, but its weight is only 60% of the weight of the grain. If the flour is stirred, the volume increases further. If the flour is compressed, the volume decreases. It is generally admitted that flour was not compressed in antiquity. Consequently, the volume of the product was generally greater than that of the raw material.[35] It is thus very difficult to calculate the weight of flour measured in volume, as was the case in Mesopotamia.

Further experiments

We have ourselves conducted experiments in husking and grinding grain which resembled that of ancient Mesopotamia – hulled barley and emmer wheat.[36] Our grinding experiments largely confirm Währen's. By using querns cut from various types of stone, we have demonstrated that stone-type does have a bearing on the resulting products. Moreover, the various flour products which are mentioned in cuneiform texts, necessarily correspond more or less to the various phases of grinding on a quern:

1) hulled grain,
2) crushed grain,
3) groats,
4) semolina,
5) coarse flour,
6) flour, and
7) fine flour.

Prior to grinding, it was necessary to husk hulled grain.[37] One of our aims was to rediscover the ancient techniques leading to effective husking.[38] Our experiments focused on husking emmer grown at the CNRS-Jalès Research Centre (France) and barley grown by local farmers. Two different techniques were followed:

1) The first method made use of various types of querns of basalt, Cretan sandstone and granite, which had been cut and roughened with a flint core at the Jalès Research Centre. The tools used were two crushers, one of wood, the other of stone.

2) The second method combined a wooden mortar and pestle, which had also been fashioned at the Research Centre.

The experiments, which made use of stone saddle-querns and of crushers of wood or stone, were found to be generally satisfactory as regards husking, hulled emmer and einkorn, but in general to be wanting in the case of husking barley. The percentage of damaged or fragmented barley was far too high for it to be ground. Moreover, when a sandstone quern was used, the handstones tended to produce sandstone powder.

On the other hand, when a basalt quern and handstones of wood or stone were used, and when the barley was wetted beforehand, the husks fell off easily, thus readily freeing the grain owing to the moistening effect. However, in such a case, it was found necessary to dry the grain in the sunshine, and then to winnow or sieve it. Thus, husking on a quern is feasible, provided the grain is soaked for a few minutes in cold water, and then dried, prior to being husked on a quern.

As regards barley which had been heated at a temperature of 100° C, husking on a quern with a crusher, either of stone or wood, proved unsatisfactory, since too great a percentage of grain was shattered or crushed. This method resembles that which includes the prior roasting of grain.

To sum up, these preliminary experiments show that husking on a stone quern,

even with wooden crushers, is successful only under specific conditions: the grain should first be soaked, although the length and intensity of soaking still have to be determined precisely. Roasting grain is not compulsory. Moreover, the risks of shattering or crushing grain increase with roasting. By following the above guidelines, it is possible to husk hulled grain on a quern. However, this technique is not satisfactory in the case of husking great quantities of grain.

To that end, the most effective technique appears to be that making use of a wooden mortar and pestle. Under the action of the pestle and of the power of percussion, the grain is husked little by little, the husk being ultimately reduced to tiny particles and to powder. The cereals rub against each other until the husks slowly break away. The particles and powder fall to the bottom of the mortar. Devoid of their husks, cereals are then winnowed or sieved, so as to collect only the naked grain. Although this technique is both very laborious and extremely lengthy, it is in our opinion the most effective and the most appropriate method for dealing with vast quantities of cereals.

Husking barley in a mortar consisted of four separate experiments: a) husking grain which had been soaked; b) husking roasted barley; c) husking barley which had been both soaked and roasted; and, d) husking barley which had not been previously tampered with. In all cases, the tools used were a mortar and a pestle, both of wood.

The above experiments demonstrate that it is possible to husk vast quantities of cereals. The most effective technique seems to be that making use of a wooden mortar and of a wooden pestle. A stone mortar was not available for the above experiments. Husking proved to be laborious and tedious, as attested in the cuneiform texts which describe numerous and various labour-forces, notably *corvée*-workers, assigned to husking work (še-ĝiš-e_3-a).

Flour and products from flour

Flours are generally defined by their extraction ratio, that is, the weight of flour cleared of impurities by sieving and bolting, compared to 100 kg of cereal due to be ground.

The finest products were bolted several times, in order to remove the bran and other impurities as much as possible. Cuneiform records distinguish more than 20 different sorts of flour.

Grain-pounding in a mortar with a wooden pestle for instance, produced hulled grain, ar-za-na in Sumerian.[39]

Grinding, repeated 5 times, resulted in crushed grain or groats[40], hence a comparatively coarse product, ni_3-ḪAR-ra in Sumerian. The daily production of a groats-crusher was 2 ban_2 thus 18.50 litres a day, the volume of the product being equal to that of the raw material, emmer groats[41] (eša) being distinct from the flour of emmer groats (zi_3-eša).

Grinding 9 times yields a finer product, a sort of semolina or coarse flour, otherwise known as 'ground corn'[42] (zi_3-$šig_{15}$ in Sumerian), which practically

does not lose volume in the course of its transformation, since according to cuneiform texts, the volume of the product was equal to that of the raw material.

By repeating the grinding operation 15 times, a fine flour was obtained, with an average extraction ratio of about 67 to 70%. Extra fine flour was called zi_3-gu.

Initial sieving produced coarse flour, containing large chunks, still mixed with bran. Wheat, for instance, yields generally 30% of pure bran.

When repeated sieving produced a comparatively pure, medium-fine flour.

A specific bolter corresponded to each type of flour[43]. The fineness of the final product depended upon repeated grinding and sieving, with increasingly finer sieves. Pure wheat flour approximated modern products, even though ancient flour was not blanched.

For all products, there were basically three grades: good (sig_5), second-rate (us_2-sa), and ordinary (DU).

Bran (duḫ) was mainly used for fattening cattle. The staff of the main breeding centres included female grinders, who were in charge of preparing food for large and small livestock.

Bread

The relation between the weight of bread and the weight of flour is difficult to determine. According to Pliny the Elder (*Naturalis Historiae* XVII: 87), *panis militarius* consisted of flour, salt, water and perhaps a little leaven: the weight of such bread was greater than that of grain by one third. The weight of flour was only 75% of that of bread.[44]

In modern bread, the weight of flour is 60–65% that of bread. L. Foxhall used 100% of wheat flour, to which only very little salt, leaven and water were added: the weight of flour was two-thirds (66.66%) of that of bread. Baking and the shape of bread play no role. Flat bread requires baking for a short time at great heat. Differences are due to the quality of flour and appropriateness of cereal type.

Cuneiform texts mention more than twenty different kinds of bread. The lexem, however, which refers to bread, ninda, has a wider meaning and includes any cereal-based food, hence broth or porridge (tu_7) as well as flat bread and loaves. An Old-Babylonian document (Legrain 1922 *PBS* 13, 61) from Nippur describes food called ninda-i_3-de_2-a, which is most often interpreted as a kind of bread. It is in fact a fine flour-based porridge, to which were added various quantities of dates, clarified butter (*ghee*), dairy produce, raisins, apples, and figs. This food was widespread in Mesopotamia in the 3rd millennium. It was offered to deities in gold cups. Hulled grain, groats or semolina were used for food similar to modern *burgul* (*bulgur* in Turkish) (Avitsur 1972–1975: 230–231). These products were often mixed with dairy produce (including cheese), various greasy substances (of vegetable or animal origin), fruit, or even meat, enhanced by spices such as cumin or coriander. To chick-pea or bean flour were mainly added greasy substances, the resulting dish being reminiscent of modern Near-Eastern *homos*, which could be savoured with vegetables or meat.

Various spices and ingredients were contained in bread. To prepare 6 large loaves (ninda-gal), 11.12 litres of coarse barley flour, 0.85 litre of emmer groats, 126 g of *samīdu* spice, 25 g of *kamamtum*, 37 g of black cumin, 62 g of *azupīru* and 126 g of salt were used (Legrain 1922 *PBS* 13, 61).

Flat bread constituted the staple diet, but leavened bread had been known since the Neolithic period, as evidenced by cupola ovens, which coexisted in the Near East as early as the 6th millennium BCE (Währen 1967: 11 ss.) with cylindrical ovens (*tanur*) (Avitsur 1972–1975: 237–241). While the former are suitable for leavened bread, the latter are more appropriate for the baking of flat bread. The great bakeries used mainly cupola ovens.[45]

One burnt loaf of bread dating to the second half of the 4th millennium BCE, was found at Judeideh (Braidwood and Braidwood 1960: 343. *Cf.* also Währen 1967: 23 s.); this was a leavened loaf, not a flat bread. Loaves dated to the 3rd millennium were made from barley, emmer or wheat flour and were round, concave or triangular, or even ball- and ring-shaped.[46]

The kitchens and bakeries of the Grain-Grinding-Households prepared cereal-based food as well as bread, which were brought to and distributed amongst the various categories of staff working for the Patrimonial Household.[47]

Redistribution

Products – flour, bread, beer, oil, and unguents or scents – were dispatched daily to distribution centres. These were first and foremost institutions such as the Palace, centres of administration, Temples, *Messenger Households*, or various production units which were granted such deliveries. However, almost all categories of staff in the service of the Patrimonial Household received food rations, besides monthly rations of grain, yearly rations of oil and wool, or of textiles, and occasional rations, especially on the occasion of great religious feasts. Part of the production was put aside for cult purposes since Temples were the individual Households of the gods, whose subsistence had to be ensured and who received their daily food rations, notably meat, flour, bread and beer, as well as varied dishes, prepared or raw. Part of these rations-offerings were in fact redistributed to the Temple staff and other categories of people receiving rations.

The regular staff of the various Households had a right to rations of flour products, which were apparently distributed once a year. The size of rations depended on the status of the recipient, who was also entitled to subsistence lands. All categories of Patrimonial staff were due a share in this system of general redistribution. The same held true for military personnel and people subject to military-*corvée*, who had a right to a plot of land and received all sorts of rations, including foodstuffs.[48]

Conclusion

The great complexes for the transformation of grain played a prime role in the social and economic life of the Mesopotamian *Patrimonial* régime, that of ensur-

ing supplies of food and drink within a system of specific redistribution. In view of the period and the available technological means, these large complexes represent a unique phenomenon in ancient history. This particular phenomenon is remarkable both because of the very size of the complexes themselves, and also because of the conceptual and organizational genius of those who, at the end of the 3rd millennium BCE, through sheer labour and will, implemented a system of such sophistication that it cannot but compel our admiration. This system, however, was a strategy for survival. Initially, the demographic pressure and the difficulties of the environment raised problems whose solution lay in the development of new means of subsistence and new production techniques likely to intensify productivity and the feeding of an ever-increasing population.

The history of the civilization of Southern Mesopotamia demonstrates clearly that, the more a society is forced into innovation, the more it tends to develop the organization of its socio-economic, political and cultural system. The great institutions described above illustrate this rule to perfection.

Acknowledgements

The results of this research will be discussed in greater detail in the forthcoming publication, *Les Grandes Unités de Transformation des Céréales: Les Minoteries Néo-Sumériennes*. The present article is based, with additions, on a lecture delivered in French, at a conference entitled *La préparation alimentaire des céréales*, held at the European University Centre for Cultural Goods, Ravello – Villa Rufolo, on April 11–14, 1988. This study is dedicated to Professor Dr. Max Währen, whose researches and suggestions prompted me to examine the cuneiform records in a new light and helped to clarify for me some technical as well as social and economic aspects mentioned in the texts of ancient Mesopotamia. Special thanks are due to Dr. C. Dauphin for her assistance in preparing the present text in English.

Notes

1 To use the expression formulated by Gordon V. Childe.

2 For a global definition of Southern Mesopotomian society in the 3rd millennium BCE, see Grégoire 1981: 27–101.

3 In the myth of *Enlil and Ninlil,* the town of Nippur is described as 'the town mantled with palm trees'.

4 In Sumerian, e_2, the 'household' consisted both of the buildings, and of the people who were members of such a complex, as well as of all the property belonging to it.

5 Kept at the British Museum: BM 20103:95–10–17, 143. This information was provided by R. M. Sigrist, who has kindly allowed me to mention it here, for which I thank him warmly.

6 The yearly rations of a woman-weaver working full time throughout the year included 334 litres (243 kg) of barley, 1.07 litres of vegetable oil, 4–5 litres of dates. Besides, occasional rations, notably of dairy produce (cheese), various fruit and vegetables, meat, but especially fish, and other foodstuffs (spices, various ingredients and materials), constituted the yearly food rations of the female labour-force.

7 In French, *minoterie*, (Grégoire 1992: 321); in German, *Getreideverarbeitungsanlage*.

8 e_2-ḪAR.ḪAR = e_2-ara_5; (cf.: ḪAR = ar_3: Fish 1932 *CST* 627:4; Deimel 1926 *Or* 20, 82:130; Oppenheim 1948 *AOS* 32, W 30 *sub* a) (e_2-ḪAR-ra = e_2-ar_3-ra); e_2-ḪAR.ḪAR = e_2-kikken(a) (var: e_2-kikken-na; e_2-ḪAR-na = e_2-kin_2-na); cf. ḪAR = kin_2, ḪAR.ḪAR = kikken; comp.: ĝeme_2-kin_2-na, ĝeme_2-kikken-na (Hackman 1937 *BIN* 5, 172:2; 173:2; Chiera 1922 *STA* 5 iii 15–17; Fish 1958 *MCS* 8, 91: BM 105711:2).

9 Notably King 1898 *CT* 3, pl. 19–20, BM 18344: Š 48 / L. 00 / 00 and Reisner 1901 *TuT* 154 = VAT 2333: AS 02 / L. 00 / 00: documents which enumerate grain-rations distributed among the staff of the Ĝir_2-su^{ki} *Grain-Grinding-Household*.

10 In Pre-Sargonic times, a hog-breeder owned 6 female grinders (ĝeme_2-ḪAR) to prepare the food for the fattening of hogs.

11 Individuals known solely by their surnames.

12 Since Schneider's article (1926:121–122), numerous texts (now published or still unpublished) have come to light.

13 A document from Umma (Schneider 1931: n° 88), dating from Year 5 of ^{d}Amar-^{d}Suena's reign, records the levying of 913 men (guruš) who had to complete their period of military-*corvée*. These men were mostly members of the regular staff of various departments belonging to several Temple-Households. They were divided into units of ten (nam-u), directed by *Heads of Tens* (ugula-u), whereas larger units were led by the nu-$banda_3$(-eren(a)$_2$)-*commanders*.

14 533 gur 2 bariga 5 ban_2: King 1898 *CT* 3, pl. 19–20, BM 18344:07 22: zi_3 iti-da-bi 8.53;2,5,0 gur.

15 AO 5668, Genouillac 1932 *TCL* 5, pl. 2, Š 48 / U. 04–12 / 20 (260 days): production: 56,547.48 litres of sundry products.

16 For instance, one from Lagaš^{ki}, BM 20012, King 1900a *CT* 9, pl. 30.

17 Such as the one in Ugnim^{ki}, mentioned in King 1900b *CT* 10, pl. 44, BM 19065, which employed 14 people only, of whom 4 men, 7 women and 3 youths.

18 A composite lexem, which has also been read PA.URU, but in fact consists of cuneograms PA+ĜIŠGAL. The duty of such women was to supervise the various members of a team. They thus acted as head workers with, apparently, the added task of recruiting agents. *Cf.* Steinkeller 1979: 176–187; Steinkeller 1983: 245, citing Pettinato *MEE* 4, 305:953, 377:0447: PA.URU = *zu-ḫa–lum/lu-um* = *siḫārum* or *siḫḫarum* and stating that PA.URU seems to be an older spelling of PA+ĜIŠGAL = *saḫḫiru*.

19 In French: *grain concassé*, *mondé*, in German, *Graupen*.

20 In French: *gruau*, in German, *Grütze*.

21 na_4-GUM. *Cf.* Stol 1979: 83–100, dicussed by Heimpel 1981: col. 632–634.

22 *Cf.* Thesiger 1983: 48: 'In front of an another house two girls in long gowns of patterned cloth, one red, the other green, pounded grain in a wooden mortar with long heavy pestles. They struck in turn, bending their bodies forward from the hips and grunted rhythmically with each blow.'

23 In French, *broyer*; in German, *reiben*; grinding being in French, *broyage*; in German, *Vermahlen*.

24 In French, *meule*; in German, *Reibmühle*.

25 In French, *meule dormante*; in German, *Reibmühle*.

26 In French, *molette*; in German, *Reibstein*.

27 There appears to be evidence for a rotary quern at Ras Shamra, *ca.* 1200 BCE. It consisted of two hemispherical stones, the lower one fitted with a tenon which was inserted into the mortice of the upper stone; the latter was kept in position by the edge of the lower stone; *cf.* Schaeffer *Syria* 10 (1929): 286–287; *Syria* 12 (1931): 2; *Syria* 15 (1934): 106. At Tell Halaf, circular querns were also discovered with a central tenon in order to maintain in position an upper stone which was fitted with a hole on its side, thus

enabling the insertion of a wooden handle so that the upper stone could be rotated over the lower one. There are supposedly other examples from Palestine.

28 *Cf.* Matthiae 1982: 43 ss. and fig. 16, 17. According to P. Matthiae, this installation was located in a fairly well-preserved room in the Western Palace, erected during the Middle Bronze I (2000–1800 BCE). It is thus slightly later than the Neo-Sumerian installations of Lower Mesopotamia.

29 Sitting atop querns is still practised nowadays by villagers of this region, when grinding with almost identical tools. A bent position with knees resting on the bench corresponds better to ancient depictions; *cf.* Matthiae 1982: 43 ss.

30 Following Pinches 1908: *Amh.* 50: S 47 (a): i 7–8: 2;0,0,0 še ĝiš–i_3 gur / i_3–ĝiš-bi 0;2,0,0 /.

31 In French, *bouchardage*; in German, *Kröneln.*

32 *Cf.* also footnotes concerning this publication: Heimpel 1981: col. 632–634.

33 Cuneiform document H. de Genouillac *ITT* 5, 6885, mentions the supply of handstones (na_4-ḪAR-šu-se_3-ga) by the quern cutter (na_4-ḪAR-gul-gul) for the preparation of the maslin for feeding *corvée*-labourers: $ša_3$-gal $ḫe_2$-dab_5 ar_3-re-de_3.

34 *Cf.* Kraybill 1977: 485–521. Braidwood, Braidwood, Howe, Reed and Watson 1987; *cf.* notably Hole 1987: 233–284; Moholy-Nagy 1987: 289–346.

35 This is confirmed by Moritz 1958: 185–186.

36 These experiments were conducted in April 1994 at the Institut de Préhistoire Orientale in Jalès by the author with the assistance of Hara Procopiou. We attempted several experiments relating, on the one hand, to husking techniques of hulled grain, and on the other, to grinding husked grain. The results of these experiments will be published ultimately in a specific study focusing on problems of husking hulled grain and of grinding. The grinding experiments were undertaken in close collaboration with Hara Procopiou, using various techniques in order to obtain flour products ranging from crushed grain to fine flour. *Cf.* also Procopiou 1998.

37 Grain was most certainly hulled with a mortar.

38 The results of these particular experiments will be described in a separate publication.

39 In French, *grain mondé*; in German, *Graupen.*

40 In French, *gruau*; in German, *Grütze.*

41 In French, *gruau de blé amidonnier*; in German, *Emmergrütze.*

42 In French, *grésillon*; in German, *Schrot.* 'Ground corn' refers to barley or emmer.

43 For example, gi-ma-an-sim ni_3-ḪAR-ra: bolter specific to groats; gi-ma-an-sim še-ĝiš-i_3: bolter for linseed; gi-ma-an-sim zi_3-dabin: bolter or sieve for barley flour; gi-ma-an-sim zi_3-gu: bolter or sieve for very fine flour; gi-ma-an-sim zi_3-$še_3$: bolter or sieve for flour. *Cf.* Salonen 1965: I.: 67 ss. The frame of such bolters or sieves was made of reed.

44 The weight of bread is very rarely mentioned in cuneiform records. Some information is supplied by Genouillac 1921: *ITT* 5, 9304. According to this document, bread, of which one ovenful must have consisted of 43 items, weighed 16 mines or 8,080 g, that is 187.90 g per item. These items were in this case flat bread, which had been weighed after baking.

45 For fire cooking devices, *cf.* Avitsur 1972–1975: 237–241: *baking oven (tanur)* (237), *pit oven* (237–238), *built oven* (238), *furnus oven (furun)* (238–239), *separate hearth furna* (239), *ṭabun-oven* (239–240); Barrelet 1974: 243–300; Bromberger 1974: 301–310.

46 Max Währen's research is based mainly on analyses of loaves or remnants of bread discovered in the course of archaeological excavations. He has published his results in various books and in numerous scientific articles. Währen has determined the composition of often minute carbonized remnants of bread dating from the Neolithic Period until the Iron Age, as well as the composition of the ingredients, their fineness, the types of flour used, the processes followed in their baking and the problems inherent to their

conservation (Währen 1967: 23 ss). See also Währen's publications in our Bibliography.

47 Cuneiform records such as King 1899 *CT* 7, 19, BM 12949, a document from Lagaš^{ki} supply detailed reports on the tasks of bakery superintendents.

48 A great number of cuneiform texts give us a fairly precise idea of these distributions of food, notably a tablet from Umma^{ki} (Ashm. 1912-1142: ŠS 08 / U. 00 / 00) which records the provisions given by central administration to a daughter of the Sovereign who remained for 32 days at Umma, before pursuing her travel by boat to Nippur (see Grégoire 1997: 90, Pl. 49).

Bibliography

Amman, L., (1914). *Meunerie, boulangerie* (Paris).

Avitsur, S., (1972–1975). 'The Way to Bread . The Example of the Land of Israel', *Tools and Tillage* 2: 228–241.

Barrelet, M.-T., (1974). 'Dispositifs à feu et cuisson des aliments à Ur, Nippur et Uruk', *Paléorient* 2, 1: 243–300.

Behrens, H., (1978). *Enlil und Ninlil, Ein sumerischer Mythos aus Nippur*, Studia Pohl: Series Maior 8, (Rome): 14, l. 3.

Blümner, H., (1912). *Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern*, Bd. I: 11–23 (Leipzig).

Braidwood, R. J. and Braidwood L. S., (1960). *Excavations in the Plain of Antioch* (Chicago).

Braidwood, L. S., Braidwood, R. J., Howe, B., Reed, C. A. and Watson, P. J., eds, (1987). *Prehistoric Archaeology along the Zagros Flanks*, The Oriental Institute of the University of Chicago, Oriental Institute Publications, 105 (Chicago).

Bromberger, C., (1974). 'Fosses à cuisson dans le Proche-Orient actuel: bilan de quelques observations ethnographiques', *Paléorient* 2, 1: 301–310.

Chiera, E., (1922). *Selected Temple Accounts from Telloh, Yokha and Drehem. Cuneiform Tablets in the Library of Princeton University.*

Childe, G. V., (1928). *New Light on the Most Ancient East* (New York): 23.

Childe, G. V., (1950).; 'The Urban Revolution', *Town Planning Review* 21, 1: 179–223.

Curwen, E. C., (1937). 'Querns', *Antiquity* 11: 133–151.

Curwen, E. C., (1941). 'More About Querns', *Antiquity* 15: 15–32.

Deimel, A. (1926). 'Umma (Djoha)-Texte aus dem päpstlichen Bibelinstitut (forts.)', *Orientalia* ps 20: 79–87.

Fish, T., (1932). *Catalogue of Sumerian Tablets in the John Rylands Library.* (Manchester).

Fish, T., (1958). *Manchester Cuneiform Studies* vol. VIII (Manchester).

Foxhall, L., (1982). 'Experiments in the Processing of Wheat and Barley', in Foxhall, L. and Forbes, H.A., 'The Role of Grain as a Staple Food in Classical Antiquity', *Chiron* 12: 41–90, App.: 75–81.

Frankfort, H., (1932/33). *Iraq Excavations of the Oriental Institute, OIC* 17 (Chicago): 23 ss.

Gelb, I. J., (1972). 'The Arua-Institution', *Revue d'Assyriologie* 66: 1–32.

Gelb. I. J., (1973). 'Prisoners of War in Early Mesopotamia', *Journal of Near Eastern Studies* 32: 70–98.

Genouillac, H. de, (1921). *Inventaire des Tablettes de Tello conservées au Musée Impérial Ottoman. Tome V: Époque présargonique, Époque d'Agadé, Époque d'Ur* (Paris).

Genouillac, H. de, (1932). *Textes Économiques d'Oumma de l'Époque d'Our*, Musée du Louvre – Département des Antiquités Orientales. Textes Cunéiformes, T. V.

Grégoire, J.-P., (1981). 'L'origine et le développement de la civilisation mésopotamienne

du troisième millénaire avant notre ère', in *Actes du Colloque Production, Pouvoir et Parenté dans le Monde Méditerranéen* (Paris), 27–101.
Grégoire, J.-P., (1992), 'Les Grandes Unités de Transformation des Céréales de la Mésopotamie du Sud à la Fin du IIIe Millénaire avant notre ère', in Anderson, P. C., ed., *Préhistoire de l'Agriculture. Nouvelles approches expérimentales et ethnographiques*, Monographie du CRA-CNRS, n° 6: 321–339.
Grégoire, J.-P., (1997). *Archives Administratives et Inscriptions Cunéiformes de l'Ashmolean Musuem et de la Bodleian Collection à Oxford. Contribution à l'Histoire Sociale, Économique, Politique et Culturelle du Proche-Orient Ancien*, Volume I, *Les Sources 1* (Paris).
Hackman, G. G., (1937). *Temple Documents of the Third Dynasty of Ur from Umma.* Babylonian Inscriptions in the Collection of James B. Nies. V (Yale).
Harlan, J., (1967). 'A Wild Wheat Harvest in Turkey', *Archaeology* 20: 199–200.
Heimpel, W., (1972), *Journal of American Oriental Society* 92, 2: 286.
Heimpel, W., (1981). *Bibliotheca Orientalis* 38, 5/6: col. 632–634.
Hole, F., (1987). 'The Jarmo Chipped Stone', in Braidwood, L. S., Braidwood, R. J., Howe, B., Reed, C. A. and Watson, P. J., eds, (1987). *Prehistoric Archaeology along the Zagros Flanks*, The Oriental Institute of the University of Chicago, Oriental Institute Publications 105 (Chicago): 233–284.
Jazny, N., (1944). 'Wheat prices and milling costs in Classical Rome', in *Wheat Studies in the Food Research Institute* 20: 149 ss.
King, L. W., (1898 / 1961). *Cuneiform Texts from Babylonian Tablets in the British Museum.* Part III. (London).
King, L. W., (1899 / 1961). *Cuneiform Texts from Babylonian Tablets in the British Museum.* Part VII. (London).
King, L. W., (1900a / 1962a). *Cuneiform Texts from Babylonian Tablets in the British Museum.* Part IX. (London).
King, L. W., (1900b / 1962b). *Cuneiform Texts from Babylonian Tablets in the British Museum.* Part X. (London).
Kraybill, N., (1977). 'Pre-Agricultural Tools for the Preparation of Foods in the Old World', in Reed, C. A., ed., *Origins of Agriculture* (The Hague): 485–521.
Lambert, M., (1953). 'Feuille de paie de Lagash (Époque Ur III)', *Revue d'Assyriologie* 47: 141–142.
Legrain, L., (1922). *Historical Fragments.* University of Pennsylvania. The University Musem. Publications of the Babylonian Section, vol. XIII (Philadelphia).
Lindet, L., (1899). 'Les origines des moulins à grains', *Revue archéologique* 35: 413, 427.
Matthiae, P., (1982). 'Fouilles de Tell-Mardikh-Ebla, 1980: Le Palais occidental de l'époque amorrhéenne', *Akkadica* 28: 43 ss.
Meissner, B., (1936). 'Warenpreise in Babylonien', *Abhandlungen. der Preussischen. Akademie der Wisssenschaften, Phil.-hist. Klasse, Jahrgang.* 136 (Berlin).
Moholy-Nagy, H., (1987). 'Jarmo Artifacts of Pecked and Ground Stone and of Shell', in Braidwood, L. S., Braidwood, R. J., Howe, B., Reed, C. A. and Watson, P. J., eds, (1987). *Prehistoric Archaeology along the Zagros Flanks*, The Oriental Institute of the University of Chicago, Oriental Institute Publications, 105, (Chicago): 289–346.
Moritz, L.-A., (1958). *Grain-Mills and Flour in Classical Antiquity* (Oxford).
Neuberger A., (1919). *Technik des Altertums* (Leipzig).
Oppenheim A. L., (1948). *Catalogue of the Cuneiform Tablets of the Wilberforce Eames Babylonian Collection in the New York Public Library*, American Oriental Society (New Haven).
Pettinato, G., (1982). *Testi Lessicali Bilingui della Biblioteca L. 2769.* Materiali Epigrafici di Ebla – 4, Napoli, Istituto Universitario Orientale di Napoli, Seminario di Studi Asiatici, Series Maior IV.

