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Man's Role in the Shaping of the Eastern Mediterranean Landscape

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The effects of irrigation agriculture: Bronze and Iron Age habitation along the Khabur, Eastern Syria

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ABSTRACT: Recent archaeological research in the Lower Khabur area of northeastern Syria focusses on Bronze and Iron Age habitation. Ancient agriculture in the area must have been based primarily on irrigation, the precipitation regime being unfavourable for rain-fed agriculture. In the Early Bronze Age (ca 3000-2000 BC) and probably also in the Middle Bronze Age (ca 2000-1500 BC) local irrigation systems seem to have existed. In the period ca 1275-1075 BC, under firm and well-organized Middle Assyrian control, large-scale irrigation agriculture fed by regional canals developed. Agriculture in the Lower Khabur area flourished again in the 9th to 7th centuries BC, under Neo-Assyrian supremacy.

1 IRRIGATION AGRICULTURE

Irrigation agriculture in the Near East has been practised since the Neolithic. The earliest evidence of an irrigation system was discovered at Choga Mami, some 110 km east of Baghdad, near the Iraqi-Iranian border. It is dated to the sixth millennium BC, to the Samarran Phase of the Pottery Neolithic Period (Oates and Oates 1976). It is widely accepted that irrigation agriculture formed the basis of the urbanization process in Mesopotamian civilization, which in turn led to the first "Hochkultur", characterized by the introduction of writing and the use of the cylinder seal as an expression of advanced division of labour, craft specialization and administration (Nissen 1988). Various aspects of the beginning of irrigation agriculture and of its effect on prehistoric and historical society have been discussed by Boserup (1965), Harris (1969), Smith (1972), Oates (1972, 1980), Adams (1972), Flannery (1976), and others. These works give a general outline of the development of agriculture in relation to natural conditions and society in the ancient Near East. At the same time the need for more historical data, raised on a local and/or regional basis, emerges.

Before discussing the effects of irrigation, a brief thought may be devoted to the preconditions for irrigation. There are five important ones which come