Pinches, Th.G., (1908). *The Amherst Tablets being an Account of the Babylonian Inscriptions in the Collection of the Right Hon. Lord Amherst of Hackney, F.S.A. at Didlington Hall, Norfolk* (London).
Procopiou, H., (1998). *L'outillage de mouture et de broyage en Crète Minoenne.* Thèse de doctorat (Paris).
Rabuté, (1909). *Le blé, la farine, le pain – Études pratiques de la meunerie et de la boulangerie* (Paris): 18.
Reed, C. A., ed., (1977). *Origins of Agriculture* (The Hague).
Reisner, G., (1901). *Tempelurkunden aus Telloh.* (Berlin).
Renfrew, J., (1973). *Palaeoethnobotany. The prehistoric food plants of the Near East and Europe.* (New York).
Salonen, A., (1965). *Die Hausgeräte der Alten Mesopotamier nach sumerisch-akkadischen Quellen.* Annales Academiae Scientiarum Fennicae, Ser. B, T. 139, Teil I. (Helsinki).
Schaeffer, C., (1929–1934). 'Les fouilles de Minet el-Beida et de Ras Samra', *Syria* 10 (1929): 286–287; *Syria* 12 (1931): 2; *Syria* 15 (1934): 106.
Schneider, N., (1926). 'Die Lohnbücher der Mühle von Sagdana'. *Archiv für Orientforschung* 3: 121–122.
Schneider, N., (1931). *Die Drehem und Djoḫa-Urkunden der Strassburger Universitäts- und Landesbibliothek in Autographie und mit systematischen Wörterverzeichnissen.* Analecta Orientalia I, Pontificio Istituto Biblico (Roma).
Steinkeller, P., (1980). 'Alleged GUR.DA = ugula-géš-da and the Reading of the Sumerian Numeral 60', *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 69, II. Halbband: 176–187.
Steinkeller, P., (1983). *Journal of Cuneiform Studies* 35, 3–4: 245.
Stol, M., (1979). *On Trees, Mountains and Millstones in the Ancient Near East,* Ex Oriente Lux (Leiden).
Thesiger, W., (1983). *The Marsh Arabs.* Penguin Travel Library (Harmondsworth).
Währen, M., (1963). *Brot und Gebäck im Leben und Glauben der alten Ägypter,* Herausgegeben vom Schweizerischen Archiv für Brot- und Gebäckkunde – Institut zur wissenschaftlichen Bearbeitung und Förderung der Brot- und Gebäckkunde (Bern).
Währen, M., (1967). *Brot und Gebäck im Leben und Glauben des Alten Orient.* Schw. Archiv für Brot- und Gebäckkunde, Institut zur wissenschaftlichen Bearbeitung und Förderung der Gebäckkunde Bern. (Basel).
Währen, M., (1981). 'Gutachten über Ausgrabungsmaterial aus Telgte a.d. Ems', *Archäologie und Naturwissenschaften* 2: 254–264.
Währen, M., (1983). '5500 Jahre alter Brotlaib identifiziert', *Bulletin der Eidgenössischen Technischen Hochschule Zürich,* N° 179 (Mai): 7–8.
Währen, M., (1984). 'Brote und Getreidebrei von Twann aus dem 4. Jahrtausend vor Christus', *Archäologie der Schweiz / Archéologie Suisse* 7/1: 1–6.
Währen, M., (1985). 'Die Entwicklungsstationen vom Korn zum Brot im 5. u. 4. Jahrtausend', *Getreide, Mehl und Brot* 39 (Bochum): 373–379.
Währen, M., (1987). 'Das Brot in der Bronzezeit und älteren Vorrömischen Eisenzeit nördlich der Alpen unter besonderer Bercksichtigung von Brotfunden aus Kreisgrabenfriedhöfen des Münsterlandes', *Ausgrabungen und Funde in Westfalen-Lippe (Münster)* 5: 23–71, 22 Abb., 6 Tab.
Währen, M., (1988). *Brot und Gebäck in der Urgeschichte, mit ausführlicher Berücksichtigung des Weck-Feingebäcks von Ovelgönne und des Haferbrotes von Langenrehm* (unpublished manuscript).
Währen, M., (1985 / 1988). 'Jungsteinzeitliche Speisereste aus dem Kanton Freiburg', *Chronique Archéologique, Archéologie Fribourgeoise,* Separatum: 85–95.
Währen, M., (1989). 'Brot und Gebäck von der Jungsteinzeit bis zur Römerzeit. Eine

Skizze zum Forschungsstand mit besonderer Berücksichtigung der westschweizerischen Seeufersiedlung', *Helvetia Archaeologica* 79: 82–114.
Währen, M., (1989). 'Identifizierung von gesäuertem Brot in Knochenasche-Kristallen einer Urnenfelderzeitlichen Bestattung in Bellenberg, Ldkr. Neu-Ulm', *Kataloge der Prähistorischen Staatssammlung, München*, N° 23: 59–65.
Währen, M., (1994–99). 'Die Urgeschichte des Brotes und Gebäckes in der Schweiz', *Helvetia Archaeologica* 25: 75–89.
Währen, M., and Schneider, Ch., (1995). *Die puls. Römischer Getreidebrei.* Augster Museumshefte 14, Römermuseum (Augst).
Währen, M., (1997/8). 'Das jungsteinzeitliche Brot von Montmirail', *Helvetia archaeologica* 28, 110: 42–52.
Währen, M., (n.d.) *Des pains-gâteaux emballés sous vide, il y a 4000 ans*, Brochure du Musée Français du Pain (Paris).
Waetzoldt, H., (1972). *Untersuchungen zur Neusumerischen Textilindustrie*, Studi Economici e Tecnologici-1, Centro per le Antichità e la Storia dell'Arte del Vicino Oriente (Roma).

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Plenty or just enough? The Diet of the Rural and Urban Masses of Byzantine Palestine

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A Land of Milk and Honey

The agricultural fertility of Palestine, 'a rich land, a land of streams, of springs and underground waters gushing out in hill and valley, a land of wheat and barley, of vines, fig-trees, and pomegranates, a land of olives, oil, and honey' (Deut. 8: 7–8), a 'land of corn and wine where the skies drip with dew' (Deut. 33: 28), was not a figment of Biblical imagination. Throughout antiquity and into the Byzantine period, the stubborn labour of the rural population overcame the vagaries of the Palestinian climate, the harsh topography of uplands, plateaux, hills and mountains, and the aridity of extensive deserts necessitating irrigation. The abundance in corn, wine and oil (Deut. 28: 51) – the Mediterranean trilogy – was praised in the late 5th or early 6th century AD in two Greek inscriptions on the mosaic pavement of a *villa rustica* in the hinterland of Caesarea Maritima: 'The Lord your God will bless your corn and your wine and your oil, and He shall increase (them). Amen' (Siegelmann 1974).[1] These were not mere literary *topoi*. Applying flotation technique for the first time to a Byzantine site in Israel, we collected a large quantity of vegetal remains in our 1977–1978 excavations of the Byzantine ecclesiastical farm at Shelomi in Western Galilee (Dauphin 1993: 47–8). Wheat, barley, olive, grape, apple and pear were identified – the staple produce of Roman farms as described in the agricultural treatises of Cato, Varro, Columella and Palladius. A high percentage of weeds, seeds of wild plants, wild grasses and wild legumes – the basic constituents of animal fodder – indicates that cattle-breeding, the *pastio agrestis* of the Roman sources, was also practised on this Byzantine estate.[2] The agricultural prosperity of Byzantine Palestine is corroborated by the Piacenza Pilgrim's euphoric description of Galilee around AD 570 as 'a paradise with corn and fruit like Egypt. The region is small, but in its wine, oil and apples it is superior to Egypt. The millet is abnormally tall, and the stalks are bigger than the height of a man' (*Itin.* 5; Geyer 1965 ed.: 131; Wilkinson 1977: 81).

Diet-deficiency Diseases: the Contribution of Palaeopathology

A different and less idyllic picture, however, is suggested by two types of bone malformation, which have been detected on some Byzantine skeletons in Palestine: *spina bifida* and dental *hypoplasia*. Both are linked to diet-deficiency during growth.

Spina Bifida

In Tomb I at Meiron in Upper Galilee, in which thirty-six individuals had been buried in the late 4th century AD, *spina bifida* of varying degrees was clear on nine out of thirteen still intact *sacra* (Smith, Bornemann and Zias 1976). *Spina bifida aperta* is a severe congenital defect of the central nervous system, which is characterized by the non-closure of the distal extremity of the neural canal in the pre-sacrum area in the fourth week of the foetus' gestation, by the exposure of the spinal cord and consequent infection. The normal development of the lumbar plexus having been thus prevented, the child dies at birth owing to a motor defect of the lower limbs, of the bladder and of the genital organs. Much less severe, *spina bifida occulta* is a defect of the bony spinal canal, whereby the incompletely-formed vertebrae do not encircle totally the spinal cord, the latters's protection being afforded solely by cartilage or membrane. Between the two types of *spina bifida*, there is a wide range of malformations of the spinal cord and of the spine.

Ferembach's 1963 hypothesis that *spina bifida* is solely due to a high rate of endogamy in a human group, was recently modulated as a result of the discovery of the manifest role played by the socio-economic environment. Carter and Evans (1973) have noted the increase in frequency of *spina bifida* in periods of diet-restriction, the great number of children from low socio-economic parental backgrounds, the mothers being either under twenty or over thirty-five years of age. Clinical study and therapeutic experiments have led researchers to incriminate folic acid. This Group B vitamin is found in green vegetables and in meat. The need for folic acid increases during pregnancy and deficiency symptoms appear rapidly (in the course of three months, as opposed to four in the case of vitamin B12). It seems that in the event of insufficient folic acid intake, an anomaly in the metabolism of folates (which is revealed in the mother by the increased need for them during pregnancy) triggers the mechanism ultimately responsible for the foetus' *spina bifida* (Seller 1987; Yates, Ferguson-Smith, Guzman-Rodriguez, White and Clark 1987). Even if *spina bifida aperta* is clearly linked to a genetic predisposition, deficiency in folic acid plays a decisive role in the increase of risk, the mother's *devitaminosis* being invariably reflected in her child's state of health. Thus, according to Mafart (1989: 81), the minor forms of *spina bifida* would indicate the 'niveau nutritionnel des populations'.

Dental hypoplasia

Hypoplasia is an anomaly in the formation of dental enamel. Teeth appear streaked with circular or transverse bands of the same colour as, or of a darker hue than, that of the dental crown. Enamel starts to form in the sixth month of gestation and continues to do so until the child's twelth year in the case of third molars. Any illness of the pregnant woman from the sixth month onwards (diet-deficiency, lack of vitamins A, C or D, severe lack of calcium, chest infections, and viruses), of the new-born infant (perinatal trauma or premature birth) and of the young child (chicken pox, measles and scarlet fever) may result in the disfunctioning (or *dysplasia*) of enamel formation. If the illness is protracted and lasts from several weeks to two months, enamel ceases to form (Crubézy 1988: 224–6). In the event of this being due to malnutrition, the enamel of one or of several teeth, and even that of all the crowns in the process of development, appears much denser than when enamel-formation resumes. The teeth of several individuals who had been buried in the early 6th century AD under the pavement of the North Church at Rehovot in the Negev desert,[3] exhibited *hypoplasia* which may have been due to nutritional stress (Hershkovitz, Ring, Rak and Arensburg 1988: 203).

Hyperostosis

A third technique has only just started to be applied to Byzantine skeletons in Israel. The observation of *cribra orbitalia* enables the detection of porotic *hyperostosis* (hypertrophy of the vault of the eye sockets) which frequently indicates anaemia due to iron deficiency (Hengen 1971; Stuart-Macadam 1985; 1992). The lack of markers of environmental stress such as dental *hypoplasia* and *cribra orbitalia* on twenty-five individuals who had been interred between the last quarter of the 4th to the first quarter of the 5th century AD in a family tomb at Giv'at Sharet, near Bet Shemesh, 23 km west of Jerusalem, coupled with the fact that the family could afford its own burial cave, 'may suggest that it was of more than modest means' (Seligman, Zias and Stark 1996: 59). Thus, to the minds of the excavators and of the expedition palaeoanthropologist, in this particular case, nutrition and financial resources were clearly linked.

The Byzantine Diet

Fish, Fowl and Sweets? or Fungi and Thistles?

The contradiction between abundance and shortage revealed by the juxtaposition of the historical and palaeoanthropological sources, is echoed in hagiography by the clash between two extremes of diet.

In the *Lives* of the holy monks of Palestine, 'a banquet' (ἡ ἑορτὴ μεγάλη) which was considered an exceptional event, invariably included loaves of fresh,

white, wheat bread, wine, oil, fresh cheese, eggs, and honey, a bonus being fish fried in a pan and eaten hot (Cyr. Scyth. *Vit. Sab.* 160: 2–7 – Festugière 1967 ed.: 88; Cyr. Scyth. *Vit. Ioan. Hesych.* 211: 12–14 – Festugière 1963 ed.: 23; Leont. Neap. *Vit. Sym. Sal.* XXVIII, 158: 23–4 – Festugière 1974 ed.: 92 and 148).[4] Likewise, in 6th-century Emesa (Ḥoms in Central Syria), a 'magnificent lunch' consisted of loaves of wheat bread, circular slabs of flat rye bread, meatballs, fish, choice wine, sweet pancakes and jam (Leont. Neap. *Vit. Sym Sal.* XXXV, 164: 4 – Festugière 1974 ed.: 98 and 153).

Some of these were the daily fare of a wealthy minority, notably of ecclesiastical dignitaries. A most humble man, St John the Almoner who was Patriarch of Alexandria in the early 7th century, was consequently racked by guilt: 'You who hope to enjoy the fruits of Eternity, you drink various sorts of wines, you swallow enormous fishes, and fowl, and well-prepared dishes, and sweets, and tiered desserts, and as many loaves of white bread as you wish' (Leont. Neap. *Vit. Ioann. Cypr.* XIX, 39: 37–43 – Festugière 1974 ed.: 367 and 470).

At the other end both of the ecclesiastical hierarchy and of the food-scale, the cave-dwelling *Boskoi* (or 'grazing' monks) ate exclusively dry grasses. The 5th-century ecclesiastical historian Sozomenus describes how these hermits grazed in the Judaean Desert: 'When the time comes to eat . . . they each have a sickle, and, roaming the desert, they feed on wild plants' (*Hist. Eccles.* VI, 33; *PG* 67: col. 1393). Lauritic monks seeking full seclusion in the inner desert, notably during Lent, with a small knife-cum-hoe unearthed the roots of *melagria* which was their sole food in this arid vastness (Cyr. Scyth. *Vit. Sab.* 56: 29 – 57: 9 – Festugière 1962b ed.: 111). These *melagria* were probably mushrooms which grow naturally under the ground surface in the desert and which Beduins still collect nowadays in the vicinity of the Dead Sea (Festugière 1962a ed: 48). *Melagria*, however, cannot grow in conditions of extreme aridity, for instance in the desert of Natupha where St Kyriakos retired at the age of seventy-seven with a disciple. On Kyriakos' order, the younger monk picked large bulbs of desert asphodel, which he boiled and served up with salt. Miraculously, they had lost their bitterness (Cyr. Scyth. *Vit. Kyr.* 227: 10–18 – Festugière 1963 ed.: 44). Likewise, the unbearable sourness of wild colocynths (a gourd considered to be poisonous) which the cook of the Great Laura had decided to serve up boiled to workmen who had undertaken a job in the monastery, was cancelled by St Sabas making the sign of the cross on the pan: 'At once, the colocynths became sweet, all ate of them and were satisfied, and they glorified God' (Cyr. Scyth. *Vit. Sab.* 138: 16–18 – Festugière 1962b ed.: 64-5).[5]

On Mons Marda (Roman Masada) which overlooks the Dead Sea, St. Euthymius found some *maloas*, which he ate together with some wild plants (Cyr. Scyth. *Vit. Euth.* 22: 6 – Festugière 1962a ed.: 75). This may have been the Byzantine Greek for the Biblical Hebrew *malouah* which was plucked off bushes of broom root in Job 30: 4. The monks of the coenobitic monastery of Theoctistus, those of the Laura of St Euthymius as well as those of the Great Laura, went periodically on expeditions in the Judaean Desert in order to collect great armfuls of

mannouthia – perhaps edible thistles (*Vit. Euth.* 72: 19–20 – Festugière 1962a ed.: 128; and, *Vit. Sab.* 92: 9–10 and 130: 29–31 – Festugière 1962b ed.: 19 and 56).[6]

Bread, beans and wine

Between the above extremes – culinary delicacies and desert plants -, what constituted a typical meal for an artisan or a peasant? For a start, monastic diet should not enter into our consideration, since it represented a deliberate attempt at setting oneself outside the norm by restraint (Rousselle 1983: 213; Regnault 1990: 92–93), the principle being not to refuse absorbing food altogether but to satisfy one's hunger progressively less (Devos 1986: 79). By its very essence, monastic diet cannot bring an answer to the question of the feeding of the masses from whom the monks intentionally set themselves apart, except when food-quantities deemed 'normal' are alluded to by the hagiographic sources before they are gradually reduced in the course of ascetic progress.

That an individual's choice of food was dictated by his pecuniary resources seems obvious. R. Eleazar b. Azaryah, who lived in Yabneh at the end of the 2nd century AD, was of the opinion that: 'He who has ten *maneh*s gets himself vegetables in a pot every day; twenty *maneh*s – gets himself vegetables in a pot and a pan; fifty *maneh*s – a *litra* of meat each Friday; a hundred *maneh*s – a *litra* of meat every day' (Tosephta, *Arakhin* 4: 27; Neusner 1979 ed., *Qodoshim*: 204). He who owned 20 *maneh*s, had therefore enough to buy oil in which boiled vegetables could simmer or be fried. In the Babylonian Talmud which was completed in the mid-6th century, the enumeration starts with one *maneh* which allowed one to buy one pound of vegetables for the cooking-pot, and continues with one pound of fish obtainable for 10 *maneh*s, one pound of meat for 50 *maneh*s, and one casserole of meat for 100 *maneh*s (Babylonian Talmud, *Ḥullin* 84a; Epstein 1935-1952 ed., *Seder Ḳodoshim* IV: 471).[7] In Alexandria at the beginning of the 7th century, a workman who earned in a workshop one *keration* (or 72 *folleis*) per day, ate hot broad beans for one *follis* (Leont. Neap. *Vit. Ioann. Cypr.* XXXVIII, 70: 10–12 – Festugière 1974 ed.: 387 and 496), whilst the entrance fee to the Baths was of five *folleis*, that same amount sufficing to cover the daily expenditure in vegetables in the house of a wealthy banker (Leont. Neap. *Vit. Ioann. Cypr.* XL, 76: 18–24 – Festugière 1974 ed.: 392 and 502). In Palestine in the same period, the daily salary of an artisan varied between six and ten *folleis*, whilst a *litra* of meat or a loaf of bread cost two *folleis* (Kindler 1989: 58). According to the *Rural Code*, an agricultural worker earned 12 *folleis* per day (*Nomos Georgikos* 22: 50: 62; Ashburner 1910 ed.: 100, 103 and 105).

The petty people of Byzantine Palestine ate mainly bread and cooked foods (Theod. Petr. *Vit. Theod.* 39: 9 – Usener, 1890 ed.: 39; Festugière 1963 ed.: 123). In the cheap eating-houses of Syria, only 'cooked dishes' (ἕψημα) and various kinds of bread were on offer, whilst the menu of Palestinian taverns consisted

solely of boiled beans seasoned with salt, and bread (Fig. 1).[8] These basic ingredients of the diet of the masses were occasionally accompanied by a pitcher of wine (Evagr. *Hist. Eccl.* IV, 34, 415: 8–10; Bidez and Parmentier 1898 eds: 184). The list of provisions sent in 614 by Patriarch John of Alexandria to Jerusalem to alleviate the sufferings of the population of the Holy City in the throes of a famine caused by its siege and capture by the Persians, is revealing: cereals, leguminous plants, wine and oil (*Vit. Anonym. Ioann.* 9: 18–23; Delehaye 1927 ed.: 23).[9] Let us now examine in greater detail the various components of the Byzantine diet.

Bread

Bread was central to the daily diet of the population of Roman and Byzantine Palestine, as of all the provinces of the Empire (Kaplan 1992: 28–30, 501–06). Superior quality bread (ἄρτος, ψωμίον) was made from fine wheat flour (*Triticum aestivus s.l.*). This bread was white and pure (ἄρτος καθαρός) and described as 'hot' (θερμός), for it was fresh (Cyr. Scyth. *Vit. Ioann. Hesych.* 211: 3–4; Festugière 1963 ed.: 23). The Mishnah differentiated between 'bread of pure flour' and 'bread of coarse meal' or *kibar* (from the Latin *panis cibarius*).[10] The flour of this coarse bread known as ἄρτος ῥυπαρός in Byzantine hagiographical texts, was of barley (*Hordeum vulgare L.*) or of wheat mixed with barley which had undergone minimum sifting. Since it contained only a

Fig. 1. Eating *ḥummōs* in a tavern in the Old City of Jerusalem, 1935. (Elia Photo Service, Jerusalem).

small amount of gluten, the dough could not rise well, so that the bread had an unappealing aspect and an unpleasant taste, and was indigestible. Bread of the poor and of the slaves in Greece and Rome, it continued to be considered of inferior quality in the Byzantine period and cost half the price of wheat bread, although the nutritional merits of both were identical.[11] Thus, when a Jewish couple separated, the Mishnah legislated that the husband had to provide his wife each week with no less than 2 *kab*s of wheat or four *kab*s of barley. The possible substitution of wheat by twice the amount of barley was allowed by R. Ishmael, only because he lived in the *Darōm* (a Southern belt of Jewish population) on the fringes of the desert where barley was more plentiful than wheat.[12]

Coarse, dry bread was frequently dipped by the Christians into water and eaten with a little salt (Regnault 1990: 81),[13] while the Jews dipped it into salty water (Babylonian Talmud, *Shabbat* 108b; Epstein 1935–1952 ed., *Seder Moʿed* II: 526) or soaked it in boiled wine (Babylonian Talmud, *Erubin* 29a; Epstein 1935–1952 ed., *Seder Moʿed* III: 201) so as to soften it. The monks of the *coenobion* of St Theodosius (Deir Dôsi) put out to dry in the sunshine the chunks of bread which had been left on the tables by the pilgrims who had celebrated the annual feast of the Mother of God and had been fed by the monks (Theod. Petr. *Vit. Theod.* 38: 12–22 – Usener 1890 ed.: 38; Festugière 1963 ed.: 123).[14] To this day in the Old City of Jerusalem, chunks of dry bread are sold cheaply by bakers.

Quality of bread depends on various factors: type of cereal, grain-grinding, flour-sifting, type of yeast, amount of water and salt, as well as baking.[15] Large, communal Pompeian mills (which when small were operated by hand or, when large by a donkey) have been discovered in several settlements, notably by our Golan Byzantine Expedition at Naʿarān (Fig. 2; Dauphin and Gibson 1991: 177). However, grain was ground and bread was baked usually at home. This is confirmed by the proportion of communal mills (18) against 174 cylindrical hand mills, Hopper mills – as at Er-Ramthāniyye in the Golan (Fig. 3; Gibson and Dauphin 1990: 41–42) – and querns. Bread ovens (*ṭabūnah*s in Arabic) have been found on fifty Byzantine archaeological sites in Palestine.[16] One of the most arduous tasks for Byzantine housewives was the grinding of grain with a hand-stone on a saddle quern which the Mishnah deemed to be one of the duties of a married woman: 'These are works which the wife must perform for her husband: grinding flour and baking bread and washing clothes and cooking food and giving suck to her child and making ready his bed and working in wool. If she brought him one maidservant, she need not grind or bake or wash; if two, she need not cook or give her child suck; if three, she need not make ready his bed or work in wool; if four, she may sit [all day] in a chair. R. Eliezer says: Even if she brought him in a hundred maidservants, he should compel her to work in wool, for idleness leads to unchastity' (Mishnah, *Ketubbot* 5: 5; Danby 1933 ed.: 252). Grinding grain on a saddle-quern is laborious and back-breaking.[17] Extracting as little as 0,8 kg of flour from 1 kg of wheat requires an hour's work. Since each individual consumed about 0,5 kg of wheat per day (Broshi 1986: 42), the rural housewife who had five or six children – the norm in Byzantine Palestine[18] – had

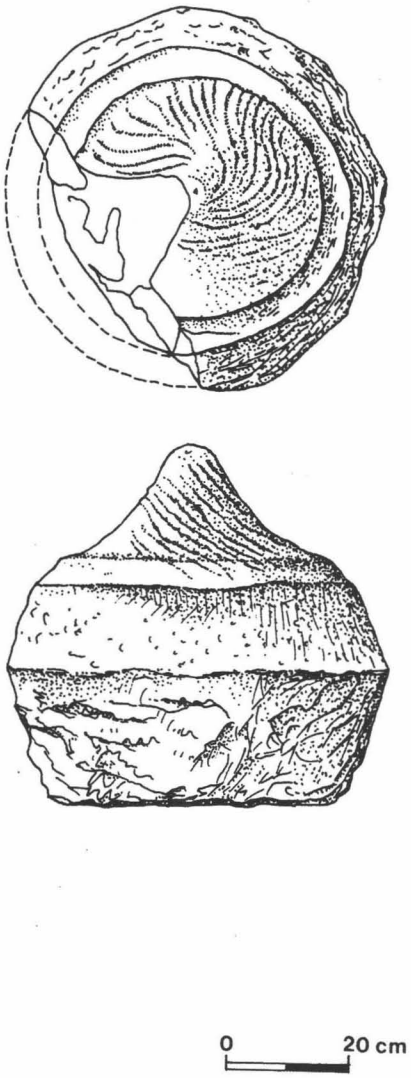

Fig. 2. Basalt cone of a Pompeian mill at Na'arān in the Central Golan. (Drawing S. Gibson).

to grind for some three hours in a row on a regular basis (for flour did not keep well in peasant attics as opposed to urban silos). This task had to be accomplished before dawn to allow for preparing and kneading the dough, and baking the bread before the husband set off for the fields (Avitsur 1876: 74). Home-made bread was very similar to so-called *pitṭa* bread which is still widely eaten in the Eastern Mediterranean (Fig. 4). Cereals were also, but more rarely, eaten as porridge (ἀθήρα), semolina flour being cooked in oil (Patlagean 1977: 39: 'l').

Fig. 3. Hopper mill at Er-Ramthāniyye in the Eastern Golan. (Photo C. Dauphin).

Fig. 4. Grocer's shop selling *piṭṭa* bread and marinated olives in the Old City of Jerusalem, 1935. (Elia Photo Service, Jerusalem).

Vegetables and Leguminous Plants

The gardens of Sebaste, Ascalon and Caesarea were famous, not for their flowers which were of no interest whatsoever to the rabbis nor to hagiographer monks, but for their vegetables.[19] According to Pliny (*Hist. Nat.* XIX, xxxii; André 1964 ed.: 61–2), Ascalon even lent its name to the shallot (*caepa Ascalonis*). In fact, the Jerusalem Talmud which was completed in the 5th century AD, forbade one to live in a city devoid of a municipal kitchen-garden.[20] The mosaic inscription of the late 6th or early 7th-century synagogue at Reḥob in the fertile Upper Jordan Valley,[21] listed agricultural produce which were 'forbidden' for consumption in the Sabbatical Year when, according to the Biblical injunction (Exod. 23: 11), fields had to lie fallow, and which had to be tithed in the six other years of the cycle: marrows, melons, cucumbers, parsnips, mint, Egyptian beans, leeks, seeds, dried figs, sesame, mustard, rice, cummin, dry lupine, large peas, garlic, village onions, onions, pressed dates, wine and oil (Sussman 1981: 152). Turnips, radishes, carrots and cauliflowers were also frequently mentioned in both Talmuds. R. Tarfon gave his disciples beetroots from his kitchen-garden to eat raw (Babylonian Talmud, *Nedarim* 49b; Epstein 1935–1952 ed., *Seder Nashim* V: 154). Likewise, the monks of Syria and Palestine set themselves apart from the rest of the population by eating green vegetables 'dry', that is raw (Evagr. *Hist. Eccl.* I, 21; Bidez and Parmentier 1898 eds: 29–30). For neither the city dwellers, nor the rural population, ever ate any food raw except at times of famine when they depended for food in part on charitable distributions. In normal circumstances, green vegetables, dried vegetables and lentils were eaten in various proportions, separately or together, but always cooked. Twenty leguminous plants are mentioned in talmudic literature, of which the majority are edible by humans, the others being animal fodder (Feliks 1967: 33–43, 154–5; 1982: 426, 429–30). A pail-ful of cooked lentils was invariably served at the table of R. Gamaliel, the compiler of the Mishnah, every day including Feast Days (Babylonian Talmud, *Beṣah* 14b; Epstein 1935–1952 ed., *Seder Mo'ed* VI: 71–2). On Sundays at Emesa in Syria, a merchant of φούσκα – a mixture of vinegar, hot water and eggs – also sold lupines and lentils simmering in cooking pots to those coming out of Mass. He also made a roaring trade in desserts, despite the competition of bakers who set up their stalls in the church square (Leont. Neap. *Vit. Sym. Sal.* XII, 146: 7–16; Festugière 1974 ed.: 80 and 133–4).

Wine

The Jewish Sages classified Palestinian wine into nine categories: red wine, white wine, clear wine, new wine, old wine, sweet wine, sour wine, bitter wine and cooked wine (Paul 1975; Dar 1986, i: 161–3). Wine from the district of Gaza – *vinum Gazetum*, *Gazetina*, *Gazetinum* – was famous and was exported to the West (Mayerson 1985; Glucker 1987: 88–9) in *amphorae* of characteristic shape and ware (Riley 1975: 27–30: Zevulun and Olenik 1979: 28*–29*).[22]

Most of the inhabitants of Byzantine Palestine drank wine from their own vines, the grapes of which were pressed locally (Figs 5 and 6). Drinking wine was part of each Feast, each wedding (Babylonian Talmud, *Qiddushin* 32b; Epstein 1935–1952 ed., *Seder Nashim* VIII: 157–8). Travellers drank wine *en*

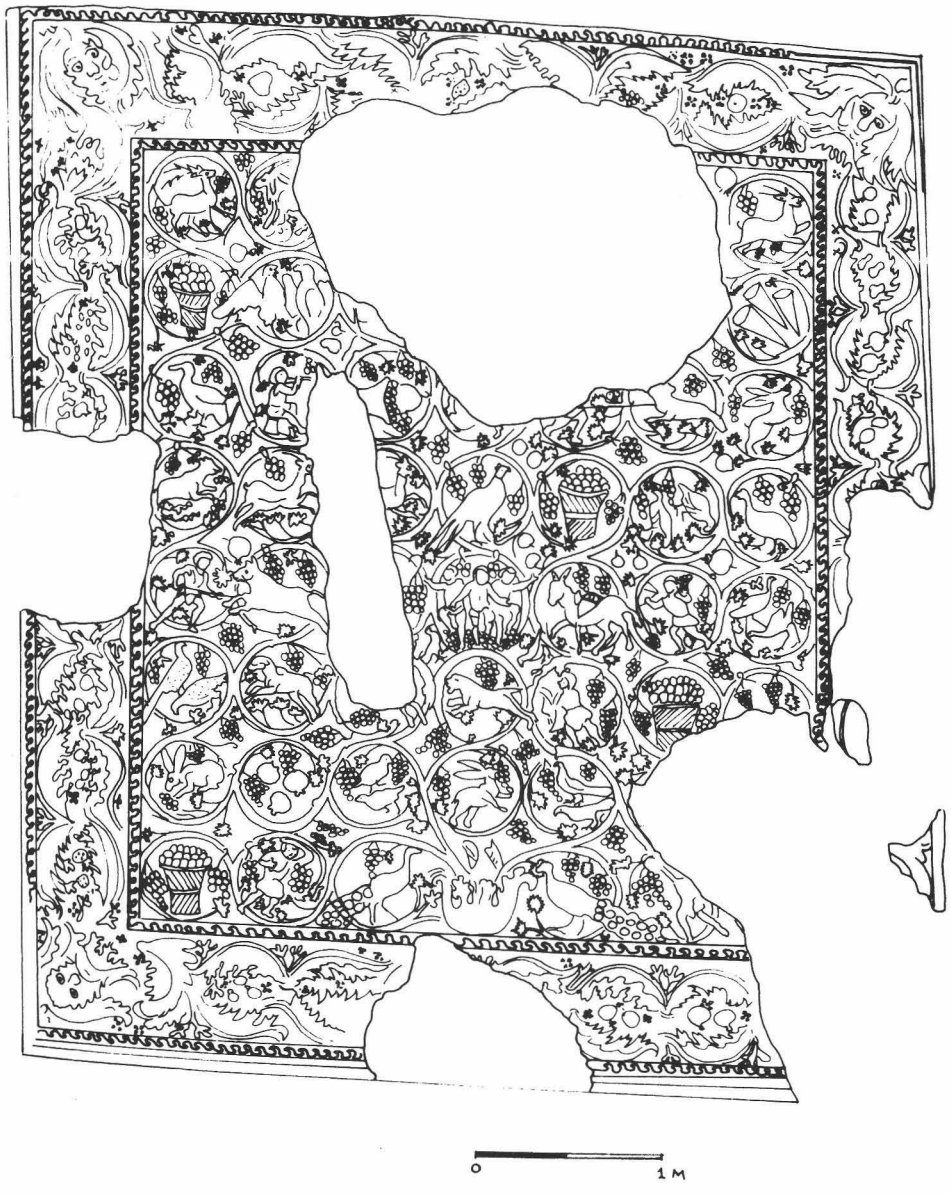

Fig. 5. Ḥammām Baysān pavement, *ca.* AD 530. (Drawing C. Dauphin).

Fig. 6. Treading grapes: detail of the central medallion of the inhabited vine scroll on the Ḥammām Baysān pavement. (Photo C. Dauphin).

route; thus, R. Gamaliel and his disciples as they walked from ʿAkko to Akhzib (Babylonian Talmud, *Erubin* 64 b; Epstein 1935–1952 ed., *Seder Moʿed*: 448–50). Occasionally they broke their journey in taverns. The policemen of Caesarea had great difficulty in enforcing the closing times of these busy establishments (Sperber 1971: 257–61).

Estimates of the daily consumption of wine by the average male Roman citizen range from 700 g to 1 litre, the latter being the daily ration received by every soldier as part of the *annona militaris* in Byzantine Egypt (Johnson and West 1979: 180–1, 226). Although wine was generally drunk diluted with either cold or hot water (Broshi 1984: 32), R. Hiyya b. Abba forbade women from drinking wine on the basis of Hos. 4: 11: 'Prostitution, new wine and old wine steal my people's wits'. The Tosephta remarked that 'the wives of the poor do not drink wine' (*Ketubbot* 5: 8; Neusner 1979 ed., *Nashim*: 76), except when suckling an infant (Fig. 7) since this required an enriched diet and the rabbis believed that *vin ordinaire* made maternal milk more nutritious (Mishnah, *Ketubbot* 5: 9 – Danby 1933 ed.: 253; Palestinian Talmud, *Ketubbot* 5: 11 – Schwabe 1878–1890 ed., VIII: 81).

Oil

The Old Testament closely associated the olive to the vine (2 Chr. 11: 11) and to wheat (Hos. 2: 8; 2: 22; Joel 2: 24). Although practically devoid of vitamins,

Fig. 7. Suckling: Beduin beggar woman and her child in the Old City of Jerusalem, 1930. (Elia Photo Service, Jerusalem).

oil is rich in calories (9,000 cal per kg). Consequently, the hermits of the Egyptian deserts never omitted to put at least a drop into their pittance (Regnault 1990: 87). The Holy Land was blessed with a great variety of olives. The *gluska* olives were marinated; the *shifqoni*, *beishani* and *agori* were pressed (Figs 8–10).[23]

Rare Delicacies

Fish and Meat

Traditionally served in Jewish homes on the Sabbath and on Feast Days (Babylonian Talmud, *Beṣah* 16b and *Shabbat* 119a; Epstein 1935–1952 ed., *Seder Mo'ed* VI: 84 and II: 586), fresh fish could only be consumed theoretically by the inhabitants of Byzantine Palestine who lived on the Mediterranean coast, at Aila-Aqaba on the Red Sea, on the shores of the Sea of Galilee and near rivers. Yet, a great quantity of fish-bones and of shell-fish, most of them from the Red Sea, were found in the excavations of Nessana in the Negev desert, thus confirming the evidence from the Nessana *papyri*. For instance, a letter dated to pre-605 discusses a cargo of sea fish whose weight had decreased between its departure (80 lbs) and its arrival (70 lbs) in Nessana (*Pap. Colt* 47; Kraemer 1958 ed.: 139–41). Other species were Mediterranean and two sweet water molluscs were Nilotic (Kraemer 1958 ed.: 66–9). These fish and shell-fish had presumably been brought from Gaza and Aila to Nessana in baskets on donkey-back (Glucker 1987: 95). Even though seaweed guaranteed a minimum of humidity and coolness, such a trade could only take place in the winter months.[24] Marinated and salted fish, as well as *garum*, are also mentioned in the Nessana accounts; they, too, must have been imported from Gaza.[25]

While meat was on the menu of all meals in the Patriarchal palace in Alexandria and was much consumed by the Byzantine army garrisoned in Palestine,[26] only wealthy civilians could afford to buy and eat meat on each Sabbath. The majority of the Jewish population ate meat only 'on the eve of the last Festival-day of the Feast [Tabernacles], on the eve of the first Festival-day of Passover, on the eve of the Feast of Pentecost, and on the eve of the New Year'. R. Yosi the Galilean added: 'On the eve of the Day of Atonement in Galilee', where it was customary to anticipate the Fast by sitting down to a copious meal (Mishnah, *Ḥullin* 5: 3; Danby 1933 ed.: 51).

The high price of meat was due throughout the Byzantine period in Palestine to the increase of husbandry at the expense of pasturage in order to feed a rapidly expanding population.[27] Pastureland was limited in any case, except in the Golan. Cattle produced work-power and milk, whereas sheep and goat provided milk, wool, hides and to a lesser degree meat.[28] Pork was much appreciated by the Christian population in the form of ham hanging in houses and of strings of sausages which were eaten dipped into mustard like frankfurters (Leont. Neap. *Vit. Sym. Sal.* XXX: 160, 24–161, 3; Festugière 1974 ed.: 94–5 and 147).

Fruit

The list of produce which a husband had to provide weekly for his estranged wife included a *kab* ($\frac{1}{8}$th lb) of dried figs or a *mina* (250 g) of fig-cake, or at the very least a similar quantity of another dried fruit (Mishnah, *Ketubbot* 5: 8;

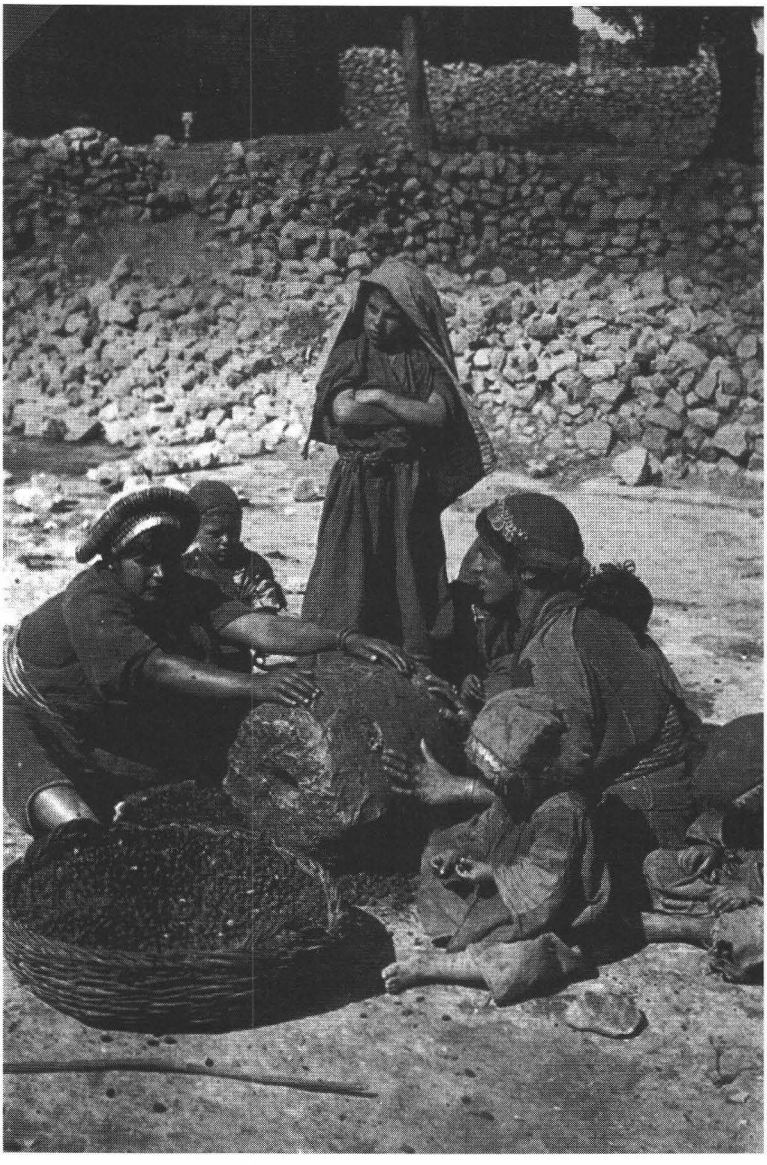

Fig. 8. Pressing olives with a stone roller in a Palestinian village.

Danby 1933 ed.: 252).[29] Figs were, of course, one of the Seven Biblical Species together with dates, grapes, pomegranates and olives (Deut. 8: 8).

Rich in protein and in Vitamins A, B and B2, dates were eaten fresh, dried or pressed (Sussman 1981: 152), both by the sedentary population and by the Beduin. In times of plenty, the Saracen 'Barbarians' who nomadized in the sixth

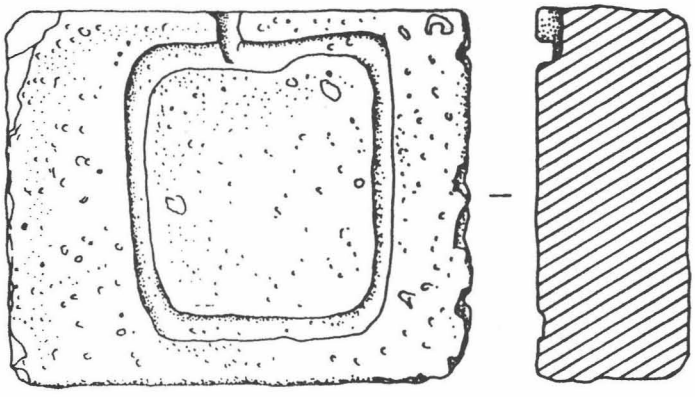

Fig. 9. Small manual oil-press (Hebrew, *bodeda*) at Farj in the Eastern Golan (Drawing S. Gibson).

Fig. 10. Pressing out oil in the Judaean Hills, 1935. (Elia Photo Service, Jerusalem).

century in the Ruba desert lived off bread, cheese and dates (Cyr. Scyth. *Vit. Sab.* 96: 13–19 and 99: 1–5; Festugière 1962b ed.: 24 and 26). Flour, moreover, may be extracted from datestones which have been dried and crushed, as well as from the dates themselves, dried and ground. This extremely nutritious flour may be mixed with barley flour in order to bake typical Beduin 'desert bread' (Fig. 11; Dembinska 1985: 435).

The price of one (or two) bunches of grapes was also that of one (or two) pomegranates or one (or two) melons: 8 *perutahs*.[30] For the same price, one could also buy three, four, five or ten figs depending on the seller and on market fluctuations (Mishnah, *Ma'aserot* 2: 5–6; Danby 1933 ed.: 69).

Cakes and Sweets

The small honey cakes (ἴτρια) mentioned in a late seventh century *papyrus* from the city and garrison of Nessana in the Negev desert (*P. Colt* 85-[D]; Kraemer 1958 ed.: 246) were probably very similar to the biscuits of flour, oil and honey which R. Aqiba baked for Passover (Babylonian Talmud, *Pesaḥim* 36a; Epstein 1935–1952 ed., *Seder Mo'ed* IV: 167). The inhabitants of Byzantine Palestine, however, did not indulge excessively in sweets. Caries were not frequent; and when detected, as on some of the teeth of the Rehovot skeletons, surprisingly they had not been treated (Hershkovitz, Ring, Rak and Arensburg 1988: 203), although filling of teeth had been practised since Hellenistic times (Zias 1991: 157; Zias and Numeroff 1986: 66–7).

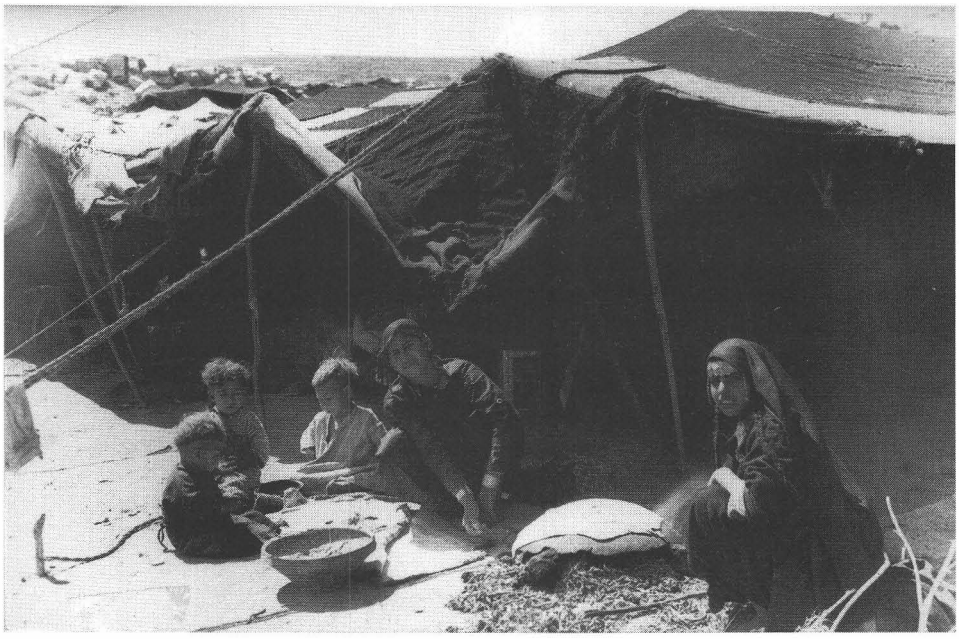

Fig. 11: Baking bread in Beduin encampment, Palestine 1930. From r. to l.: flattened dough spread on a metal baking tray resting over hot embers and ashes; a very large, circular *piṭṭa* which has been partly folded over; in the foreground, a mortar. (Elia Photo Service, Jerusalem).

Plenty or just enough?

Examined individually, the various components of the Byzantine diet in Palestine appear healthy. Baked at nearly 200°C, bread is nearly free from germs. Its starches and complex glucides are slowly absorbed by the intestine, and transit is facilitated by the long fibres of bread. Although it contains very few lipids (1–1.5%), it supplies the body with Group B vitamins and minerals, especially calcium and magnesium (Leynaud-Rouand 1991). One kilogram of bread is approximately equivalent to 2,800 calories, which is the minimum intake necessary for a worker in a pre-industrial economy, the normal intake being between 3,500 and 4,000 calories (Delort 1986: 97–8). These, however, should be provided in a balanced way by proteins, lipids and glucides. Moreover, proteins from cereals play an important role in optimizing proteins with a high nutritional value derived from leguminous plants (Guggenheim 1978: 75–6, 284–5).

Calculating the relative proportions of ingredients within the Byzantine diet

In order to assess the nutritional value of the diet of the Byzantine urban and rural masses of Palestine, it is fundamental to determine the proportions in which the various ingredients were absorbed. At the onset of his stay in the monastery of Seridos near Gaza, Dositheus – a military page who had embraced monasticism –, ate a loaf and a half of 4 lb-bread, thus altogether 6 lbs or 1.962 kg × 3.5 cal/g = 6.867 cal, which he progressively reduced to 163 g × 3.5 cal/g = 570 cal (Doroth. Gaz. *Vit. Dos.* § 4–5; Regnault 1966 ed.: 250–1).[31] The amount of bread consumed daily by a Byzantine Egyptian appears to have been even larger. St Macarius the Egyptian asked a woman driven to desperation by her son who was possessed by the Devil and who consistently threw up his daily bread and water: 'What do you wish him to eat?'. She replied: 'Ten pounds of bread'. The hagiographer-monk Palladius comments: 'That was a lot'. Finally, Macarius healed the young man but established 3 lbs as his daily ration of bread and compelled him to work (Pallad. *Hist. Laus.* 17 – Butler 1898–1904 ed.: 47; Leloir 1981 ed.: 65). The Egyptian peasant (*fallāḥ*) eats on average ten *piṭṭa*s per day, which approximately weigh 5 lbs (Ayrouth 1952: 124), this being only slightly inferior to Dositheus' initial consumption of bread.

The Rabbinic sources contain important evidence for the assessment of relative quantities of various foods. Broshi (1986: 41–2) has calculated the amounts in litres, kgs and calories of the four produce which a husband was under the obligation to give his estranged wife each week: two *kab*s of wheat, hence 2.854 l or 2.037 kg, worth 6,111 cal; half a *kab* of vegetables, thus 0.713 l or 0.597 kg, equivalent to 2,035 cal; half a *log* of oil, hence 0.178 l or 0.162 kg, thus 1,458 cal; finally, a *kab* of dried figs, hence 1.427 l or 0.713 kg or 2,9992 cal. The total comes to 11,244 calories for a six-day week, thus 1,874 calories per day.[32] According to the Food and Agriculture Organization (FAO) of the United Nations, the minimum calory intake necessary for a woman of child-bearing age

varies between 2,090 and 2,220 calories. From menopause onwards, the intake may be reduced and oscillates between 1,540 and 1,980 calories. The diet advocated by the rabbis was thus akin to the dietetical recommendations of the FAO.

The Mishnah differentiated between the simple weekday fare and a richer, more varied fare eaten on the Sabbath (*Erubin* 8: 2; Danby 1933 ed.: 132). By forcing the estranged couple to eat the Friday (or Sabbath eve) meal together, the rabbis were making sure that the wife enjoyed at least one copious and nutritious meal per week. The husband, moreover, was supposed to give his wife a *ma'ah* each week for her petty expenses.[33] If he did not, then she could keep her earnings from her spinning work for herself (whereas in normal circumstances she would have handed them to her husband, whether estranged or not). In this way, her diet could be increased thanks to her husband's *ma'ah* or to her own work. The calory balance of her diet appears normal, but with a tendency to be on the low side. In reality, it was precarious.

Malnutrition and Iron-depletion

The effects of Malnutrition

Malnutrition lay in wait for all those who lived just above the poverty line. St Symeon Salos brought cooked foods, bread and a pitcher of wine to a prostitute who, lacking clients and thus money, had not tasted anything other than water for three days (Evagr., *Hist. Eccl.* IV, 34; Bidez and Parmentier 1898 eds: 184, 6–13). Poverty and hunger compelled a Christian Arab woman to offer herself to Sissinius the hermit who dwelled in a cave near the River Jordan (Joh. Mosch., *Prat. Spir.* 136 – *PG* 87.3: col. 3000; Rouët de Journel 1946 ed.: 187–8), and some rabbis were forced to borrow in order to feed themselves (Babylonian Talmud, *Ḥullin* 84a; Epstein 1935-1952 ed., *Seder Ḳodashim* IV: 472).

R. Gamaliel suffered from scurvy for seven years (Babylonian Talmud, *Baba Meṣia* 85a; Epstein 1935–1952 ed., *Seder Neziḳin* II: 486), which is symptomatic of a chronic deficiency in Vitamin C (Manson-Bahr and Apted 1982: 527). Judging from their diet, most of his contemporaries and their descendants must have been also affected by it. Since the population of Byzantine Palestine absorbed a large quantity of bread, it could not have lacked in Vitamin B1 which cereals contain, but would certainly have lacked in Vitamin B6 which is found in meat, green vegetables and fruit, and in Vitamin C which is plentiful in fruit and fresh vegetables, but of which far too little was eaten, if at all.

Iron-depletion

'The chief necessities of human life are water, fire, iron and salt, flour, honey and milk, the juice of the grape, oil, and clothing' (Eccles. 39: 26). Salt plays a paramount role in the composition, the pressure and the balance of body liquids,

as well as it regulates blood pressure. It is significant that it should have been coupled with iron which is found in meat, especially in liver and in kidneys, in fish, beans, green vegetables, mushrooms, raisins, prunes and oats. Consisting mainly of bread and of a *companaticum* (or broth) cooked in a cauldron, the predominantly vegetarian diet of the urban and rural masses of Byzantine Palestine was deficient in iron as well as in proteins.

The body, moreover, is able to absorb only a fraction of the iron which is available in foods, the quantities absorbed varying according to the types of food. The amount of iron which the body extracts from cereals and vegetables in general is considerably inferior to that derived from liver, muscles and ferrous salts. The percentage of iron-absorption is different for each individual, the medium rate being 6,9% for adults and 9,3% for children. A person suffering from acute iron deficiency may absorb up to 20% (and sometimes more) of the iron contained in foods. In the diet of the masses of Byzantine Palestine, iron was provided mainly by cereals and vegetables. The amount of iron absorbed was therefore relatively small. From the limited range of ingredients of the Early Mediaeval diet which is similar to the diet under examination here, Bullough and Campbell (1980: 321) have inferred iron-deficiency and an abnormally low daily absorption rate which would not have exceeded 0,25–0,75 mg. The World Health Organization has estimated that the minimum modern daily intake of iron is 10 mg, the average intake varying between 10 and 30 mg. Bullough and Campbell are of the opinion that the diet of Late Antiquity and of the Early Middle Ages provided at most 10 mg of iron, but probably less. The average absorption rate of iron from cereals is 4.5%, but may reach up to 7.8% in the case of anaemic individuals. Thus, the daily absorption rate for 10 mg would have oscillated between 0,45 and 0,78 mg. If the diet provided 4 or 5 mg of iron per day, as they believe, the daily absorption rate would have been between 0.25 and 0.75 mg. This would not have been sufficient a rate for men for whom iron derived from food must replace between 0.5 and 1 mg which are lost each day in urine, *faeces* and sweat. As regards women, an identical requirement is compounded by iron lost in menstruation. Hence a daily intake of 1 to 2 mg of iron is necessary as sheer replacement of lost iron. Consequently, women between *menarche* and menopause require at least twice more iron than men. If the diet of Late Antiquity barely covered the needs in iron of men, then women must have been seriously anaemic, this ultimately endangering population renewal. An essential clue for the demographic decline of Palestine which started a century before its fall to the Arabs, iron depletion-induced anaemia taken to its logical conclusion is a prime marker for studying the long-term effects of diet on demography, as we have recently fully demonstrated (Dauphin 1998, II: 505–18).

Notes

1 This is a variant of Deut. 7: 13; and, 'From their fruits, corn, wine and oil, they were made more prosperous' – Ps. 4: 8 as interpreted by the Septuagint.

2 Marcus Cato, *De Re Rustica*, and Marcus Terentius Varro, *De Re Rustica* (Hooper

and Ash 1979 eds); Lucius Junius Moderatus Columella, *De Re Rustica. De Arboribus* (Ash 1977 ed.; Forster and Heffner 1968 eds; 1979 eds); and, Palladius, *De Re Rustica* (Martin 1976 ed.). See also, White 1970: 173–89 on cereals, 224–6 on arboriculture, 189–91 and 199–203 on fodder, and 272–88 on animal husbandry. On flotation technique, see French 1971; and, Weaver 1971. Palaeobotanical analysis was undertaken by Dr M. Kislev of Bar-Ilan University, Israel.

3 On the North Church at Rehovot (geog. coord. 108.048) in the Negev, see Tsafrir 1988 ed.

4 The Greek text of the *Life of St Euthymius*, the *Life of St Sabas*, the *Life of St John the Hesychast* and the *Life of St Kyriakos* by Cyril of Scythopolis was edited by Schwartz (1939).

5 On the Great Laura or Deir Mâr Sâbâ (geog. coord. 1815.1236) in the Judaean Desert, see Hirschfeld 1990: 31–2, No. 16; and, Dauphin 1998, III: Feuilles 11–12 (Jerusalem), No. 242.

6 On the *Coenobion* of Theoctistus (geog. coord. 1859.1318) at Deir Muḳallik, see Hirschfeld 1990: 12–13, No. 4; and, Dauphin 1998, III: Feuilles 11–12 (Jerusalem), No. 143. On the Laura of Euthymius at Khân el Ahmar (geog. coord. 182.133), Hirschfeld 1990: 15–18, No. 6; and, Dauphin 1998, III: Feuilles 11–12 (Jerusalem), No. 131.

7 In the Tannaitic and early Amoraic periods (first and second centuries AD), one *maneh* was worth one hundred *dinar*s or *denarii*. From the third century, the value of the *maneh* dropped to one *denarius* (Sperber 1966: 200–03). A *litra* (from the Greek λήτρα) was a 12 ounce-pound (Whitting 1973: 294).

8 For Syria, Evagr. *Hist Eccl.* IV: 34 (Bidez and Parmentier 1898 eds: 184). For Palestine, Babylonian Talmud, *Erubin* 53b (Epstein 1935–1952 ed., *Seder Mo'ed* III: 373).

9 See also, Leont. Neap. *Vit. Ioann. Cypr.* XVIII: 15–17 (Festugière 1974 ed.: 366 and 468).

10 Mishnah, *Makkot* 2: 8 (Danby 1933 ed.: 760). Krauss (1910–1912, I: 92–106) has listed the various kinds of bread mentioned in the Rabbinic sources.

11 See notably, Heichelheim 1938: 129; White 1976: 147 and 167–8. Also, Libanius, *Oratio* XI: 21 and 23 (Foerster 1906 ed.: 443–4); Babylonian Talmud, *Shabbat* 140b (Epstein 1935–1952 ed., *Seder Mo'ed* II: 710) and *Mo'ed Qatan* 28a (Epstein 1935–1952 ed., *Seder Mo'ed* VIII: 183).

12 Mishnah, *Ketubbot* 5: 8 (Danby 1933 ed.: 252). One *kab* was worth 4 *log*s or 8 *litra*s, hence $\frac{1}{8}$th of a pound (Danby 1933 ed.: 798).

13 It was then called Βρεκτός (Patlagean 1977: 42, 1b.f.).

14 On the monastery of St Theodosius (or Deir Dôsi) at Deir Ibn 'Ubeid (geog. coord. 1759.1255), see Hirschfeld 1990: 26–8, No. 14; and, Dauphin 1998, III: Feuilles 11–12 (Jerusalem), No. 214.

15 The various stages of bread-production, as described by Grégoire 1999 (*infra*, pp. 21–31), are also applicable to Byzantine Palestine.

16 On agriculture and the processing of olive, grape and wheat at Na'arān (geog. coord. 2147.2706) and Er-Ramthāniyye (geog. coord. 2256.2696), see Gibson and Dauphin 1990; and, Dauphin and Gibson 1992–3: 14–16 and 25–28. For communal mills, see Dauphin 1998, III: Feuille 1 (Nahariya), site No. 29; Feuille 2 (Zefat), No. 92; Feuille 3 (Haifa), No. 97; Feuille 4 (Teverya), Nos 7, 12, 39, 50, 150, 157 and 205; Feuille 6 (Bet She'an), Nos 48 and 68; Feuille 9 (Yeriḥo), Nos 46, 52 and 53; Feuille 10 (Ashqelon), No. 314; and, Feuilles 11–12 (Jerusalem), No. 262.

For cylindrical hand mills, see Dauphin 1998, III: Feuille 1 (Nahariya), sites Nos 2, 29, 42, 59 and 60; Feuille 2 (Zefat), Nos 22, 66 and 114; Feuille 3 (Haifa), Nos 17, 42, 63, 95, 97, 112, 125, 133, 141, 170, 181, 195, 197, 201, 202, 204, 225, 274, 308, 313, 334, 340 and 352; Feuille 4 (Teverya), Nos 1, 7, 19, 22, 25, 37, 39, 43, 88, 91, 100, 102, 103, 120, 144, 147, 157, 199, 205 and 218; Feuille 5 (Netanya), Nos 2, 13, 29, 34, 35,

45, 50, 55, 60, 78, 137, 149, 168, 172, 177, 178, 183, 186, 189, 194, 198, 223, 242, 243, 247, 250, 262, 265, 266, 272, 288 and 296; Feuille 6 (Bet She'an), Nos 10, 12, 104, 114, 127, 134, 147 and 183; Feuilles 7–8 (Tel Aviv), Nos 4, 47, 51, 54, 55, 61, 77, 78, 93, 94, 101, 115, 140, 156, 161, 171, 190, 193, 194, 200, 204, 207, 209, 230, 235, 262, 274, 276, 316, 344, 359, 380, 388, 389 and 432; Feuille 9 (Yeriḥo), No. 41; Feuille 10 (Ashqelon), Nos 1, 13, 110, 204, 205, 219, 314 and 315; Feuilles 11–12 (Jerusalem), Nos 6, 25, 27, 62, 133, 149, 155, 159, 184, 186, 192, 199, 208, 249, 252, 261, 262, 263, 265, 275, 276, 289, 295, 319, 331, 335, 406 and 463; Feuilles 15–16 (Arad), Nos 24, 27, 30, 34, 38, 49, 62, 96 and 97; Feuilles 19–20 (Dimona), Nos 5 and 18.

For Byzantine bread ovens, see Dauphin 1998, III: Feuille 1 (Nahariya), Nos 59 and 67; Feuille 2 (Zefat), Nos 17 and 65; Feuille 3 (Haifa), No. 33; Feuille 4 (Teverya), Nos 37, 74 and 137; Feuille 5 (Netanya), Nos 57 and 188; Feuille 6 (Bet She'an), Nos 52, 71, 83, 100, 134 and 184; Feuilles 7–8 (Tel Aviv), Nos 34, 144 and 392; Feuille 9 (Yeriḥo), Nos 71 and 79; Feuilles 11–12 (Jerusalem), Nos 52, 191, 240, 249, 266, 289, 313, 322, 340, 429, 430, 432, 456, 461 and 473; Feuille 13 (Yammit), No. 34; Feuille 14 (Beer Sheva), Nos 24 and 34; Feuilles 15–16 (Arad), Nos 16, 93, 97 and 98; Feuille 18 (Sede Boqer), Nos 1 and 68; and, Feuilles 19–20 (Dimona), No. 5.

17 Grinding is described in detail by Grégoire 1999 (*infra*, pp. 22–29).

18 On the standard family size in Byzantine Palestine, see Dauphin 1998, II: 396–9.

19 On the gardens of Sebaste, see Mishnah, *Arakhin* 3: 2 (Danby 1933 ed.: 546); on those of Ashqelon, Tosephta, *Shebia'it* 4: 1 (Neusner and Sarason 1986 eds, *Zera'im*: 222) and Palestinian Talmud, *Shebi'it* 6: 1 (Schwab 1878–1890 ed., II: 375); on those of Caesarea, Porat 1975.

20 Notably, Palestinian Talmud, *Qiddushin* 4: 14 (Schwab 1878–1890 ed., IX: 290) and Babylonian Talmud, *Nedarim* 49b (Epstein 1935–1952 ed., *Seder Nashim* V: 154).

21 On the Reḥob synagogue (geog. coord. 1966.2077), Vitto 1981; and, Dauphin 1998, III: Feuille 6 (Bet She'an), No. 85.

22 See also, Kingsley 1994–5.

23 On *gluska* olives, Mishnah, *'Abodah Zarah* 2: 7 (Danby 1933 ed.: 439–40). The Tosephta brought to the attention of parsimonious housewives the inexpensiveness of this particular type of olive (Tosephta, *Demai* 5: 11 – Neusner and Sarason 1986 eds, *Zera'im*: 105). On *shifqoni*, *beishani* and *agori* olives, Mishnah, *Peah* 7: 1 (Danby 1933 ed. 17–18) and *Kelim* 17: 8 (Danby 1933 ed.: 629), and Palestinian Talmud, *Bikkurim* 1: 3 (Schwab 1878–1890 ed., III: 360–1). On the olive-tree and the olive, Goor and Nurock 1968: 89–120. On the pressing of olives and oil-production, Amouretti 1986: 156–81; and, more particularly in Byzantine Palestine, Dar 1986, i: 165–90; and, Frankel 1992; 1994.

24 Similarly, between the 17th and the late 19th century, Channel herring was ferried from Dieppe to Paris in horse-drawn carts which broke the journey, inland, at Beaumont-le-Hareng, both to feed the horses and to water the seaweed which kept the precious cargo fresh (*Femme Actuelle* No. 761, 26 avril–2 mai 1999: 109).

25 On marinated fish, *P. Colt* 85–(C) which is dated to the end of the 7th century (Kraemer 1958 ed.: 245–7); on salted fish, *P. Colt* 47 which is pre-AD 605 (Kraemer 1958 ed.: 140–1). *Garum* sauce was obtained from chunks of decomposing fish mixed with herbs and salt which had macerated in water containing olive oil, wine or vinegar (André 1961 ed.: 198–200; Jackson 1988: 36). A speciality of Magdala (also called Taricheae) on the western shore of the Sea of Galilee (geog. coord. 1986.2478; Dauphin 1998, III: Feuille 4 [Teverya], No. 75), it was also imported into Palestine (see *P. Colt* 87, dated to the 7th century: Kraemer 1958 ed.: 259).

26 The diet of the garrison of the small late 4th–late 6th century fort at Zoḥar Illit (geog. coord. 1730.0715) on the western *Limes*, consisted primarily of meat (mainly sheep and goat, but also pork and beef), and to a lesser degree of fowl, fish, hare and gazelle (Harper 1986: 336).

27 Sperber (1965: 253) quotes the price of meat between 290 and the beginning of the 4th century as well as of cattle between the 1st century and the second half of the 4th century (p. 254), and compares the price of meat to those of bread and wine (pp. 261–2). On 4th–century prices, see Sperber 1968: 246–9. On the demographic boom between the mid–4th and late 5th century in Palestine, see Dauphin 1998, I, Ch. IV.

28 Wool is mentioned at Nessana, notably in *P. Colt* 89 dated to the late 6th or early 7th century (Kraemer 1958 ed.: 256–8).

29 One *mina* equalled 160 *zuzs*. Since one *zuz* weighed 3,5 gr, one *mina* would have weighed 250 gr (Danby 1933 ed.: 798).

30 The *perutah* was the smallest bronze coin (Danby 1933 ed.: 797).

31 For an evaluation of the calory-value of bread, see Kaplan 1992: 26–7, n. 13.

32 Mishnah, *Ketubbot* 5: 8–9 (Danby 1933 ed.: 252–3); Tosephta, *Ketubbot* 5: 8–9 (Neusner 1979 ed., *Nashim*: 75–6); Palestinian Talmud, *Ketubbot* 5: 11 (9), (10) and 11 (Schwab 1878–1890 ed., VIII: 80–2); and, Babylonian Talmud, *Ketubbot* 64b (Epstein 1935–1952 ed., *Seder Nashim* III: 387–91). There is no consensus regarding the values to be attributed to Talmudic weights and measures. We have chosen Broshi's Table B (1986: 41) which is based on the system according to which one *se'ah* equalled 8.565 litres, as suggested by Feliks (1967: 185–6).

33 The *ma'ah* was the smallest silver coin (Danby 1933 ed.: 797).

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Bibliography

Amouretti, M.-C., (1986). *Le pain et l'huile dans la Grèce antique. De l'araire au moulin* (Paris).

André, J., (1961). *L'alimentation et la cuisine à Rome* (Paris).
André, J. ed., (1964). *Pline l'Ancien. Histoire Naturelle – Livre XIX* (Paris).
Ash, H. B. ed., (1977). *Lucius Junius Moderatus Columella. On Agriculture.* I. *Res Rustica I–IV* (Cambridge, Mass. – London).
Ashburner, W. ed., (1910). 'The Farmer's Law', *Journal of Hellenic Studies* 30: 85–108.
Avitsur, S., (1976). *Man and His Work. Historical Atlas of Tools and Workshops in the Holy Land* (Jerusalem) – Hebrew.
Ayrouth, H., (1952). *Fellahs d'Egypte* (Le Caire).
Baras, Z. *et alii* eds, (1992). *Eretz Israel from the Destruction of the Second Temple to the Muslim Conquest* (Jerusalem) – Hebrew.
Bidez, J. and Parmentier, L. eds, (1898). *The Ecclesiastical History of Evagrius with the Scholia*, (London).
Broshi, M., (1984). 'Wine in Ancient Palestine – Introductory Notes', *The Israel Museum Journal* III: 21–40.
Broshi, M., (1986). 'The Diet of Palestine in the Roman Period – Introductory Notes', *The Israel Museum Journal* V: 41–56.
Bullough, V. and Campbell, C., (1980). 'Female Longevity and Diet in the Middle Ages', *Speculum* 55: 317–25.
Butler, C., (1898–1904 ed.). *The Lausiac History of Palladius* (Cambridge).
Carter, C. O. and Evans, K., (1973). 'Spina bifida and anencephalus in Greater London', *Journal of Medical Genetics* 73,10: 209–34.
Cato, *De Re Rustica*, eds Hooper, W. D. and Ash, H. B., 1979.
Columella, *De Re Rustica*, I–IV (ed. Ash, H. B., 1977), V–IX (eds Forster, E. S. and Heffner, E. H., 1968), X–XII (eds Forster, E. S. and Heffner, E. H., 1979).
Crubézy, E., (1988). *Interactions entre facteurs bio-culturels, pathologiques et caractères discrets. Exemple d'une population médiévale, Canac (Aveyron)*, Thèse de Médecine, Université de Montpellier–I.
Cyril of Scythopolis, *Vita Euthemii*; *Vita Sabae*; *Vita Ioanni Hesychasti*; *Vita Cyriaci*; *Vita Theodosii*, ed. Schwartz, E., 1939.
Danby, H. ed., (1933). *The Mishnah* (Oxford–London).
Dar, S., (1986). *Landscape and Pattern. An Archaeological Survey of Samaria 800 B.C.E. – 636 C.E.*, Vols (i) and (ii), BAR International Series 308 (1) and (ii) (Oxford).
Dauphin, C., (1993). 'A Byzantine ecclesiastical farm at Shelomi', in Tsafrir Y. 1993 ed.: 43–8.
Dauphin, C., (1998). *La Palestine byzantine: Peuplement et Populations*, Vols I–III. BAR International Series S726 (Oxford).
Dauphin, C. and Gibson, S., (1991). 'Golan Survey, 1988', *IEJ* 41: 76–9.
Dauphin, C. and Gibson, S., (1992–3). 'Ancient Settlements in their Landscapes: the Results of Ten Years of Survey on the Golan Heights (1978–1988)', *BAIAS* 12: 7–31.
Delehaye, H. ed., (1927). 'Une Vie inédite de Saint Jean l'Aumonier', *Analecta Bollandiana* 45: 5–74.
Delort, R., (1986). 'L'aliment-roi: le pain', *L'Histoire* No. 85: 96–102.
Dembinska, M., (1985). 'Diet: A Comparison of food consumption between some Eastern and Western monasteries in the 4th–12th centuries', *Byzantion* 55: 431–62.
Devos, P., (1986). 'Règles et pratiques alimentaires selon les textes. Le salut par l'ascèse?', in *Le Site monastique Copte des Kellia. Actes du Colloque de Genève*: 73–83.
Dorotheus Gazae, *Vita Dosithei*, ed. Regnault, L., 1966.
Epstein, I. ed., (1935–1962). *The Babylonian Talmud* (London).
Evagrius Scholasticus, *Historia Ecclesiastica*, eds Bidez, J. and Parmentier, L., 1898.
Evans, J.K., (1980). 'Plebs Rustica II', *American Journal of Ancient History* 5: 134–73.
Feliks, Y., (1967). *Mixed Sowing, Breeding and Grafting* (Tel Aviv) – Hebrew.
Feliks, Y., (1982). 'Jewish Agriculture in the Period of the Mishnah and Talmud', in Baras, Z. *et alii* eds (Jerusalem): 419–41 – Hebrew.

Ferembach, D., (1963). 'Frequency of spina bifida occulta in prehistoric human skeletons', *Nature* 199: 100–1.
Festugière, A.-J. ed., (1962a). *Les Moines d'Orient.* III/1. *Les Moines de Palestine. Cyrille de Scythopolis: Vie de Saint Euthyme* (Paris).
Festugière, A.-J. ed., (1962b). *Les Moines d'Orient.* III/2. *Les Moines de Palestine. Cyrille de Scythopolis: Vie de Saint Sabas* (Paris).
Festugiêe, A.-J. ed., (1963). *Les Moines d'Orient.* III/3. *Les Moines de Palestine. Cyrille de Scythopolis: Vie de Saints Jean l'Hésychaste, Kyriakos, Théodose, Théognios, Abraamios. Théodore de Pétra: Vie de Saint Théodose* (Paris).
Festugière, A.-J. ed., (1974). *Léontios de Néapolis. Vie de Syméon le Fou et Vie de Jean de Chypre* (Beyrouth).
Foerster, R. ed., (1906). *Libanii Opera* (Lipsiae).
Forster, E. S. and Heffner, E. H. eds, (1968). *Lucius Junius Moderatus Columella.* III. *On Agriculture and Trees. Res Rustica X–XII. De Arboribus* (Cambridge, Mass. – London).
Forster, E. S. and Heffner, E. H. eds, (1979). *Lucius Junius Moderatus Columella.* II. *On Agriculture. Res Rustica V–IX* (Cambridge, Mass. – London).
Frankel, R., (1984). *The History of the Processing of Wine and Oil in Galilee in the Period of the Bible, the Mishna and the Talmud*, Parts I and II, Ph.D. thesis, Tel-Aviv University (Hebrew).
Frankel, R., (1992). 'Some Oil Presses from Western Galilee', *BASOR* 286: 39–71.
French, D. H., (1971). 'An Experiment in Water-Sieving', *Anatolian Studies* XXI: 59–64.
Geyer, P. ed., (1965). Antoninus Placentinus, *Itinerarium*, Corpus Christianorum Series Latina 175 (Turnholt): 127–74.
Gibson, S. and Dauphin, C., (1990). 'Landscape Archaeology at Er-Ramthaniyye in the Golan Heights', in Fiches, J.-L. and Van Der Leuw, S. E. eds, *Archéologie et Espaces. Actes des X^e Rencontres Internationales d'Archéologie et d'Histoire d'Antibes* (Juan-les-Pins): 35–45.
Glucker, C. A. M., (1987). *The City of Gaza in the Roman and Byzantine Periods*, BAR International Series 325 (Oxford).
Goor, A. and Nurock, M., (1968). *The Fruits of the Holy Land* (Jerusalem–London–New York).
Grégoire, J.-P., (1999). 'Major Units for the Transformation of Grain: The Grain-Grinding-Households (e_2-ḪAR.ḪAR) of Southern Mesopotamia at the end of the III^rd^ millenium before the Common Era', *BAIAS* 17: 7–38.
Guggenheim, J. K., (1978). *Human Nutrition* (Jerusalem) – Hebrew.
Harper, R. P., (1986). 'Upper Zohar: A Preliminary Excavation Report', in Freedman, Ph. and Kennedy, D. eds, *The Defence of the Roman and Byzantine East. Proceedings of a colloquium held at the University of Sheffield in April 1986*, British Institute of Archaeology at Ankara Monograph No. 8, BAR International Series 297 (Oxford): 329–36.
Heichelheim, F. M., (1938). 'Roman Syria', in Frank, T. ed., *An Economic Survey of Ancient Rome* (Baltimore): 123–257.
Hengen, O. P., (1971). '*Cribra orbitalia* pathogenesis and probable etiology', *Homo* 22: 57–75.
Hershkovitz, I, Ring, B, Rak, Y. and Arensburg, B., (1988). 'Skeletal Remains from the Northern Church', in Tsafrir, Y. ed., *Excavations at Rehovot-in-the-Negev.* Vol.I. *The Northern Church*: 193–209.
Hirschfeld, Y., (1990). 'List of Byzantine Monasteries in the Judean Desert', in Bottini, G. C., Di Segni, L. and Alliata, E. eds, *Christian Archaeology in the Holy Land. New Discoveries. Archaeological Essays in Honour of Virgilio C. Corbo, OFM*, SBF Collectio Maior 36 (Jerusalem): 1–90.

Hooper, W. D. and Ash, H. B. eds, (1979). *Marcus Porcius Cato, On Agriculture. Marcus Terentius Varro, On Agriculture* (Cambridge, Mass. – London).
Jackson, R., (1988). *Doctors and Diseases in the Roman Empire* (London).
John Moschus, *Pratum Spirituale*; *PG* 87.3, cols 2852–3112.
Johnson, A. and West, L., (1979). *Byzantine Egypt: Economic Studies* (Princeton).
Kaplan, M., (1992). *Les Hommes et la Terre à Byzance du VIème au XIème siècle: Propriété et exploitation du sol*, Byzantina Sorbonensia 10 (Paris).
Kindler, A., (1989). 'Donations and Taxes in the Society of the Jewish villages in Eretz Israel during the 3rd to 6th centuries C.E.', in Hachlili, R. ed., *Ancient Synagogues in Israel. Third–Seventh century C.E.*, BAR International Series 499 (Oxford): 55–60.
Kingsley, S. A., (1994–5). 'Bag-Shaped Amphorae and Byzantine Trade: Expanding Horizons', *BAIAS* 14: 39–56.
Kraemer, C. J. Jr. ed., (1958). *Excavations at Nessana.* Vol. III. *Non-Literary papyri* (Princeton).
Krauss, S., (1910–1912). *Talmudische Archäologie*, I–III (Leipzig).
Leloir, L. ed., (1981). *Palladius. Les moines du désert. Histoire lausiaque* (Paris).
Leontius of Neapolis, *Vita Symeonis Salou* and *Vita Ioannis Cyprii*, ed. Festugière, A.-J., 1974.
Leynaud-Rouaud, C., (1991). 'Le Pain d'aujourd'hui et de toujours', *Valeurs Mutualistes, MGEN*, No. 133 (janvier): 23–25.
Libanius, *Oratio* XI, ed. Foerster, R., 1906.
Mafart, B.-Y., (1989). 'Intérêt et limite de l'étude de quelques marqueurs osseux de la malnutrition au cours de la croissance', *Actes des 4e Journées Anthropologiques. 'Dossier de Documentation archéologique no. 13'* (Paris): 73–84.
Manson-Bahr, P. E. C. and Apted, F. I. C., (1982). *Manson's Tropical Diseases* (London).
Martin, R. ed., (1976). *Palladius. Traité d'Agriculture.* T. I. *Livres I et II* (Paris).
Mayerson, Ph., (1985). 'The Wine and Vineyards of Gaza in the Byzantine Period', *BASOR* 257: 75–80.
Neusner, J. ed., (1979). *The Tosefta. Fifth Division. Qodoshim (The Order of Holy Things)* (New York).
Neusner, J. and Sarason, R. S. eds, (1986). *The Tosefta (First Division). Zera'im (The Order of Agriculture)* (Hoboken).
Nomos Georgikos, ed. Ashburner, W., 1910.
Palladius, *De Re Rustica*, ed. Martin, R., 1976.
Palladius, *Historia Lausiaca*, ed. Butler, C., 1898–1904.
Papyri Colt, ed. Kraemer, C. J. Jr, 1958.
Patlagean, E., (1977). *Pauvreté économique et pauvreté sociale à Byzance* (Paris–La Haye).
Paul, S. M., (1975). 'Classification of Wine in Mesopotamian and Rabbinic Sources', *IEJ* 25: 42–45.
PG Migne, J.-P. ed., (1857–1912). *Patrologiae Graecae cursus completus, Series graeca* (Paris).
Piacenza Pilgrim, *Itinerarium*, ed. Geyer, P., 1965.
Pliny the Elder, *Historia Naturalis. Book XIX*, ed. André, L., 1964.
Porat, Y., (1975). 'The Gardens of Caesarea', *Qadmoniot* VIII: 90–93 (Hebrew).
Regnault, L., (1966). *Maîtres spirituels au désert de Gaza. Barsanuphe, Jean le Prophète & Dorothée* (Sablé-sur-Sarthe).
Regnault, L., (1990). *La Vie quotidienne des Pères du Désert en Egypte au IV*e siècle (Paris).
Riley, J. A., (1975). 'The Pottery from the First Season of Excavation in the Caesarea Hippodrome', *BASOR* 218: 25–63.
Rouët de Journel, M.-J. ed., (1946). *Jean Moschus. Le Pré Spirituel* (Paris).

Rousselle, A., (1983). *Porneia. De la maîtrise du corps à la privation sensorielle. IIe–IVe siècles de l'ère chrétienne* (Paris).
Schwab, M. ed., (1878–1890). *Le Talmud de Jérusalem*, T.I–IX (Paris).
Schwartz, E., (1939). *Kyrillos von Skythopolis* (Leipzig).
Seligman, J., Zias, J. and Stark, H., (1996). 'Late Hellenistic and Byzantine Burial Caves at Giv'at Sharet, Bet Shemesh', *'Atiqot* XXIX: 43–62.
Seller, M. J., (1987). 'Unanswered questions of neural tube defects', *British Medical Journal* 294: 1–2.
Siegelmann, A., (1974). 'A Mosaic Floor at Caesarea Maritima', *IEJ* 24: 216–21.
Smith, P., Bornemann, E. C. and Zias, J., (1976). 'Preliminary Report on the Human Skeletal Remains from Tomb I', in Freedman, D. N. ed., *Preliminary Excavation Reports: Bâb edh–dhra', Sardis, Meiron, Tell el-Hesi, Carthage (Punic), Annual of the American Schools of Oriental Research* 43: 105–08.
Sozomenus, *Historia Ecclesiastica*; *PG* 67: cols 843–1630.
Sperber, D., (1965). 'Costs of Living in Roman Palestine', *Journal of the Economic and Social History of the Orient* 8: 248–71.
Sperber, D., (1966). 'Costs of Living in Roman Palestine', *Journal of the Economic and Social History of the Orient* 9: 182–211.
Sperber, D., (1971). 'On Pubs and Policemen in Roman Palestine', *Zeitschrift der Deutschen Morgenlandischen Gesellschaft* 120: 257–63.
Stuart-Macadam, P., (1985). 'Porotic Hyperostosis: Representative of a Childhood Condition', *American Journal of Physical Anthropology* 66: 391–8.
Stuart-Macadam, P., (1992). 'Porotic Hyperostosis: A new Perspective', *American Journal of Physical Anthropology* 87: 39–47.
Sussmann, J., (1981). 'The Rehob Inscription: A Translation', in Levine, L. I. ed., *Ancient Synagogues Revealed* (Jerusalem): 152–3.
Theodore of Petra, *Vita Theodosii*, ed. Usener, H., 1890.
Tsafrir, Y. ed., (1988). *Excavations at Rehovot-in-the-Negev*. Vol. I. *The Northern Church, Qedem* 25 (Jerusalem).
Tsafrir, Y. ed., (1993). *Ancient Churches Revealed* (Jerusalem).
Usener, H. ed., (1890). *Der heilige Theodosios Schriften des Theodoros und Kyrillos* (Lepizig).
Varro, *De Re Rustica*, eds Hooper, W. D. and Ash, H. B, 1979.
Vita Anonymi Ioanni, ed. Delehaye, H., 1927.
Vitto, F., (1981). 'The Synagogue at Reḥob', in Levine, L. I. ed., *Ancient Synagogues Revealed* (Jerusalem): 90–4.
Weaver, M. E., (1971). 'A New Water Separation Process for Soil from Archaeological Excavations', *Anatolian Studies* XXI: 65–68.
White, K. D., (1970). *Roman Farming* (London).
White, K. D., (1976). 'Food Requirements and Food Supplies in Classical Times in Relation to the Diet of the Various Classes', *Progressive Food Nutrition Science* 2: 143–91.
Whitting, P. D., (1973). *Byzantine Coins* (London).
Wilkinson, J., (1977). *Jerusalem Pilgrims Before the Crusades* (Jerusalem).
Yates, J. R. W., Ferguson-Smith, M. A., Guzman-Rodriguez, R., White, M. and Clark, B. J., (1987). 'Is Disordered folate metabolism the basis for the genetic predisposition to neural tube defects?', *Clinical Genetics* 31: 279–87.
Zevulun, U. and Olenik, Y., (1979). *Function and Design in the Talmudic Period* (Tel Aviv).
Zias, J. (1991). 'Death and Disease in Ancient Israel', *Biblical Archaeologist* (September): 147–59.
Zias, J. and Numeroff, K., (1986). 'Ancient Dentistry in the Eastern Mediterranean: A Brief Review', *IEJ* 36: 65–67.

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Geometrical Planning in Monumental Herodian Architecture

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Introduction

In a previous article in *BAIAS*, I presented evidence to show that the enclosure of Herod's Temple complex was set out according to a simple geometrical scheme based on equilateral (60°) triangles, as shown in Fig. 1 (Jacobson 1990/91; cf. Jacobson 1980). According to this scheme, the existing inner platform of the *Haram al-Sharif*, with the late seventh-century AD Dome of the Rock, preserves the basic layout of the Inner Temple of Herod's time, thereby demonstrat-

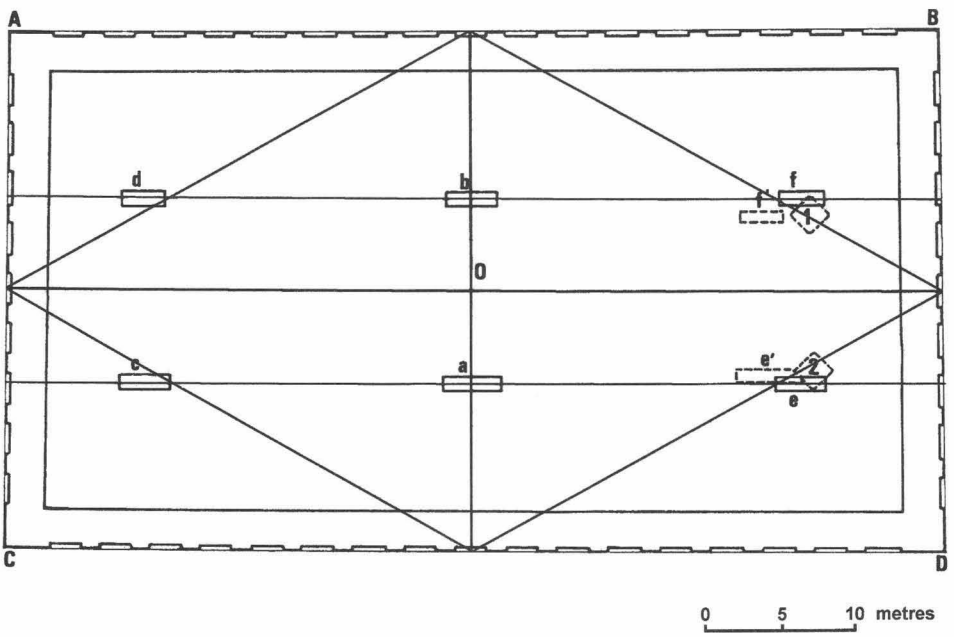


Fig. 1. Plan of the *Haram al-Khalil* (Tombs of the Patriarchs) in Hebron, showing its geometrical basis. ABCD represents the wall of the enclosure. a, b, c, d, e′, f′ refer to the cenotaphs commemorating Abraham, Sarah, Jacob, Leah, Isaac and Rebecca respectively. The cenotaphs of Isaac and Rebecca are considered to have been situated at e and f prior to the erection of the pillars 1 and 2.

ing a degree of continuity of tradition. In particular, the Sanctuary would correspond closely with the Dome of the Rock, while the altar would have coincided with the Dome of the Chain. This interpretation accords with Jewish tradition, as recorded in the description of the Temple Mount by Rabbi Jechiel of Paris in the thirteenth century:

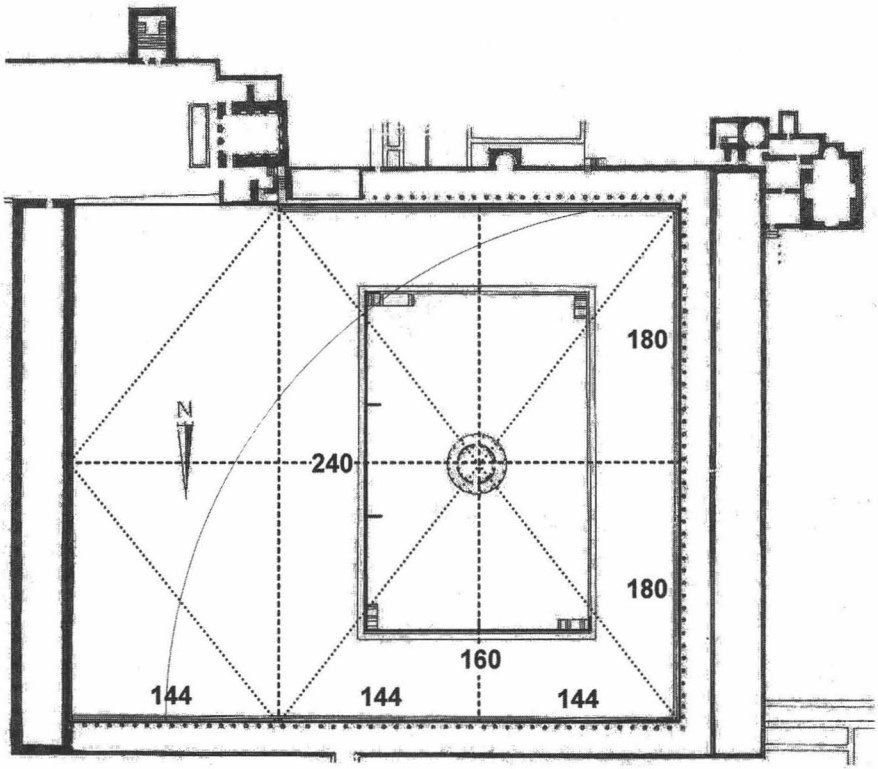
'Round the *Even Shetiya* (''foundation stone,'' here meaning the *Sakhra*) the Ishmaelite (i.e. Arab) kings have built a very beautiful building for a house of prayer and erected on the top a very fine cupola (i.e. the Dome of the Rock). The building is on the site of the Holy of Holies and the Sanctuary, and in front of the mosque towards the Altar (i.e. on its eastern side) is a structure of pillars and the cupola is at the top of these pillars and it would seem that this was the place of the outer Altar which was in the Court of Israel' (Adler 1987, 118).

The structure with a cupola, built on pillars, on the eastern side of the Dome of the Rock is uniquely identifiable as the Dome of the Chain. Even without applying the same geometrical arguments, in recent times other authors have also reached the conclusion that the Dome of the Chain, which was built together with the Dome of the Rock in the Umayyad period, coincided with the ancient altar (Rosen-Ayalon 1989, 27, n. 21; Hollis 1934, 309; Conder 1878, Vol. ii, 361; Pl. facing p. 359).

In like fashion, it was argued that the present inner platform of the *Haram* is a successor to the consecrated area of the Temple Mount which was demarcated in the period of the Second Temple by a low balustrade, known as the *soreg* (Jacobson 1990/91, 50–51). This proposal found tangible support in the form of a broad monumental staircase, which was 'rediscovered' in nineteenth century photographs (Jacobson and Gibson 1995). This ancient staircase (labelled S1 in Fig. 1) had stood in close alignment with the proposed southern perimeter of the *soreg* and lay parallel to the south wall of the enclosure. It had disappeared by the end of the century although not before it had been photographed and recorded on the Ordnance Survey maps of the *Haram.*

An analysis of the plan of the monumental enclosure that Herod constructed at Hebron around the Tombs of the Patriarchs has shown that this, too, conforms to precisely the same ratio (Jacobson 1981). The walls of the enclosure at Hebron form an almost perfect rectangle measuring 34.0 × 59.1 m (Vincent and Mackay 1923, 43), so that the adjacent sides are in the ratio 1.737:1, equal to the tangent of 60.1° (see Fig. 2). The positions of the six cenotaphs, or *nefashoth*, commemorating the Old Testament Patriarchs and Matriarchs (marked a–f), follow the symmetry of the enclosure, although two of the monuments (e and f) were moved out of alignment in the Middle Ages when the piers 1 and 2 were constructed (*ibid.*). The walls of the Hebron enclosure are constructed of drafted-margin masonry in an identical style to the surviving Herodian portions of the retaining wall of the Temple enclosure, and appear to have been the work of the same architects and craftsmen (Jacobson 2000).

Neighbouring Herod's kingdom, at Damascus, the inner enclosure of the



(a)

Fig. 2. Garden and Pool at Lower Herodium. (Measurements shown are in Roman feet).

temple of Jupiter Damascenus, which is dated by an inscription in the wall to AD 15/16, was likewise designed according to the same geometry (Jacobson 1981; Watzinger and Wulziger 1921, 3–42; Seyrig 1950, 34–37). Again, the upper part of the exterior of the enclosure wall at Damascus, like that of the Herodian walls surrounding the Temple Mount and the Tombs of the Patriarchs, is decorated with pilasters (Thiersch 1909, 103; Creswell 1969, 156, n.7). This suggests the same architectural influences at work as at Jerusalem and Hebron.

The importance of mathematical planning in Herod's monumental building programme will now be illuminated with additional examples.

Geometrical planning in Herod's building projects

It has been observed that the forum at Samaria-Sebaste (excluding the basilica, which was built on a separate terrace) had the same proportions, as shown in

Table 1. Ample archaeological evidence was found by the archaeologists to demonstrate that its level platform was constructed in the Herodian period (Reisner, Fisher and Lyon 1924, 211–13). The pattern of monumental enclosures constructed by Herod and based on equilateral triangles is therefore consistently reinforced, as demonstrated by the data in Table 1 below.

I have found that a comparable geometrical scheme, involving an equilateral triangle with 60° angles, governs the proportions of the *oecus* (or banqueting hall) on the lowest terrace of the Northern Palace at Herod's desert fortress at Masada (Jacobson 1998/99). This chamber circumscribes an equilateral triangle, and its internal length-to-breadth ratio is half that of the enclosures represented in Table 1.

The appearance of 60° angles in ground-plans is indicative of the employment of circular geometry because these angles are most easily drawn using a straightedge and a pair of compasses, following the procedure described in Euclid (*Elementa*, proposition 1.1). Evidence has been obtained for the use of proportions involving the tangent of 60°, which is identical to the irrational factor $\sqrt{3}$, in Greek temples from the mid-third century BC onwards. Examples include the *naiskos* within the temple of Apollo at Didyma and the temple of Dionysus at Teos designed by the famous Ionian architect, Hermogenes, who flourished in c. 200 BC (de Jong 1989). The ratio $\sqrt{3}$:1 also governs the plan of the 'Teatro Marittimo' in Hadrian's Villa at Tivoli and other buildings in the Roman Empire (Wilson Jones 1989, 134–35; Jacobson 1986, 71–75), and it forms the basis of Vitruvius' prescription for the ideal plan of a Roman theatre (Gros 1994, 69–70). Vitruvius recommends that the plan of the theatre should be determined by inscribing four equilateral triangles at 30° intervals in the circle of the orchestra (Vitr. *De Arch.* v 6, 1–2). The twelve vertices of these symmetrically placed

Table 1: Proportions of three Herodian enclosures and the temenos *of Jupiter Damascenus compared*

Enclosure	Reference	Average outer length, *l* metres	Average outer breadth, *b* metres	Length/ breadth ratio (*l*/*b*) = tan θ	Angle θ
Jerusalem, Temple	Simons 1952, 346	485 (west wall)	280 (south wall)	1.732	60.0°
Hebron, Tombs of the Patriarchs	Vincent and Mackay 1923, 43	59.1	34.0	1.737	60.1°
Samaria-Sebaste, forum	Reisner *et al.* 1924, Vol. 1, 211	128	72.5	1.766	60.5°
Damascus, inner *temenos* of the temple of Jupiter	Creswell 1969, 156, ns. 4 and 5	157.5	96.7	1.629	58.5°

triangles fix the positions of the seven stairways between the *cunei* (wedge-form banks of seats) and the remaining five define the arrangement of the stage.

There are examples from Herod's projects of geometrical planning involving other proportions and mathematical schemes. One of these is the rectangular enclosure at Mamre (*Ramat al-Khalil*), built around the Oak of Abraham. That enclosure has average external dimensions of 48.95 × 64.94 m, which approximates to 165 × 220 Roman feet (Mader 1957, 77, n. 34; Z37 = Plan. 1), so that its sides are in the proportions of 3:4. Therefore the long and short sides taken together with the diagonal constitute the Pythagorean 3,4,5 right-angled triangle. The perfectly circular hilltop palace of Upper Herodium follows an even more sophisticated geometrical plan, which has been the subject of a detailed analysis (Jacobson 1984).

Elsewhere, arithmetic ratios, which reflect a more usual Roman design methodology, are encountered (Wilson Jones 1989). An especially fine example is the garden and pool complex at Lower Herodium (Netzer 1993, 622–23; 1999, 101–103). The plan of this complex and its geometrical resolution are shown in Fig. 3. This garden enclosure comprises a large rectangular pool measuring 46 × 70 m, set in a garden 125 m long and 105 m wide. The pool was 3 m deep and could contain approximately 10,000 m^3 of water. In the centre of the pool was a circular pavilion, probably in the form of a *tholos* with concentric colonnades. The garden was landscaped on an artificially levelled terrace and owing to the natural slope of the ground, the entire area to the east of the pool was raised on an earth fill held in place by massive retaining walls along the southern and eastern boundaries (see Fig. 3). The southwest corner of the pool had been cut into the bedrock, to a depth of up to 6 m, in order to maintain a horizontal level to the western end of the garden. Porticoes in the Ionic order surrounded the garden on three sides, over a distance of approximately 250 m. The floor of the porticoes was set about 1.2 m above the garden to which it was joined by stairs that ran along the full length of the colonnades. In several respects, this garden and pool complex echoes the Temple enclosure and also the forum at Samaria-Sebaste:

1. These three schemes involved the construction of artificial terraces which were created by the use of an earth fill to raise sections and by hewing into the bedrock to lower other parts of the enclosure.
2. The border of these enclosures was defined by porticoes.

The layout of this garden and pool enclosure is rectilinear and is based on simple arithmetic ratios. The garden itself is a rectangle measuring, 360 × 432 Roman feet. These proportions are a ratio of 5:6, multiplied by a common factor of 72 feet. The numbers 12 and 6, together with 4 and 10 dominated Roman numerology and were preferred factors used in design (Wilson Jones 1989, 121–23). The proportions of the pool, too, were governed by the same principles: here the ratio is 2:3 and the common multiple is 80 feet.

A relevant point to make concerning the use of geometry in Herodian architectural plans is that abstract geometrical designs dominated the artistic repertoire

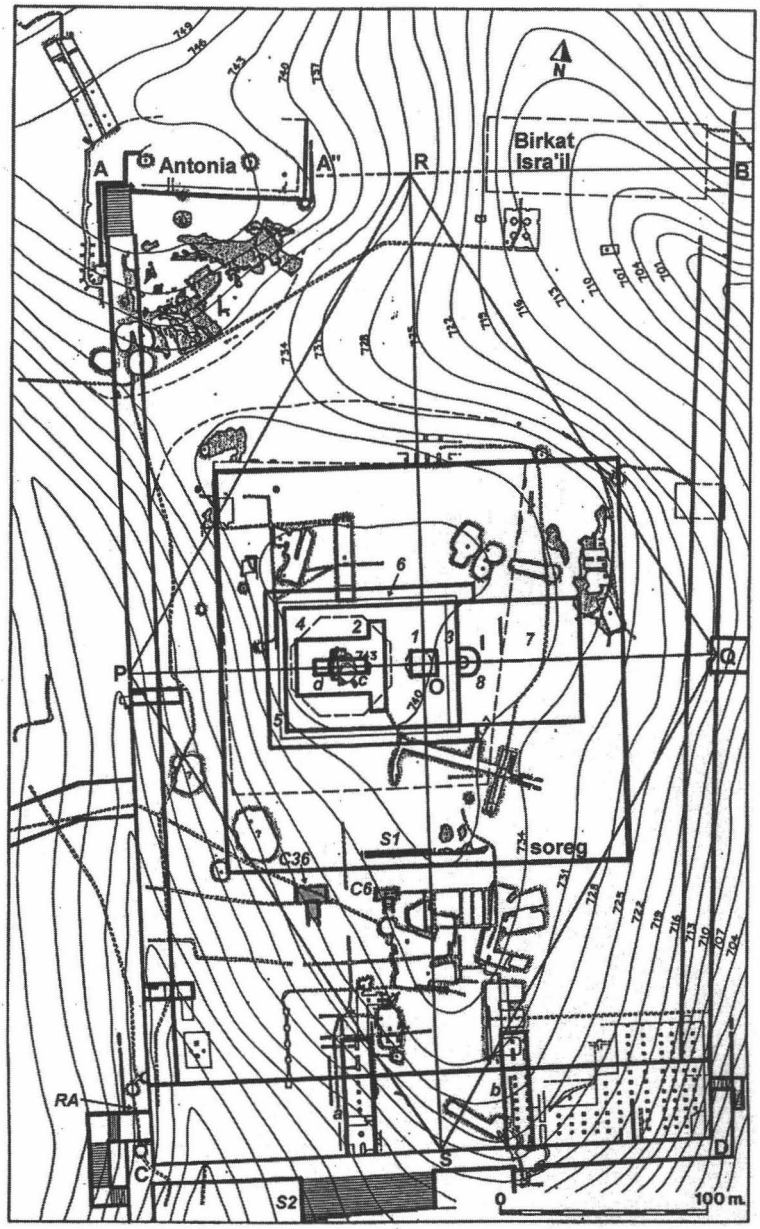


Fig. 3. Plan of the *Haram al-Sharif*, with the geometrical resolution of the Temple complex superimposed. (Drawing by S. Gibson, with additions by the author).
1 Altar; *2* Sanctuary; *3* Court of Israel; *4* Inner Court (Court of the Priests; *5* 14 (or 12) steps; *6* Terrace (*hel*); *7* Court of the Women; *8* Semicircular steps and Gate of Nicanor; *a* Passage to *Huldah* Gate (Double Gate); *b* Passage to *Huldah* Gate (Triple Gate); *c* Sanctuary (*hekhal*); *d* Holy of Holies (*devir*); *S1* monumental steps on Temple Mount (visible in the 19th century); *S2* Monumental steps uncovered in front of the Double Gate; *C36* Cistern 36 (ancient miqveh?); *C6* Cistern 36 (ancient miqveh?); *RA* Robinson's Arch.

of Judaea in the period of the Second Temple for the reason that representational images were proscribed by Jewish law. A similar emphasis on geometrical patterns is observed in Islamic art. Especially favoured in Herodian decoration are compass drawn rosette patterns, which occur with great regularity in mosaics and stone reliefs of this period (Ovadiah 1994 [mosaics]; Avi-Yonah 1961, 15–21 [stonework]). Most common of all are three and six-petalled (triangular and hexagonal) rosettes exhibiting a 60° symmetry. Fig. 4 shows how these rosettes were drawn. One of these rosettes in mosaic, comprising six petals in black on a white ground, graces the floor of a small bathroom of the luxurious mansion in Area P of N. Avigad's excavations of the Upper City that directly overlooks the Temple Mount (Avigad 1984, 104; 144). The craftsmen who were responsible

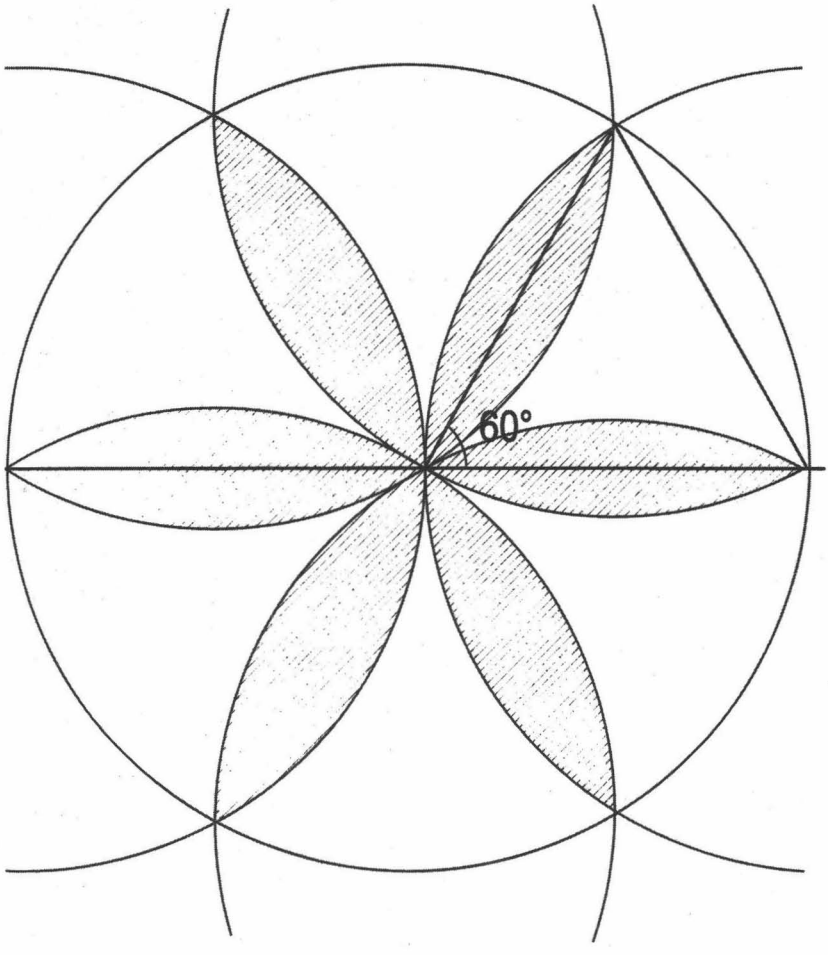


Fig. 4. Hexagonal rosette, showing drawing procedure.

for this mosaic might have received their geometrical training from the same school as the architects who were responsible for the ground plan of Herod's Temple.

Conclusions

Geometrical planning on a large scale was a hallmark of Herod's building programme, as this study has shown. Judaea had never before experienced such a methodical approach to architectural design and rigorous application of the rules of symmetry to the layout of buildings. This development in the architecture was a direct consequence of a change in the political fortunes of Judaea. Herod was appointed a client king by Rome and he enjoyed self-governing status within the Empire. This gave his kingdom ready access to Roman architectural expertise and fashions. Therefore, it should come as no surprise to find strong Roman influences in several of Herod's building projects.[1] Not only do we see Roman predilection for strict symmetry in design reflected in these building complexes, but the schemes themselves were often direct transplants from the Roman architectural repertoire. For example, the peristyle with a basilica at one end, as employed in the outer court of Herod's temple and the forum-basilica at Samaria-Sebaste, was adopted from Roman market architecture.

We also observe characteristic Italian-style patterned mosaics and *opus sectile* pavements at Herod's palace at Jericho and his mountain strongholds of Cyprus, Machaerus and Masada (Foerster 1995, 153–61), *opus reticulatum* at Jerusalem, Panium and Jericho (Dodge 1990, 109, 112; Deichmann 1979, 473–76), and western harbour technology, including the use of hydraulic *opus caementicium* (concrete) at Caesarea (Oleson and Branton 1992). Illusionist wall paintings in the Pompeian Second and Third Styles have been found at Herodium, Masada, Samaria-Sebaste and Jerusalem that have matching counterparts in Italy (Fittschen 1996; Foerster 1995, 25–26), and Campanian-style Italian bath-houses with *suspensura* and tubulation (i.e. hypocausts) abound in Herod's palaces and desert fortresses (Nielsen 1990, 103–104). In fact, all these features are so strikingly Italianate that scholars now believe that architects and builders were brought specially from Rome and elsewhere in Italy to work on Herod's building projects (Geiger 1996, 140; Foerster 1995, xviii, xxi).

Note

1 Roman models were not consistently adopted in Herod's building projects. The more conservative east Greek architectural and artistic tradition continued to play a conspicuous role, for example in the Western Palace at Masada (Foerster 1995, 162–70).

Bibliography

Adler, E. N., (1987). *Jewish Travellers in the Middle Ages* (New York).
Avigad, N., (1984). *Discovering Jerusalem: Recent Archaeological Excavations in the Upper City* (Oxford).

Avi-Yonah, M, (1961). *Oriental Art in Roman Palestine (Università di Roma – Centro di Studi Semitici, Studi Semitici 5*; Rome) = *Art in Roman Palestine* (Jerusalem, 1981), 119–211.
Conder, C. R., (1878). *Tent Work in Palestine*, 2 vols. (London).
Creswell, K. A. C., (1969). *Early Muslim Architecture*, Vol. 1, 2nd edn. (Oxford).
Deichmann, F. W., (1979). 'Westliche Bautechnik im Römischen und Rhomäischen Osten,' *MDAI(R)* 86, 473–527.
de Jong, J. J., (1989). 'Greek mathematics, Hellenistic architecture and Vitruvius' De Architectura,' in H. Geertman and J. J. de Jong, *Munus non Ingratum* (*Proceedings of the International Symposium on Vitruvius' De Architectura and the Hellenistic and Republican Architecture, Leiden 20–23 January 1987 = BABESCH Supplement 2*; Leiden), 100–113.
Dodge, H., (1990). 'The Architectural Impact of Rome in the East,' in M. Henig (ed.), *Architecture and Architectural Sculpture in the Roman Empire* (Oxford), 108–120.
Fittschen, K., (1996). 'Wall Decorations in Herod's Kingdom: Their Relationship with Wall Decorations in Greece and Italy,' in K. Fittschen and G. Foerster *Judaea and the Graeco-Roman World in the Time of Herod in the Light of Archaeological Evidence (Acts of a Symposium Organised by the Institute of Archaeology, the Hebrew University of Jerusalem and the Archaeological Institute, Georg-August-University of Göttingen, Jerusalem, Nov. 3–4, 1988*; Göttingen), 139–61.
Foerster, G., (1995). *Masada V. The Yigael Yadin Excavations 1963–1965 Final Reports: Art and Architecture* (Jerusalem).
Geiger, J., (1996). 'Herod and Rome: New Aspects,' in I. M. Gafni, A. Oppenheimer and D. R. Schwartz (eds.), *The Jews in the Hellenistic-Roman World: Studies in Memory of Menahem Stern* (Jerusalem), 133–45 [Hebrew].
Gros, P., (1994). 'Le schéma vitruvien du théâtre latin et sa signification dans le système normatif du *De Architectura*' *Rev. Arch.* 82, 57–80.
Hollis, F. J., (1934). *The Archaeology of Herod's Temple. With a Commentary on the Tractate Middoth* (London).
Jacobson, D. M., (1980). 'Ideas Concerning the Plan of Herod's Temple,' *PEQ* 112, 33–40.
Jacobson, D. M., (1981). 'The Plan of the Ancient Haram el-Khalil in Hebron,' *PEQ* 113, 73–80.
Jacobson, D. M., (1984). 'The Design of the Fortress of Herodium,' *ZDPV* 100, 127–36.
Jacobson, D. M., (1986). 'Hadrianic Architecture and Geometry,' *AJA* 90, 69–85.
Jacobson, D. M., (1990/91). 'The Plan of Herod's Temple,' *BAIAS* 10, 36–66.
Jacobson, D. M., (1998/99). Masada (review article) *BAIAS* 18, 85–95.
Jacobson, D. M., (2000). 'Decorative Drafted-Margin Masonry in Jerusalem and Hebron and its Relations', *Levant* 32, 141–60.
Jacobson, D. M., and Gibson, S., (1995). 'A Monumental Stairway on the Temple Mount,' *IEJ* 45, 162–70.
Mader, A. E., (1957). *Mambre: Die Ergebnisse der Ausgrabungen im heiligen Bezirk, Râmet el-Halîl in Südpalästina 1926–1928* (Freiburg im Breisgau).
Netzer, E., (1993). 'Lower Herodium,' in *NEAEHL*, 621–26.
Netzer, E., (1999). *Die Paläste der Hasmonäer und Herodes' des Grossen* (Mainz).
Nielsen, I., (1990). *Thermae et Balnea. The Architecture and Cultural History of Roman Public Baths* (Aarhus).
Oleson, J. P., and Branton, G., (1992). 'The Technology of King Herod's Harbour,' in R. L. Vann (ed.), *Caesarea Papers: Straton's Tower, Herod's Harbour, and Roman and Byzantine Caesarea* (= *JRA Suppl. 5*; Ann Arbor, MI), 49–67.
Ovadiah, A., (1994). 'Mosaic Pavements of the Herodian Period in Israel,' in P. Johnson, R. Ling and D. J. Smith (eds.), *Fifth International Colloquium in Ancient Mosaics, Bath, 5–12 September, 1987* (*JRA Suppl. Series 9*), 67–76.

Reisner, G. A., Fisher, C. S., Lyon, D. G., (1924). *Harvard Excavations at Samaria 1908–1910*, (Cambridge, MA).
Rosen-Ayalon, M., (1989). 'The Early Islamic Monuments of al-Haram al-Sharif: An Iconographic Study,' *Qedem* 28.
Seyrig, H., (1950). 'Sur les ères de quelques villes des Syrie,' *Syria*, 27, 5–50.
Simons, J., (1952). *Jerusalem in the Old Testament: Researches and Theories* (Leiden).
Thiersch, H., (1909). *Pharos, Antike Islam und Occident* (Leipzig / Berlin).
Vincent, L.-H., and Mackay, E. J. H., (1923). *Hébron, le Haram el-Khalil, sépulture des Patriarches* (Paris).
Watzinger, C., and Wulzinger, K., (1921). *Damaskus: Die antike Stadt* (Berlin).
Wilson Jones, M., (1989). 'Principles of Design in Roman Architecture: The Setting Out of Centralized Buildings,' *PBSR* 57, 106–151.

Book Notice

The Birth of a New Discipline: Archaeological Demography

CLAUDINE DAUPHIN

Dauphin, C., *La Palestine byzantine: Peuplement et Populations*, BAR International Series S 726, Vols I–III, 1042 pages, 117 figures and tables. With a Preface by R. Moorey, Keeper of Antiquities at the Ashmolean Museum, Oxford. Archaeopress, Oxford, 1998. Price: £105.

A population's growth as well as its decline is linked to a set of three variables: natality, mortality and migration. Several other factors also enter the equation, notably: nuptiality, age at marriage, duration of marriage, fecundity, fertility, male to female ratio, life expectancy and population structure. The exact rules of this demographic game in antiquity appear to us intractable for want of numerical data.

A Demographic Analysis without Statistics

Byzantine society was one of many ancient societies devoid of statistics (Patlagean 1969: 1354). The two main pillars of historical demography, census returns and public records, on which general statistics are based (Sauvy 1976: 24–30, 49, 333–5), are lacking for 4th–7th century Palestine. Nor are there cadastral inventories (*praktika*) such as those from the 13th century onwards listing the 'hearths' of *proskathemenoi* peasants who were attached to a domain and fulfilled fiscal obligations to a landlord (Svoronos 1956: 330–1; Laiou-Thomadakis 1977: 9–23). Following Sauvy's terminology (1976: 16), Byzantine demography therefore should be considered 'extensive' rather than 'pure', 'human' rather than 'numerical'.

An ancient society reveals itself primarily through the fossilized remains of its life and death, in its abodes and burial places. Thus, of necessity we were compelled to become a scavenger and grave-digger in order to bring to fruition a demographic analysis of Byzantine Palestine coinciding with Israel within its 1973 borders minus Sinaï which was retroceded to Egypt in 1980, and comprising *Palaestina Prima*, *Secunda* and *Tertia* of Byzantine civil, military and ecclesiastical administration, as well as the Rabbinical 'Land of Israel' whose borders were

delineated in the Tosephta, the Palestinian Talmud and Tannaitic literature (Ch. I: 'The Geographical and Historical Framework').

The Sources

Of the diverse 'Materials for the History of the Settlement of Byzantine Palestine' constituting Part I of our study of the demographic evolution of Palestine from the reign of Constantine Ist (AD 324–337) to the Umayyad Conquest (636–640), the archaeological sources (which are mainly unpublished) are most copious: 19th century travelogues, the explorations of V. Guérin (1868–1880), the descriptions and maps of the Survey of Western Palestine by C. R. Conder and H. H. Kitchener (1881–1883), the archaeological archives of the Mandatory Government of Palestine (1922–1948), those of the State of Israel since 1948 and of the Archaeological Survey of Israel since 1964, as well as the results of our excavations of the Churches of Nahariya (Dauphin and Edelstein 1984) and Dor (Dauphin 1997) on the Mediterranean coast, of the ecclesiastical farm at Shelomi in Western Galilee (Dauphin 1986), of the settlements of Khirbet Jannaba et-Taḥtā in the Valley of Elah (Dauphin 1991), Gevulot and Ohad in the Northwestern Negev (Dauphin 1979a; 1979b), and of our surveys of four Roman and Byzantine settlements in the Golan (Dauphin and Gibson 1992–3). The systematic scrutiny of the archaeological archives led to the elaboration of a database of 2,930 Byzantine sites listed and described in the *Catalogue* of Vol. III, as well as computerized, sorted and depicted on a series of twenty regional demographic maps (as exemplified by Fig. 1) drawn by S. Gibson. Despite shortcomings due to a not negligible factor of destruction of the data which is often incomplete and rarely precisely dated, the considerable contribution of the archaeological material enables the filling-in of numerous *lacunae* in the historical sources: geographical and ecclesiastical lists; registers of military units; works of Biblical topography; the Madaba Mosaic Map; Latin, Greek and Syriac hagiography and Patristics; Rabbinical literature; and, Arabic geographical and historiographical texts (Ch. II: 'The Sources and their Limitations').

The Land: Growth and Vitality

The second part of the book ('Anatomy and Life Cycle of a Byzantine Province') traces the demographic and religious evolution of the three Palestines (Ch. III: '*Provincia*, Holy Land and National Home'). Byzantine Palestine lacked unity: it was divided into administrative and religious zones that did not necessarily coincide and were themselves fragmented into city-territories, episcopal dioceses and distinct districts according to Jewish Law. Moreover, Jerusalem – the focus of both Jewish and Christian pilgrimage – was considered an exception for it harboured the remains of the Jewish Temple and was one of the five Patriarchates of Christendom. To the South, Palestine was edged by the *Limes* ('border') and *Saltus* ('imperial estates') which formed a steppic belt between the desert and

7-8 TEL AVIV

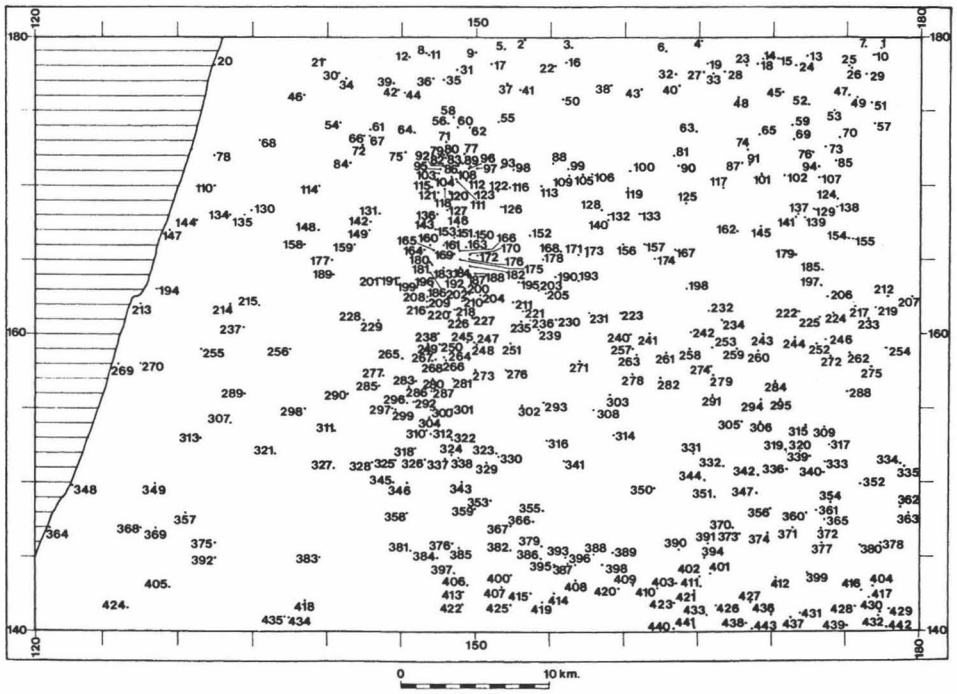


Fig. 1. An example of regional demographic maps: the distribution of Byzantine settlements in the region of Tel Aviv. (Drawing S. Gibson).

the sown, a 'Pioneer Fringe' (Amiran 1953: 250–1). To the North, a buffer-zone (covering modern Lebanon and Syria) dubbed 'Sourya' by the Rabbis, separated the 'Land of Israel' which was subjected to tithing (*terumah*), to the gift to the Temple priest of a portion of dough (*ḥallah*) which was thrown into the fire since the destruction of the Temple by the Romans in AD 70, and to the observance of the Sabbatical Year (*shebi'it*), from 'Foreign Lands' devoid of such obligations.

Between the 4th and the mid-6th century, Palestine witnessed a dramatic demographic and economic expansion evidenced by the density of settlement (Ch. IV: 'Population: Expansion'). Contradicting the inflated number of 2,800,000 inhabitants put forward by Avi-Yonah (1979: 219–21), both Ben-David (1974: 41–44) and Broshi (1979) have independently rightly linked population numbers to agricultural potential and estimated the population of Byzantine Palestine at about 1,000,000.

Population distribution depends on climate and natural environment, in particular hydrography. Thus the coastal plain and inland basins of Eastern Samaria and Galilee which are endowed with deep and well-watered soils (springs, a high water table and *wādī*s running a few metres beneath the surface of plains and thus being easily diverted in order to irrigate fields), offered favourable conditions

for agriculture. On the other hand, owing to the rarity of water (notably underground water at a small or medium depth) and to soil-erosion solely controlled by terrace-agriculture, the karstic central uplands were unsuitable for agriculture. Therefore, the natural geographical conditions of Palestine would lead one to expect a concentration of population in the plains, the uplands being less densely populated. The maps depicting the distribution of population in Byzantine Palestine (Figs 2 and 3) show exactly the opposite. This 'anomaly' is due to a direct correspondance between density of settlement and fertility of soil. Thus, in the Byzantine period, settlement density was at its highest in the central highlands, on Terrae Rossae (Type A soils) on which the Mediterranean trilogy of cereals, olive and vine as well as fruit trees (apricot, apple and plum) were grown, and on Brown and Pale Rendzinae (Type B) which are not rich but easily cultivated soils on which the olive and vine requiring little or no water prospered. Despite sharing similar properties with Terrae Rossae, the dark basaltic soils (Types D and F) of the Golan and Lower Galilee were slightly less populated. Characterized by basaltic Protogrumosols, basaltic brown Grumosols and pale Rendzinae (Type D), the Lower Golan and Eastern Lower Galilee were pasturelands, with wheat and barley growing however on patches of deep soils. In the highest part of the Golan plateau, deep Basaltic brown Mediterranean soils (Type F) which are superimposed over the oldest lava flows, were excellent for cereals and fruit trees, whereas thinner soils covering the most recent flows were good pasturelands.

Since it is clear, even from a cursory glance at maps Figs 2 and 3, that each region offered its own particular agricultural and demographic landscape, we conducted a detailed analysis of the distribution of the 2,930 sites of our *Catalogue* regionally, according to the subdivision of Palestine into 26 maps by the Archaeological Survey of Israel, and by using conjointly several 'ciphering grids' (physical geography, pedology, hydrography and climate).[1] This new analytical method – a variant of Landscape Archaeology conceived and applied by us to Byzantine Historical Geography – has enabled us to follow the rhythm of growth particular to each region as well as to progress from a micro-analysis to a global view.

It is striking that the most densely settled areas of Palestine in the Byzantine period were on the one hand, the uplands, plateaux, hills and mountains of Judaea, Samaria, Galilee and Golan, and on the other, marginal zones requiring irrigation. These areas, considered to be 'harsh' in view of their topography or climate, share the following characteristic: the extension of the 'sown' is commensurate to man's stubborn labour. A cyclical Boserupian pattern[2] emerges: the increase of agricultural production gave rise to a demographic boom which necessitated further extension of arable land as well as the intensification of agricultural productivity, olive and vine plantations being the classic response of Mediterranean agriculture to demographic expansion.[3]

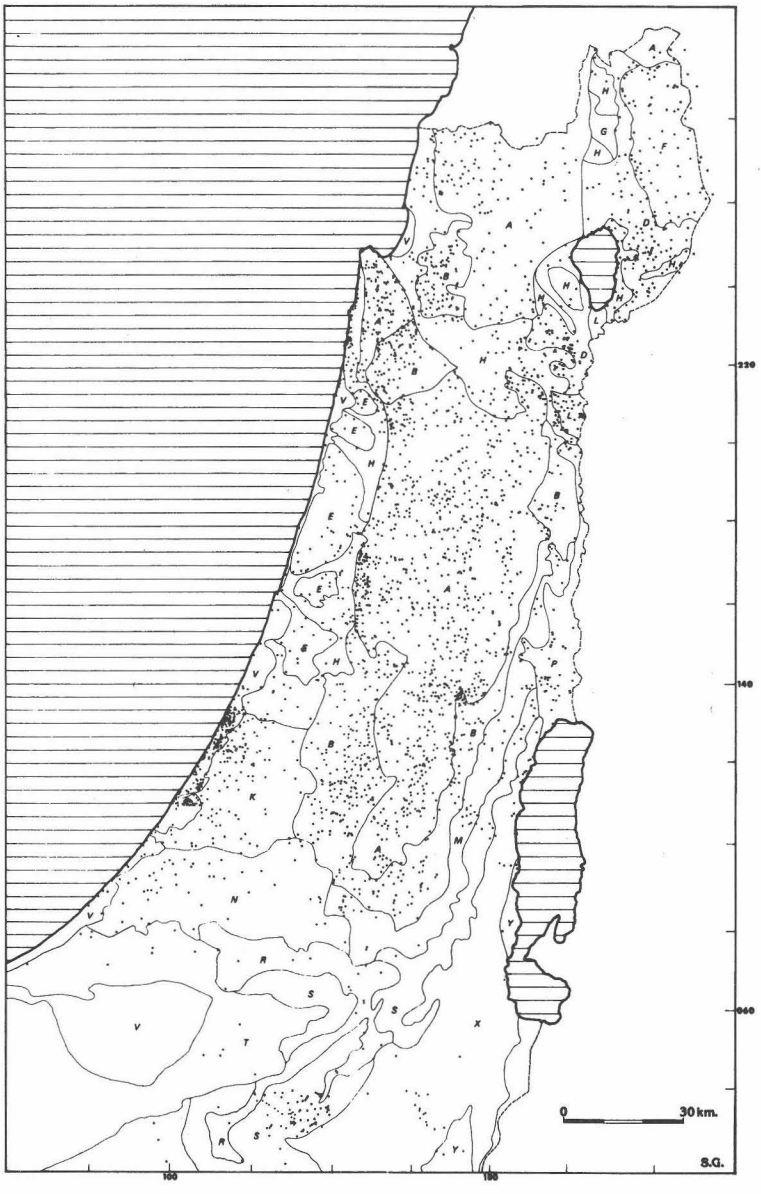


Fig. 2. Distribution of Byzantine settlements and soils in Northern and Central Palestine. A: Terrae Rossae and brown and pale Rendzinae; B: brown and pale Rendzinae; D: basaltic Protogrumosols, brown basaltic Grumosols and pale Rendzinae; E: Hamra soils; F: brown Mediterranean basaltic soils and basaltic Lithosols; G: Hydromorphic and gley soils; H: Grumosols; K: Dark brown soils; L: Calcareous Serozems; M: Brown Lithosols and loessial arid brown soils; N: Loessial arid brown soils; P: Alluvial arid brown soils; R: Loessial Serozems; S: Brown Lithosols and loessial Serozems; T: Sandy Regosols and arid brown soils; V: Sand dunes; X: Bare rocks and desert Lithosols; Y: Reg soils and coarse desert alluvium. (Drawing S. Gibson).

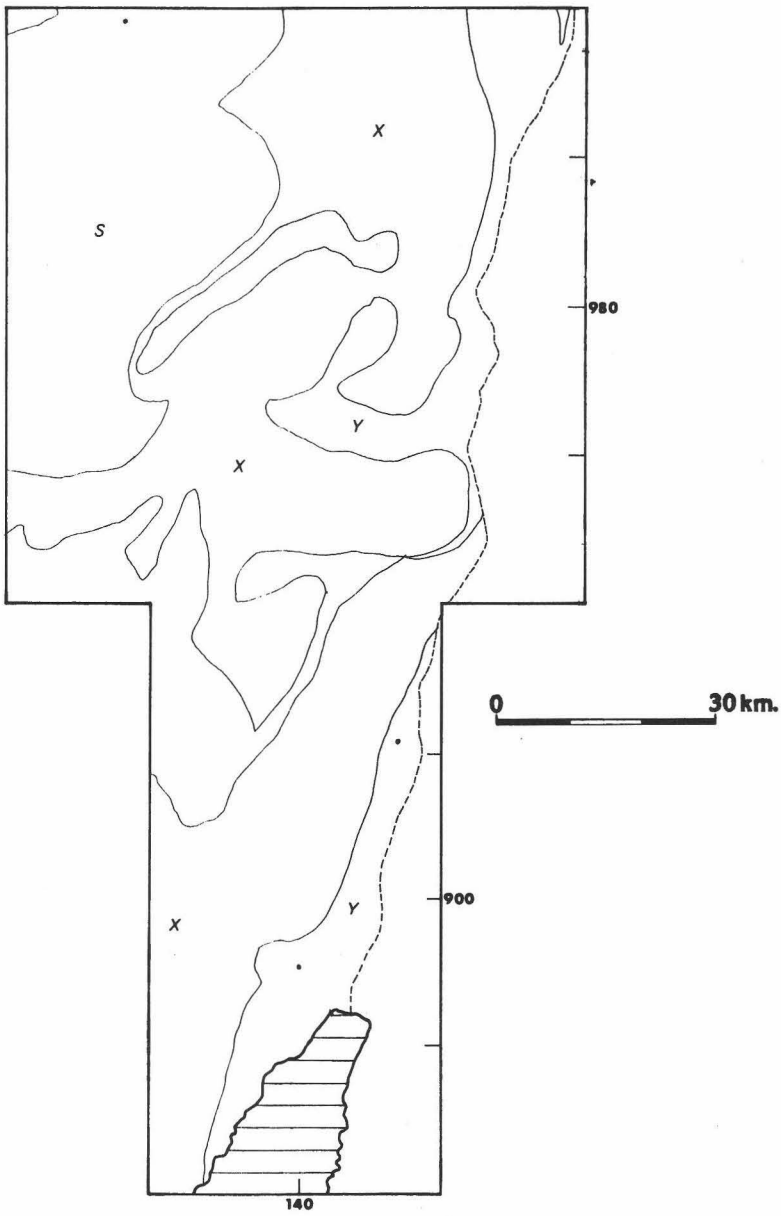


Fig. 3. Distribution of Byzantine settlements and soils in Southern Palestine: S: Brown Lithosols and loessial Serozems; T: Sandy Regosols and arid brown soils; V: Sand dunes; X: Bare rocks and desert Lithosols; Y: Reg soils and coarse desert alluvium. (Drawing S. Gibson).

The Peoples

Despite a clear North-South opposition revealed by palaeo-anthropology (morphological differences between the peoples of Northern and Southern Palestine being due probably to climate, economy and ethnic components), the main characteristic of the Byzantine population of Palestine was heterogeneity (Ch. V: 'Ethnic groups, Languages and ''Nationalities'' in Byzantine Palestine'). This resulted from the juxtaposition on a Canaanite substratum of peoples of diverse origins, compounded by the survival of ethnic groups such as the Itureans, the Nabateans and the Samaritans, and by grafts associated with conversions. The onomasticon, moreover, reflects linguistic variety, and epigraphy reveals complex connections between languages and religions. The Christians expressed themselves in Greek, Latin and Christo-Palestinian (the Aramaic dialect of Palestine), the Jews in Hebrew and Aramaic. The liturgical and literary language of the Rabbis – Hebrew – was clearly distinguished from the vernacular – Aramaic –, in the same way that Greek was the language of education and commerce, whilst Christo-Palestinian (also known as Syro-Palestinian) was used by the common people. In the eyes of the Jews, Greek was the language of 'assimilation'. The Nestorians and Monophysites used Syriac as their liturgical and literary language. A clue for determining origin, language also enables the detection of various 'foreign' communities in Byzantine Palestine: Armenians, Georgians and westerners. Besides the cosmopolitan cities (the universal capital Jerusalem, the ports and provincial *metropoles*), the Rabbinical Schools and Christian monasteries were melting-pots for scholars and monks of widely diverse origins ranging from Spain to the Caucasus. However, over and above their local or foreign origin, village, city or region (*origo* or birthplace being a fundamental concept of Roman Law), in a Late Antique world devoid of the concept of 'nationality' which had not yet been invented, the inhabitants of Byzantine Palestine defined themselves primarily by their religions.

The Religions

In 4th century Palestine, the Christians were still a minority in relation to the Jews and Samaritans whose numbers, however, had decreased since the 3rd century as a result of a severe economic crisis. The pagans formed a 'silent majority' (Ch. VI: 'Settlement and Religion in Byzantine Palestine: the Struggle for Supremacy'). Following its revival under the reign of Emperor Julian 'the Apostate' (361–363), paganism was inexorably tracked down by the Byzantine Church and State. Outlawed but deep-rooted with its idols and temples, particularly on the slopes of Mount Hermon and on the borders with Egypt, it stood its ground defying its oppressors. Syncretist paganism (Mithraism and Manicheism, the cults of Orpheus and of Dionysus) continued to attract followers. Consequently, in order to eradicate paganism, Christianity was compelled to adopt two methods: the neutralization by destruction of pagan cult places and their appropriation as

well as that of pagan rites such as *incubatio* as a prerequisite for miraculous healing. Nevertheless, despite being forbidden by Byzantine Law, magic and superstitions flourished and remained anchored in daily life thanks to ancient nature cults which focused devotion on mountains, hills, evergreens, springwater and stone heaps.

In order to trace the progress of Christianity in its struggle for supremacy, we elaborated an analytical method of regional religious demography which combines the distribution of archaeological remains bearing religious symbols and signs, with cartography and the historical sources, notably legislation (Ch. VII: 'Settlement and Religions in Byzantine Palestine: Orthodoxy and Heresies'). This innovative approach has enabled us to bring to light modifications in the religious components of the cities, towns, villages and hamlets of Byzantine Palestine, per region and per century.[4] Once marginal religious groups deemed 'heretical' (Judaeo-Christianity, Gnosis, Marcionism, Montanism) had been eliminated, the Church turned against heterodoxy (Arianism, Origenism, Pelagianism, Nestorianism, Monophysitism, Monoenergism and Monothelism) until the Trinitarian and Christological Quarrels had ultimately torn asunder Byzantine society in the Holy Land.

Meanwhile, the 'Orthodox' Church substantially assisted the totalitarian Byzantine State in its policy of ethnic cleansing which concentrated on liquidating the Samaritans and slowly asphyxiating the Jewish communities (Ch. VIII: 'Settlement and Religion in Byzantine Palestine: Christian Domination'). We have followed step by step the evolving relations between Christianity and Judaism. Fragile peace (for the Church was aware of the Jews' importance in numbers and wished to preserve at least some as fossilized witnesses of the Old Testament) was increasingly eroded by political and civil ostracism sustained by Patristic anti-Jewish rhetoric. The Jewish settlement of most regions diminished except in the Galilee, the Golan and the *Darōm* of Southern Judaea and the Northern Negev. The infiltration by Christians of those Jewish enclaves is strikingly borne out by our regional-chronological maps of religious demography (as exemplified by Figs 4–7), until the final triumph of Christianity at the beginning of the 7th century. Within cities, towns and villages, the complex relations between the Jewish and Christian communities evolved, the dynamics of coexistence and replacement being detectible thanks to the changing patterns of juxtaposition of heterogeneous religious symbols and the presence of contemporaneous inscriptions in various languages. Despite the curtailing of their civil liberties to the point of legal humiliation, the Jewish communities of Byzantine Palestine appear to have been prosperous, as evidenced notably by donations for the embellishment of synagogues and Houses of Study, as well as by the numismatic contents of synagogue treasuries. From the reign of Emperor Justinian Ist (527–565), the Jews greeted Imperial measures of exception by rebelling. The break between the Jewish and Christian communities of Palestine was finally consummated during the Persian Invasion of 614 which played the role of catalyst.

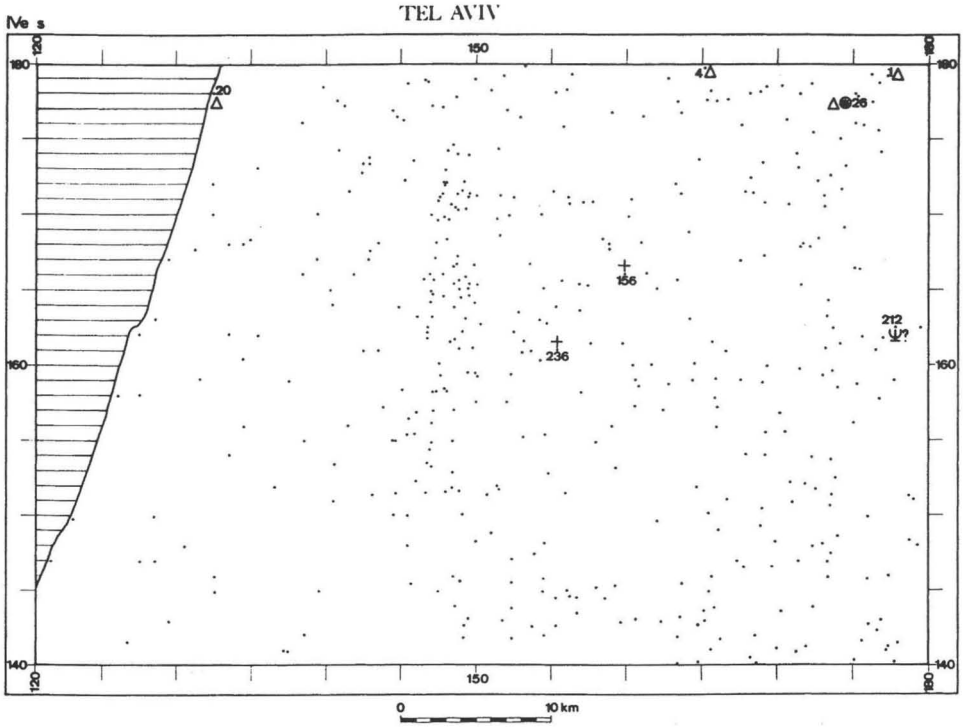


Fig. 4. An example of religious demographic maps: the distribution of religions in the 4th century in the region of Tel Aviv: Ψ Jews; + Christians; △ Samaritans; ⊛ pagans. (Drawing D. Porotski).

Decline and Fall

Part III of the book ('The Forces of Disintegration') analyzes the reasons for the demographic and economic decline which rendered Byzantine Palestine an easy prey for the Arab invaders. In the course of the 7th century, Palestine underwent a dramatic population decrease. Rejecting the simplistic explanation which until recently put the onus on the Persian and Arab invaders (Ch. IX: 'Population: Decline. Depopulation by Conquest'), we unearthed the seeds of decay in the preceding Byzantine centuries themselves. Viewing the data provided by dedications, epitaphs and the osteological examination of cemeteries in the light of the Patristic and Rabbinic sources, we dismantled the mechanisms which had governed both the growth and the decline of the population and settlement of Palestine during the Byzantine period (Ch. X: 'Population: Decline. Natural Depopulation'). Our approach has been that of a demographer, a sociologist and a historian of mentalities in analyzing nuptiality (legal and real puberty; precocious marriages; true age at marriage and duration of marriage; rate of nuptiality; widowhood, divorce and remarriage; procreative marriage); fertility and natality (reproduction rate; the family nucleus in Byzantine Palestine; infant, child and

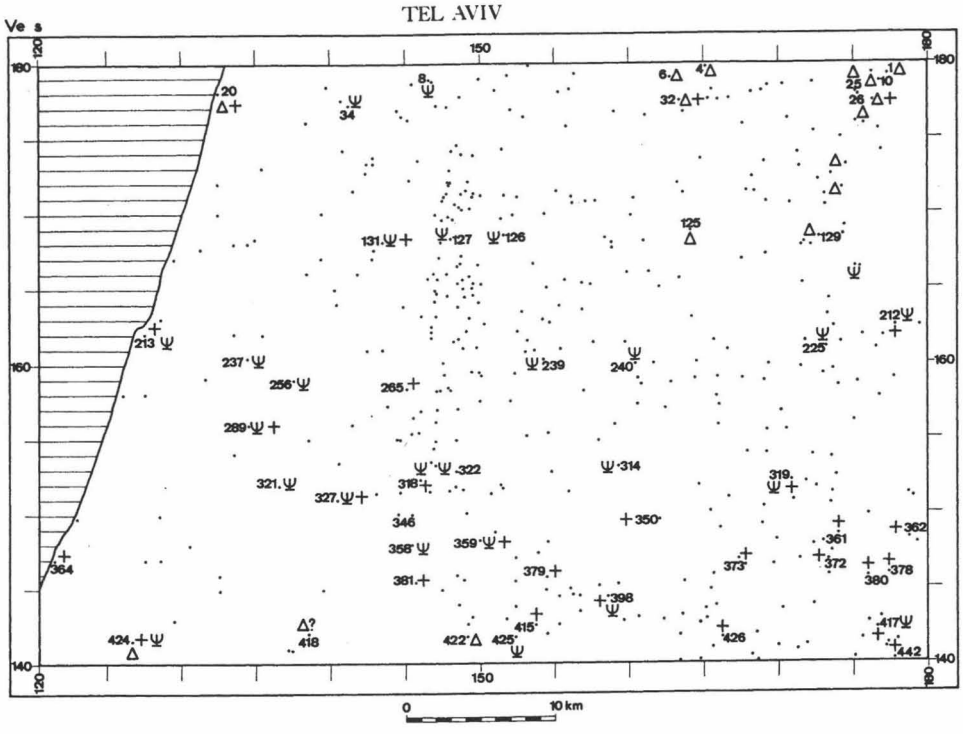


Fig. 5. Distribution of religions in the region of Tel Aviv in the 5th century. (Drawing D. Porotski).

juvenile mortality). The quest for possible demographic checks in the course of the 6th century whose effects would have been felt only one or two centuries later, led us to assess the importance of natural and induced sterility (notably that of eunuchs), of sexual prohibitions that restricted natality naturally, and of the role of contraception, abortion and infanticide as intentional limitations of natality, as well as to evaluate the demographic weight of the abandonment of children (*expositio*).

The oft-repeated assumption that, encouraged by Christianity within the organized framework of monasticism, ecclesiastical celibacy had a real impact on natality and ultimately emasculated Byzantine society (Patlagean 1969: 1361–2, 1369; 1977: 128–31, 153–4), urgently needed to be challenged and reviewed. If eunuchs, celibate lay persons, and homosexuals (the latter representing a mere 10% of any population, according to the 1948 *Kinsey Report*, and moreover being frequently sexually ambivalent) cannot perturb substantially a society consisting predominantly of large families (Wrigley 1978: 149) nor jeopardize its renewal, why has such importance been attributed to ecclesiastical celibacy, especially when one considers that it was often chosen *after* a certain number of years of marriage and the procreation of children, and since it was neither compulsory for

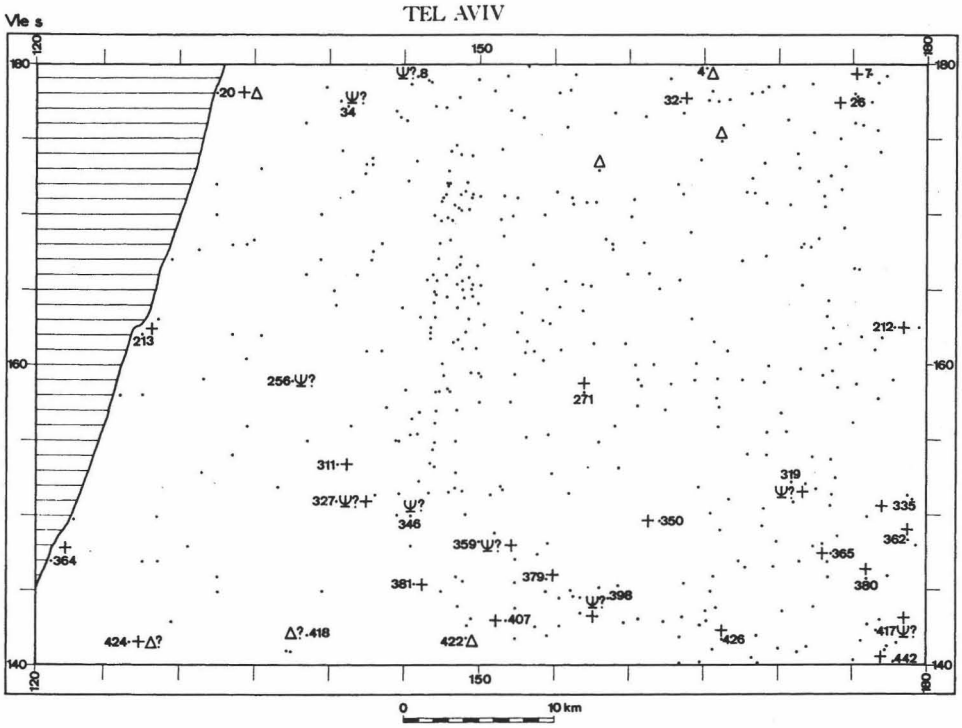


Fig. 6. Distribution of religions in the region of Tel Aviv in the 6th century. (Drawing D. Porotski).

clerics nor always followed to the letter by bishops and monks? The fascination exercised by monasticism on Byzantinists has certainly contributed to distort the problem and to inflate it beyond measure. In fact, various calculations linking the number of monks to the number of monasteries in the Holy Land and to their sizes in *dunams*,[5] have led us to posit that the number of monks and nuns in Byzantine Palestine barely totalled 10,000 and thus represented only 1% of the population in general. The impact of ecclesiastical celibacy on natality was therefore negligible. It was high time to have proven numerically beyond doubt that perpetual chastity required by Christian ascetism had never been 'a serious matter in its demographic implications' (Charanis 1971: 66).

What were then the real causes of the demographic decline of Palestine in the 7th century? Despite a lengthening of life expectancy from 30 years in the Roman period to 40 years in the Byzantine 6th century, the general natality and mortality rates (30 births and 30 deaths for 1,000 persons) were similar. Therefore, the age population pyramid of Byzantine Palestine was most probably concave. Young and expanding, its population may be dubbed 'progressive', thus resembling that of modern developing countries. Byzantine Palestine was at Stage II of the Demographic Transition model or 'early expanding stage' presently reached by

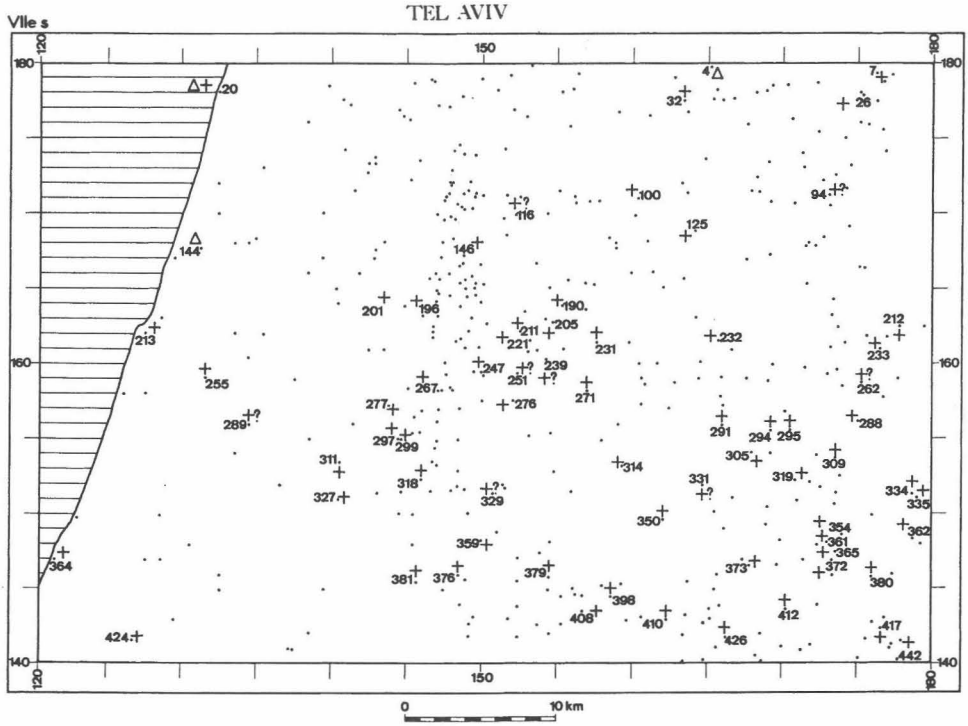


Fig. 7. Distribution of religions in the region of Tel Aviv in the first decade of the 7th century. (Drawing D. Porotski).

Bangladesh.[6] However, in accelerating and ultimately outstripping the pace of economic development beyond its agricultural potential, the rate of population growth inevitably engenders a serious danger, that of the 'poverty trap' in which Bangladesh now finds itself.

This cycle proved particularly hellish for Palestine whose population had been weakened over the centuries by endemic diseases – tuberculosis, syphilitic *bejel*, leprosy, endoparasitoses, and malaria – propagated by the absence of real hygiene and by the overcrowding of urban centres by peasants uprooted by rural exodus (Ch. XI: 'Population: Decline. Diseases, Famines and Plagues'). Despite the abundance of wheat, wine and oil of this 'rich land' (Deuteronomy 8: 7-9), the peoples of Byzantine Palestine had an iron-deficient and thus anaemia-inducing diet.[7] Droughts and plagues of locusts in the early 6th century brought in their train famines with catastrophic demographic consequences, not only in the number of deaths, but also because of subsequent amenorrhea and impotence which caused a sharp drop in birth-rates. The Justinianic Plague (541–542), moreover, made considerable inroads in this weakened population, by mowing down entire families and obliterating the reproductive forces of a whole generation. The initial damage was multiplied by cyclical resurgences of the scourge, notably by the Plague of ʿImwās (639–640).

The Conclusion ('Towards a new equilibrium') emphasizes the sclerosis induced by technological stagnation in Palestine locked in a rigid economic system in which peasants perpetuated traditional agricultural practices and economic production was sucked in by the strong centralized State to its capital, Constantinople (Kaplan 1992: 493–500, 520–2, 581). Famines and plagues propelled Palestine into a serious situation of depopulation and economic decline. However, the collapse of the Byzantine régime in Palestine was also caused by an intolerant and mean imperial rule in Constantinople whose inept policies and irresponsible local administration totally devoid of perspicacity ultimately led to the rejection of Hellenism and Orthodoxy and to the country's recovery of its Semitic roots after six centuries of foreign – Roman and Byzantine – domination.

The political changes engendered by the Moslem Conquest required some readjustments on the part of the populations of Palestine. The Jews re-established themselves in the Holy City from which they had been banned since AD 70. The Christian community withdrew into itself and was forced to learn how to behave once again as a minority.

The Lessons of *La Palestine byzantine*

By demonstrating that 'sources commonly regarded as heterogeneous and intractable may be marshalled together, interrogated and then assimilated to illuminate basic historical problems which are as much of general as they are of local significance', as noted by R. Moorey in the Preface, our work has given the lie in a spectacular manner to Tsafrir's admission of scientific powerlessness to trace the demographic dynamics of Byzantine Palestine 'at our current stage of knowledge and with our present abilities of analyzing data' (Tsafrir 1996: 271). Traditional methods of interpretative archaeological investigation being insufficient in order to follow demographic fluctuations through three centuries in Palestine, a different and infinitely more complex and arduous procedure was required. Borrowing the most appropriate analytical tools from the range offered by Landscape Archaeology, Physical Geography, Anthropology, Religious Sociology, and Social and Economic History, and successfully testing itself painstakingly at every stage of a major scholarly enterprise, the innovative approach which we have elaborated in the course of some twenty years, has grown into a discipline in its own right – Archaeological Demography. Since 'The proof of the pudding is in the eating', we look forward to modifications and refinements as younger generations of scholars will – we hope – apply this new approach widely, both spatially and chronologically to other lands, periods, Cultures and Civilizations.

Notes

1 These correspond to the 'grilles de lecture' defined by the French Structuralist School of the early 1960s.

2 According to Boserup (1965: 118), the increase of settlement density and the intensification of work create favourable conditions for economic development.

3 A similar agrarian cycle was detected by Le Roy Ladurie (1969: 65, 345–52) in 16th century Languedoc.

4 This approach has been applied by us to Western Galilee from the Hellenistic period to the Arab Conquest (Dauphin, 1999; Dauphin, in press).

5 The Palestinian *dunam* corresponds approximately to 1,000m^2 (Abujaber 1989: 262).

6 On the Demographic Transition model, Waugh 1990: 292–6; Witherick 1990: 52–66.

7 See our 'Plenty or just enough? The Diet of the Rural and Urban Masses of Byzantine Palestine' in the present issue of the *BAIAS* (*infra*, pp. 39–65).

Acknowledgments

We wish to thank wholeheartedly Mr A. Eytan, Director of the Israel Department of Antiquities and Museums when we launched in October 1975 upon the research which led to *La Palestine byzantine: Peuplement et Populations*, for access to the archaeological archives of the British Mandatory Government of Palestine and of the State of Israel. We are most grateful to Dr Z. Yeivin, then Director of the Archaeological Survey of Israel, for kindly allowing us to examine its survey files, and to Mr A. Drori, Director of the Israel Antiquities Authority, for permission to incorporate the results of our excavations and surveys in our enterprise of archaeological demography. Our study was funded by the Lady Davis Fellowship Trust of the Hebrew University of Jerusalem, the French Académie des Inscriptions et Belles Lettres, the Direction des Affaires Culturelles of the Ministère français des Affaires Etrangères, the Lady Carlisle Research Fellowship of Somerville College, University of Oxford, the Centre National de la Recherche Scientifique, Paris, and the Centre de Recherche Français de Jérusalem. The list of colleagues worldwide who helped us bring this project to fruition is too long to be quoted here, but the omission of three names would be unforgivable: Dina Castel spent five years beside us in the Archives of the IAA translating from Hebrew; Dr S. Gibson and D. Porotski (IAA) shared the daunting task of drawing 107 demographic maps and histograms.

Bibliography

Abujaber, R. S., (1989). *Pioneers Over Jordan. The Frontier of Settlement in Transjordan, 1850–1914* (London).

Amiran, D. K., (1953). 'The Pattern of Settlement in Palestine', *IEJ* 3: 65–78, 192–209, 250–260.

Avi-Yonah, M., (1979). *The Holy Land from the Persian to the Arab Conquests (536 B.C. to A.D. 640). A Historical Geography*, rev. ed. (Grand Rapids).

Ben-David, A., (1974). *Talmudische Ökonomie. Die Wirtschaft des jüdischen Palästina zur Zeit der Mischna und des Talmud*, Band I (Hildesheim–New York).

Boserup, E., (1965). *The Conditions of Agricultural Growth. The Economics of Agrarian Change under Population Pressure* (Chicago).

Broshi, M., (1979). 'The Population of Western Palestine in the Roman-Byzantine Period', *BASOR* 236: 1–10.

Charanis, P., (1971). 'The Monk as an Element of Byzantine Society', *Dumbarton Oaks Papers* 25: 63–84.
Conder, C. R. and Kitchener, H. H., (1881–1883). *Memoirs of the Survey of Western Palestine*. I. *Galilee* – 1881; II. *Samaria* – 1882; III. *Judaea* – 1883 (London).
Dauphin, C., (1979a). 'Gevulot', *HA* 69–71: 83 (Hebrew).
Dauphin, C., (1979b). 'Ohad', *HA* 69–71: 84 (Hebrew).
Dauphin, C., (1991). 'The Excavation of a Byzantine Site at Khirbet Jannaba Et-Tahta', *Atiqot* XX: 111–117.
Dauphin, C., (1993). 'A Byzantine ecclesiastical farm at Shelomi', in Tsafrir, Y. (ed.), *Ancient Churches Revealed* (Jerusalem): 43–48.
Dauphin, C., (1997). 'On the Pilgrim's Way to the Holy City of Jerusalem: The Basilica of Dor in Israel', in Bartlett, J. R. (ed.), *Archaeology & Biblical Interpretation* (London): 145–165.
Dauphin, C., (1999). 'Between Phoenicia Maritima and the Land of Israel: The Population of a Frontier Zone in the Byzantine Period', in Fine, S., Kramer, W. M. and Sabar, S. (eds), *A Crown for a King. Studies in Jewish Art, History and Archaeology in Memory of Professor Stephen S. Kayser* (Berkeley): 73–95.
Dauphin, C., (in press). 'Sitting aside territories and religions: Kabri and its region in the Hellenistic, Roman and Byzantine Periods', in Kempinski, A. (ed.), *Kabri* I (Tel Aviv).
Dauphin, C. and Edelstein, G., (1984). *L'église byzantine de Nahariya (Israël). Etude archéologique*. Byzantina Mnemeia 5 (Thessaloniki).
Dauphin, C. and Gibson, S., (1992–3). 'Ancient Settlements in their Landscapes: the Results of Ten Years of Survey on the Golan Heights (1978–1988)', *BAIAS* 12: 7–31.
Guérin, V., (1868–1880). *Description de la Palestine. Judée* I–III – 1868; *Samarie* I–II – 1874; *Galilée* I–II – 1880 (Paris).
Kaplan, M., (1992). *Les Hommes et La Terre à Byzance du VIème au XIème siècle: Propriété et exploitation du Sol*, Byzantina Sorbonensia 10 (Paris).
Kinsey, A. C. et alii, (1948). *Sexual Behavior in the Human Male* (Philadelphia).
Laiou-Thomadakis, A. E., (1977). *Peasant Society in the Late Byzantine Empire. A Social and Demographic Study* (Princeton).
Le Roy Ladurie, E., (1969). *Les Paysans du Languedoc* (Paris).
Patlagean, E., (1969). 'Sur la limitation de la fécondité dans la haute époque byzantine', *Annales. Economies, Sociétés, Civilisations* 6: 1353–1369.
Patlagean, E., (1977). *Pauvreté économique et pauvreté sociale à Byzance* (Paris–La Haye).
Sauvy, A., (1976). *Eléments de Démographie* (Paris).
Svoronos, N., (1956). 'Petite et Grande Exploitation à Byzance', *Annales* 11: 325–335.
Tsafrir, Y., (1996). 'Some Notes on the Settlement and Demography of Palestine in the Byzantine Period: the Archaeological Evidence', in Seger, J. D. (ed.), *Retrieving the Past. Essays on Archaeological Research and Methodology in Honor of Gus W. van Beek* (Mississippi State University): 269–283.
Waugh, D., (1990). *Geography. An Integrated Approach* (Walton-on-Thames).
Witherick, M. E., (1990). *Population Geography* (London and New York).
Wrigley, E. A., (1978). 'Fertility Strategy for the Individual and the Group', in Tilly, C. (ed.), *Historical Studies of Changing Fertility* (Princeton): 135–154.

Book Review

Avraham Negev, *The Architecture of Oboda: Final Report.* Qedem 36 (Monographs of the Institute of Archaeology, The Hebrew University of Jerusalem), 1997.

Avraham Negev's contribution to our understanding of the Nabataean world is enormous, and the publication of his final report on his work at Oboda a significant event. In the foreword, after telling of his early activities at Oboda, Negev explains that the present volume contains the results of his excavations in 1958–61 and 1989, but not those carried out jointly with Rudolph Cohen in 1975–77. This present 'final' report therefore will not be the last word on the subject.

Negev's report begins with a useful chapter on the work of previous scholars and archaeologists – Seetzen, Robinson and Smith, Palmer and Drake, Musil, Jaussen, Savignac and Vincent, Woolley and Lawrence, and Wiegand – complete with copies of their plans of Oboda. A useful feature of Negev's book is that he introduces his discussion of each building or area with direct quotations from the findings of these earlier scholars. Negev describes in turn the Middle Nabataean period (with the 'Temple of Obodas' [?] and the 'Western Temple', both founded in the reign of Obodas III, 30–9 BC), the Late Roman period (with a street of houses, a tower, the villa originally excavated by the Colt Expedition in 1936–37, and a burial cave whose identification as the tomb of Obodas by Jaussen, Savignac and Vincent Negev doubts), the late Roman-Byzantine citadel of the early 4th century and the first half of the 5th century; their destruction is attributed to the Arab invasion of 636 AD. Chapter 6 describes a Byzantine building and cave complex, apparently used for the wine industry, and a bath house. The final chapter discusses architectural decorations (Negev), re-used architectural spolia (S. Szidat), coins (A. Kindler), and small finds (R. Rosenthal-Heginbottom).

This book has its good points and its bad points. It is well illustrated, with clear photographs, and the photographs do illustrate the points being made in the text, which is a real virtue in books of this genre. The photographs, however, frequently show the buildings as reconstructed by the National Parks Authority for the benefit of tourists, and there are occasional hints in the text that Negev was aware of alternative possibilities. On the whole the description of the buildings is clear, but the reader needs to work hard to correlate text and plans and photographs; this is not a popular coffee-table work for swift and easy scanning. On the other hand it will not entirely satisfy the professional archaeologist. The only section given is one reprinted from Jaussen, Savignac and Vincent (p. 16), and there is no clear general plan of the site; that given on p. 2 is woefully inadequate, with no identification of buildings or of phases, and no contours. While there is

a clear general plan of the acropolis on p. 16, and of the Late Roman-Byzantine citadel on p. 95, no features are identified; enlightenment comes only by close reading of the text. Fig. 17 shows 'Nabataean remains on the acropolis' – but of which period? The plan of 'Colt's villa' on p. 74 is rendered confusing by its compass symbol which points south instead of north. At least the plan of the Byzantine dwelling and cave on p. 158 is given numbers to assist with identification of the various rooms.

The early development of the site's earliest buildings remains problematic, as Negev admits. Negev (pp. 2–3) dates both the smaller temple and the 'western temple' to the reign of Obodas III (30–9 BC), the dedication of the smaller temple being to the king-god Obodas II, 'whose untimely death earned him an apotheosis' (p. 3). But this raises some difficulties. Obodas II is not known from any ancient historian's reference, but his existence is perhaps evidenced by coins which Meshorer (*Nabataean Coins*, Qedem 3, 1975, pp. 16–20) dates 62–60 BC. Negev dates Obodas II's reign approximately 62/1–58 BC (p. 3). David Graf (ABD 4 [1992], 971), however, argues strongly that the Tell esh-Shuqafiya inscription 'firmly places the accession year of Malichus I in 61/60 BC, leaving a possible gap of only one year for the hypothesized Obodas, assuming that Aretas III died in 62 BC, not in 61 BC.' Even if we grant the existence of Obodas II, the circumstances of his supposed apotheosis remain totally unclear, and the dedication of the temple to its builder, Obodas III, cannot be totally ruled out.

As with the beginning, so with the end of Oboda. Negev ascribes the destruction of the citadel and the churches to the Arab invasion of 636, rejecting his earlier view that the destruction was the work of the Persian invasion of 617–19 AD (see p. 151). In fact, there seems little firm evidence either way, and the question must remain open.

Finally, it must be noted that the book quite properly limits itself to studying the architecture of Oboda. It does not attempt to provide a full history of the site, or a study of its culture. A more serious limitation is that it lacks an index. However, Negev has given us a very useful volume, and his contribution to Nabataean studies continues to deserve our respect and gratitude.

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(The Church of Ireland Theological College, Dublin)

Obituary

REVD ROBERT PITT F.R.P.S. (1920–1998)

In late December 1998 a group of friends and some relatives of Bob Pitt gathered in a church in Orpington, Kent, to bid him farewell. Present were those representing the three most important areas of his life: the United Reform Church, professional photography and the archaeology of the Holy Land.

Bob was born in Australia in 1920. He studied theology in Melbourne and in 1948 was ordained a minister in the Baptist Church. He practiced his vocation firstly in Sydney then later in Canada, where he married. Sadly, the marriage was not a success and he was plunged into a dark despair wherein he questioned his life's purpose and vocation. Eventually he overcame these problems and went to California to study photography and especially portraiture. The skills he developed he brought to England in the 1960s and began to specialize in theatrical portraits. Some of his subjects subsequently became good friends – he was especially fond of Andrew Cruikshank and Susan Hampshire. The photography work continued and widened, his confidence returned and he renewed his ministry in the Church which had now transformed into The United Reform Church, his parish was Bellingham S.E. London.

London was to be his home for the rest of his life although he occasionally hankered after the sun of his native Australia. Bob was a man of many talents and one was pre-eminent – that of making friends. A good raconteur, he thrived in groups of like minded and lively people. He joined the Palestine Exploration Fund and eventually served on their committee; he joined the Anglo-Israel Archaeological Society soon after it was founded by Dr Richard Barnett and Yigael Yadin and he became a member of the Royal Photographic Society. His professional interest in the Holy Land allied to his photographic skills prompted him to help set up a specialist group in 1974 under the patronage of Sir Mortimer Wheeler. An inaugural meeting was held in South Audley Street in a packed lecture theatre. This specialist group within the R.P.S. continues to this day.

Bob's interest in the archaeology of the New Testament took him to Israel many times and again, friendships flourished, his closest friend being Danny Bahat. The considerable archive of photographic material he acquired during his Middle Eastern travels is now deposited with the Palestine Exploration Fund.

Being a person of small material needs it was a surprise to find that he occasionally gambled a pound or two on the National Lottery. If questioned about this his reply was always the same – any winnings were to go to the P.E.F. He

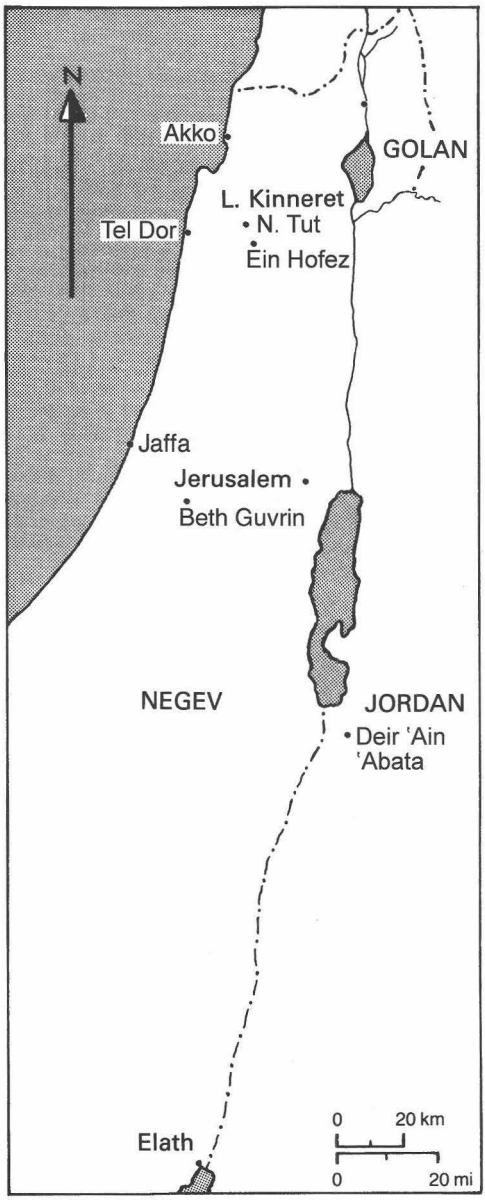
never did win but he did do the Fund a signal service in 1985 by helping to retrieve from a London auction house a manuscript map of 'The Survey of Western Palestine'. Although the means in this little piece of theatre were sometimes questionable the ends were noble and he never suffered any agony of conscience, despite his clerical collar.

The last years of his varied and eventful life were spent in retirement in Orpington and latterly in Dulwich. Although his pastoral work had come to an end his interests and enthusiasms persisted until the very end despite the deafness that frustrated him so much.

Bob leaves two daughters and a son and three grandchildren to whom he was devoted. In the words of a close friend 'he was an unfailing supporter of young scholars' – he is greatly missed.

Ashley Jones

Summaries of Lectures



Ugarit: Clues from a Canaanite City?

Adrian H. W. Curtis

There can be no doubt that the discoveries from Ras Shamra, ancient Ugarit, on the Syrian coast, have had a profound impact on the study of the Hebrew Bible. This is true not least of the hitherto unknown language, now known as Ugaritic, which has expanded our knowledge of the North-west Semitic group of languages to which Hebrew belongs. And the Ugaritic texts have given an invaluable insight into some of the religious beliefs and practices of the citizens of Ugarit. The numerous artefactual finds reveal that, at its zenith, Ugarit was a highly cultured cosmopolitan city.

Although there is evidence of occupation of the site from the Neolithic to the Roman period and perhaps beyond, the 'Golden Age' was from the 15th to the 12th century BC when it was probably destroyed by the 'Sea Peoples'. Its prosperity derived from its commercially and strategically important geographical location at a 'crossroads' between the Aegean, Anatolian, Mesopotamian and Levantine worlds; Egyptian and Hittite kings were anxious to be on good terms with Ugarit.

The major part of the lecture involved a slide presentation which sought to illustrate something of the variety of types of discovery from the site. Buildings considered included the Temple of Baal and the High-priest's house, the so-called 'Rhyton Temple', and the Royal Palace, as well as tombs, the warehouses in the harbour area, and the 'postern' gate. Artefacts were noted which revealed various artistic techniques and cultural influences, and which included depictions of deities, probably Baal and El. An indica-

tion was also given of the variety of types of textual material discovered.

The question-mark in the title must not be forgotten! It relates both to the word 'clues' and to the word 'Canaanite'. It has become customary to use the adjective 'Canaanite' with reference to the discoveries from Ugarit, as, for example in the volumes prepared by G. R. Driver (1956) and J. C. L. Gibson (1978) entitled *Canaanite Myths and Legends* (Edinburgh; T. & T. Clark). Indeed, it could be argued that it is precisely because the discoveries were labelled 'Canaanite' that they were so avidly seized upon by biblical scholars in the hopes of shedding light on a people who receive such a bad press in the Hebrew Bible. But whether Ugarit lay within territory which could legitimately be termed 'Canaan' is far from certain and many would suggest that it was too far north. (On this issue, see A. R. Millard, 'The Canaanites' in D. J. Wiseman [ed.], *Peoples of Old Testament Times*, Oxford; Clarendon Press, 1973, 29–52.) But insofar as the culture, beliefs and practices of the people of Ugarit may be regarded as representative of a wider area (and examples of the Ugaritic language have been found as far south as Israel), then the discoveries from Ras Shamra *may* shed some light on people who can be called 'Canaanite'.

And to what extent might ancient Israelites have come into contact with, or been influenced by the type of beliefs and practices evidenced by the discoveries from Ugarit? Even a traditional view which saw the origins of Israel in a 'conquest' of Canaan which took place after a 13th century BC exodus would make it unlikely that any ancient Israelite could have been directly influenced by a person or text from Ugarit! The view that there was an Israelite 'conquest' of Canaan has increasingly been called into question and there has been a tendency to think in terms of Israel 'emerging' *within* Palestine (cf. e.g. R. B. Coote and K. W. Whitelam, *The Emergence of Early Israel in Historical Perspective*, Sheffield; Almond Press, 1987). Indeed, it has been suggested that the Israelites were originally Canaanites (cf. e.g. N. P. Lemche, *The Canaanites and their Land: the Tradition of the Canaanites*, JSOT Supplement 110, Sheffield; JSOT Press, 1991). In the context of the ferment of views about what it is possible to know of the origins of Israel, the discoveries from Ugarit, with their evidence of beliefs and practices of people who lived in the Levant in the latter half of the second millennium BC, may have their part to play. But the extent to which they reflect earlier, or later, or geographically more widespread beliefs and practices is far from clear. In seeking clues, the student of ancient Israel and/or the Hebrew Bible will need to exercise the utmost caution.

The Recent Excavations at Beth Guvrin-Eleutheropolis

Amos Kloner

The late Roman-Byzantine city of Beth Guvrin-Eleutheropolis (AD199/200) covered an area of 650 dunams, consisting of two major topographic elements: the southern hill, located south of the modern Beth Shemesh/Hebron–Qiryat Gat–Ashkelon road; and the much smaller northern area of the city, built on a low plain to the north of the modern-day road. This road passes over the southern moat of the Crusader city, filled up in the thirteenth century. The southern moat itself was dug into and thoroughly destroyed the line of the main east–west street of Eleutheropolis (the *decumanus*), from which a small part of a stylobate and two column bases have been found.

The city expanded northwards during the second century AD. It was here, after the Bar-Kokhba war and especially from the second half of the second century AD onwards, that large public buildings for the city's administration and daily life were constructed. The expansion at first probably consisted of a military camp and other installations, such as the amphitheatre and the walls adjacent to it.

Four large structures have been

Fig. 1. The Roman amphitheatre of Beth Guvrin-Elentheropolis. The northern access gallery looking north. In front an underground vaulted corridor. Photo taken in December 1995 (courtesy Israel Antiquities Authority).

revealed along the northern side of the *decumanus*. They are, in order from east to west:

A building of the late Roman period, made of large ashlar blocks, adjacent to the modern road, where a wide double arch rising above the road is still visible. Double arches were exposed also in the public bath, a typical architectural innovation of the late second and third centuries AD, which is found in other sites of the period. This structure was also used as a public building during the Byzantine period, probably with some civil or religious function. It has been identified by several scholars of the nineteenth and early twentieth centuries as being part of the 'northern fortress' (Abel 1924:589).

West of this building a second large structure is located. Because of an inscription on the structure's architrave and frieze, which is dated from the second half of the fourth century AD, it is thought that this building was an inn (Dagan, Fischer and Tsafrir 1985:33–4; Kloner 1993:195–6). It was probably square in plan and had a portico of columns crowned with Corinthian capitals. It was built during the late Roman period on undisturbed soil and continued in use during the Byzantine period.

Further west of these two structures a bath-house has been revealed beneath a square fortress dated to the Early Muslim period. The 2200 sq m bath-house revealed three phases of use. Initially a Late Roman period bath was built of large ashlar stones, carefully designed with double arches over the central openings. The bathhouse was constructed above a system of vaults made of ashlars with Severian type stone dressing.

The Byzantine phase, from the fifth century AD, is represented by the well-preserved heating system (*hypocaust*) and

sections of the mosaic floor still *in situ*. These give a graphic illustration of the manner in which the *suspensera* was covered with layers of large square bricks and tiles below the mortar and tesserae of the flooring. The frigidarium of the bath-house consisted of a pool surrounded by mosaics. An extensive sewage system was also revealed below the floors. Finally, during the seventh century AD changes occurred which indicate that only a limited section of the bath still functioned.

The fourth building is the Roman amphitheatre, which was built on flat land on the northwest outskirts of the city of Beth Guvrin. The elliptical structure has maximum dimensions of 71 × 56 m; its total area is 3000 sq km. The building was constructed with large rectangular limestone ashlars, locally quarried from the hard *nari* crust which forms on the local Eocene chalk. The amphitheatre consists of a walled arena with subterranean galleries, girded by a rather small *cavea* resting on a series of connected barrel vaults which form a large ambulatorium used as a service corridor. The round ambulatorium is interrupted at both ends of the major (north–south) axis by two large access galleries leading to the arena. Ten rectangular doorways lead from the *ambulatorium* (service corridor) to the arena, three arched openings to the outside, and two low openings connect the service corridor with the tribunes (*pulvinaria*) located at each end of the minor (east–west) axis of the arena. Four vaulted *vomitoria* admitted the public to the *cavea*.

The excavation results suggest that the structure was erected during the second half of the second century AD and served its original function for about 200 years, until the late fourth century AD, presumably falling into disuse in the wake of the severe earthquake of May AD 363. Architectural alterations ascribed to the Byzantine period indicate that the structure was adapted for use as a public building. Dismantling of the *cavea* seats probably started in the Byzantine period and was completed by the Early Islamic period (seventh–eighth centuries AD). In medieval to Ottoman times the building served mainly as a stable, as well as for industrial purposes.

The outer wall of the amphitheatre presents the unusual phenomenon of large roughly-cut limestone blocks protruding from the façade. These are arranged in groups of two or three, at intervals of about 4 m, and are irregularly and asymmetrically spaced. While it might be suggested that these features should be interpreted as evidence for planned building extensions, it is more probable that the protrusions were intended to break the monotony of the façade. They should be regarded as a stylistic device, and not as evidence that the outer wall was left in an unfinished state (Kloner and Hubsch 1996:87).

Eleven columns 0.48 m in diameter were found, broken but still *in situ* 3.3 m from the arena wall. A pavement of square and rectangular limestone slabs between the arena wall and the columns was found, with evidence that it had been repaired at least twice. The columns and pavement are dated by the associated ceramic material to the Byzantine period, and indicate that the amphitheatre was adapted to serve a new public function, possibly as a marketplace. The arena would have been circled by a roofed gallery with the service corridor housing shops or storerooms.

The depiction of Eleutheropolis in the sixth-century Madaba mosaic map includes a domed and colonnaded circular building (Avi-Yonah 1954:69). It is not inconceivable that this building could have been intended to represent the amphitheatre, transformed into a public building with a roofed portico during the Byzantine period.

Seven roads met at Eleutheropolis. Five of these roads were marked by milestones: the roads leading to Hierosolyma-Aelia, to the Hebron mountains (southbound), to Askalon, to Gaza, to Lod-Diospolis and Emmaus-Nicopolis. The other two roads lead to Hebron (northbound) and to the southern

Shephelah's larger villages: Kishor, Thella and Rimmon.

Two aqueducts supplied the water needs of Eleutheropolis. The eastern aqueduct, 25 km long, came from the Hebron mountains; the northern aqueduct, 3 km long, came from Tel Goded. A third system of water supply was cut underground into the rock, bringing water to the city in a tunnel from the nearby eastern vicinity.

Cemeteries were found all around the city (Dahari, Avni and Kloner 1987; Kloner 1994:198–200; Oren and Rappaport 1984). They consist of clusters of rock-cut burial caves dated to the Early Roman period and mainly to the late Roman, Byzantine and Early Muslim (eighth century AD) periods. Since each period's cemeteries encircled the area of the then-contemporary city, another criterion for studying the town limits is thus created.

Bibliography

Abel, F.-M. (1924). 'Découvertes récentes à Beit Djebrin', *RB* 33,1:583–604.

Avi-Yonah, M. (1993). Mosaics at El-Maqerqesh, Beth Guvrin. In E. Stern ed. *The New Encyclopedia of Archaeological Excavations in the Holy Land*, Vol. 1, Jerusalem:197–8.

Avi-Yonah, M. (1954). *The Madaba Mosaic Map with Introduction and Commentary*. Jerusalem.

Dagan, Y., Fischer, M., Tsafrir, Y. (1985). 'An Inscribed Lintel from Bet Guvrin', *IEJ* 35:28–34.

Dahari, U., Avni, G., Kloner, A. (1987). 'The Jewish Necropolis of Beth Govrin', *Qadmoniot* XX nos. 3–4 (79–90):97–102. (Hebrew)

Kloner, A. (1993). 'Beth Guvrin'. In E. Stern ed. *The New Encyclopedia of Archaeological Excavations in the Holy Land*, Vol. 1 , Jerusalem:195–201.

Kloner, A., Hubsch, A. (1996). 'The Roman Amphitheater of Bet Guvrin: A Preliminary Report on the 1992, 1993 and 1994 Seasons', *Atiqot* XXX:85–106.

Oren, E. D., Rappaport, U. (1984). 'The Necropolis of Maresha–Beth Govrin', *IEJ* 34:114–153.

Tsafrir, Y., Di-Segni, L., Green, J. (1994). *Tabula Imperii Romani-Iudaea Palaestina*. Jerusalem.

Survey and Excavations at the South-East End of the Dead Sea in Jordan

K. D. Politis

During the last decade intensive surveys in conjunction with new excavations have been conducted at the south-eastern end of the Dead Sea in Jordan. These have substantially increased our knowledge of the area for the Bronze and Iron Ages, the Roman/Nabataean, Byzantine and medieval Islamic periods. The results of work at three sites were recently presented in a lecture to the Anglo-Israel Archaeological Society by K. D. Politis, the director of those projects. They include: the Sanctuary of Lot at Deir ʿAin ʿAbata, the Nabataean cemetery at Khirbet Qazone and the Biblical city of Zoar – comprising Tuleila Qasr Moussa Hamid, Khirbet Sheik ʿIsa, Tawahin es-Sukkar and An Naqʾ.

The Sanctuary of Lot was excavated from 1988 to 1999. It is comprised of a triple-apsed basilical church built around a natural cave which the early Christians believed was the place where Lot and his daughters took refuge after the destruction of Sodom and Gommorah (Genesis 19). The church is flanked by a seven-metre deep arched reservoir on the south and a domestic and hostel area to the north. The complex formed a *coenobium* type monastery occupied from the 7th to late 8th centuries AD and dated by two mosaic floor inscriptions and ceramics. There was evidence for an earlier Byzantine foundation of the monastery, as well as Roman/Nabataean, Middle Bronze II and Early Bronze I occupation at the site.

Khirbet Qazone is a 1st to 3rd century

AD cemetery site of a Nabataean character. During 1996 and 1997 over 3,500 shaft graves were recorded, most of which had been recently robbed-out. Their structure is identical to those at Khirbet Qumran. Several *betyl* grave markers were found as well as typical Nabataean pottery and jewelry. The most remarkable discovery though, was over 40 complete and semi-complete Graeco-Roman textiles in relatively good preservation.

Currently an intensive survey is being conducted in the Ghor es-Safi with the future prospect of conducting large scale excavations there. Tawahin es-Sukkar has been identified as a large industrial complex related to sugar production during the 12th to 15th centuries AD. The Khirbet Sheik ʿIsa site is the commercial centre of the medieval Islamic and Byzantine city of Zoar. The An Naqʿ area comprises an expansive Early Bronze Age necropolis. Adjacent to this is the Byzantine cemetery relating to the city of Zoar which has yielded Christian and Jewish tombstones. Tuleila Qasr Moussa Hamid has only recently been identified as the Iron Age site of Biblical Zoar.

The Material Culture of Northern Israel at the Time of the Achaemenid Empire (532–332 BC) – Two Recent Excavations

Yardenna Alexandre

The Nature of the evidence. The combined evidence of the historical, literary, epigraphic and archaeological material available permits only a sketchy reconstruction of the Persian period in the north of Israel. Archaeological surveys have consolidated the view that the deportations carried out by the Assyrians at the end of the 8th – beginning of the 7th century BC led to a severe depletion in the population of the north of the country. Although other populations were introduced to the region from Syria and beyond, the recovery of the population in the 6th century BC was slow. Surveys have revealed that most areas of the country were extensively populated in the 5th century BC and excavations have exposed a wealth of finds dating from this period. On the other hand, there is a dearth of architectural evidence for cities, town-planning, public buildings and domestic architecture, which has led to the view of the Galilee as a region of dispersed villages, with limited town life.

It seems, however that the archaeological picture is fragmentary as a result of several factors. Firstly, several of the large mounds were abandoned at the end of this period, as a result of which the top layer of settlement was subject to long-term erosion and damage (e.g. Megiddo, Yoqneam). Secondly, where settlements continued into later periods, the Persian level suffered extensive damage from the intensive building activities of the Hellenistic-Roman period (e.g. Samaria, Shechem). Thirdly, the tell sites were largely occupied by a palace-fort or large building (e.g. Hazor, Megiddo). It is necessary therefore to make use of all the available materials in order to present as coherent a picture as possible.

The geographical-historical background. Israel, or Palestine, was a minor region in a vast empire in the Persian period. It was included in the satrapy of *eber nahari*, 'Beyond the river', which at the time of the foundation of the empire by Cyrus the Great (539–530), included Babylonia and all the conquered Babylonian territories. In the reorganization of the empire under Darius I (522–486 BC), it appears that Babylonia and Assyria were formed into a single satrapy (the 9th) and Syria, Phoenicia, Palestine and Cyprus were a separate satrapy (the 5th). The internal administrative divisions of the satrapy are not well-defined due to a lack of clear information from the written sources. It is the general consensus that the Achaemenids adopted the internal administrative framework from the previous Assyrian and Babylonian rule. The 5th satrapy was divided into provinces (*phwh* or *medinah*), autonomous cities and tribal areas. The provinces included Galilee, Samaria, Judah, Idumaea and

Ashdod. The northern coastal cities were under the jurisdiction of the Phoenician cities (Tyre, Sidon). The northern coast of Israel may have been organized as the province of Dor. The southern coast (Gaza) and the Negev were controlled by the Arab tribes.

The Galilee. Historical sources of the Persian period do not mention any cities in the Galilee inland area and the main town or the capital of the Galilee province has not been established. Potential candidates are Megiddo (the capital under the Assyrian administration), Hazor, or Akko towards the end of the Persian period. The pottery and the finds from the inland sites (e.g. from Dan, Hazor and Beth Yerah) are similar to the finds from the sites along the coastal plain, pointing to a Phoenician population, or at least a strong Phoenician influence.

The Galilee coast and the Akko plain. The literary evidence mentions three important coastal settlements: Akhzib (Ecdippa), Akko and Shikmona. These towns were probably under the authority of the kings of Tyre. The archaeological excavations and surveys revealed significant occupational levels at these sites and at a fourth site – Tell Abu Hawam, as well as a dense network of rural settlements in the hinterland of the sea ports.

The coast from Shiqmona to Jaffa. This short coastal strip was densely populated with more than 35 large and small settlements, including Dor, which may have been the capital city. The inscription on the tomb of Eshmunezer, the king of Sidon, indicates that Dor and probably Jaffa, belonged to Sidon by the 5th century BC. The literary sources and archaeological excavations have clearly demonstrated that the coastal area was densely populated and that there were many flourishing settlements.

Two sites between Dor and Yoqneam. Nahal Tut: This is a site located next to a river in the Wadi Milikh road about 8 km from Yoqneam. A courtyard building with a large open courtyard, surrounded by rooms and a circumvallating wall. The sizes of the room varied and were used for several activities and for storage. A single period site which came to an end in a violent destruction. The finds at the site indicated clearly that the site was used for agricultural activities, the production of wheat, the preparation of flour and storage of agricultural produce on a large scale. Secondary activities included sheep shearing and fishing. Weapons included arrowheads, daggers and a catapult head. The destruction of the site was probably at the hands of Alexander the Great, as evidenced by the Macedonian-minted low denomination bronze coin found in the destruction level.

Ein Hofez. Located about 3 km to the south-west of Tell Yoqneam, and some 6 km from Nahal Tut. There is an adjacent water source and the surrounding land is arable. The site is complex, consisting of several phases of occupation within the Persian Period. The building remains consist of a large number of interconnecting rooms, exhibiting several alterations and at least three floor levels. There may have been a circumvallating wall with a limited number of entrances. The rooms contained several *tabun*s (ovens), pits and a bath. The finds in the building consist of large quantities of pottery, including various types of storage jars and a very large quantity of metal (iron and bronze) implements. From the finds, which bear a strong resemblance to the finds from Nahal Tut, it is clear that the occupants of the settlement were involved in agriculture, producing wheat and flour. Additional finds include pottery imports from Cyprus and Greece, possibly luxury items from Egypt, a limestone incense altar, bronze ladles, bowls and needles. Coins include 4th century BC Sidonian silver coins and two silver tetradrachmas of Alexander the Great.

The contribution of the two sites to our understanding of the Persian period. The two sites have much in common, yet throw light on different aspects of the settlement in the Persian period. Nahal Tut is a single-period site, established late in the Persian period, according to the architectural plan of

courtyard buildings, well-established in the Persian period. There were few occupants of the building, not families, and they were involved in the production and storage of produce for the central government, most probably for the Persian army. The site was destroyed by Alexander the Great in 332–331 BC. The site at Ein Hofez was established in the 6th – early 5th century BC. It was a complex domestic occupation where a broad variety of activities took place over a couple of centuries. In the last phase of the Persian period the site was not subject to destruction. It is probable that the occupants fled when the Nahal Tut site was destroyed and subsequently the site was occupied by the Macedonian army without an intervening break.

On a general note, it must be pointed out that, whereas from the historical sources it is clear that the area was under the control of the Persian Achaemenid empire, the material finds show strong Phoenician influence and there is almost no hint in the finds of the Persian presence.

Grants Given by the Society

ROBINA RENDALL

Extracting teeth from a rotting sperm whale was not precisely what I had in mind when I joined those excavating at Tel Dor this season. However, it was my first experience of digging and I was prepared to be surprised . . . but perhaps I should rewind a bit.

There were about a hundred and fifty of us digging at Dor this year. It was the nineteenth season of excavation under the direction of Ephraim Stern of the Hebrew University in Jerusalem. Groups arrived from as far afield as Germany, South Africa, Korea, the USA and, of course, Israel. I found myself with the group from UC Berkeley in California, under Andrew Stewart. Among the ranks were Canadians, an Italian, a Venezuelan, a Siberian, and three of us from sunny Glasgow!

We soon accustomed ourselves to the routine of eating, sleeping, and breaking rocks in the hot sun. Accommodation at Pardes Hanna Agricultural School was basic, but friendly and welcoming. The food was not gourmet, but peanut butter was plentiful, so I was happy.

During the dig we were encouraged by Andy and his excellent team of supervisors to get involved with as many aspects of excavation as possible. These included washing pottery, taking levels, filling in day books and so on. There were also optional lectures, classes in archaeological illustration, pottery reading, locus card writing and optional expeditions to the local Tishbi winery for tasting sessions!

It was all interesting, and some of it challenging, but I discovered early on that my forte was wielding a pick-axe. Despite the unaccustomed heat, I found great personal fulfilment in hacking up the earth like a woman possessed! When I came to possess my own pick, that was left by a looter in the night, my cup of happiness was full. Fortunately, the damage left in his wake was not too severe.

This year's dig was not notable in terms of small finds – mainly lamps, bone needles and a few coins – but two items are worth mentioning. A tiny golden bull's-head was found by the Cornell group. I believe it was from the Iron II phase and was thought to be Canaanite. In our area was found a small polished amethyst with a warrior etched onto its surface.

In my square we were digging through Roman remains (second century AD). We were breaking new ground, so the first week was a little sparse on discoveries – a robbed out Moslem grave, and a lot of tumble. However, on the eighth day of digging I was rewarded by the discovery of an extremely well preserved *tabun* (oven), embedded in a courtyard on the east side of the embarcadero (main street). From this point on, my activities at Dor had a maximum radius of about fifty centimetres.

I spent my days sitting in an oven (which was worthy of the name!), and excavated it to a depth of well over a metre. After this we removed it carefully, brick by brick, for possible reconstruction at the site museum 'The Glasshouse' in Kibbutz Nahsholim. Since two more *tabuns*, of slightly different construction, and a stone kiln were found in close proximity, we concluded that they comprised some kind of industrial installation, though for production of what was unclear.

Nonetheless, I still maintain that my best find of the season was my sperm whale tooth. In the final week

(fortunately) the whale washed up on the shore below our area, and made its presence felt with a stench that cannot be described! As there was no immediate way to move it, it was fortunate that the dig was drawing to a close. Since sperm whales apparently do not occur in the eastern Mediterranean, it was surmised that this one had drifted quite a distance since it expired – a fact that I was well able to believe as I joined the marine biologists from Haifa University on the beach.

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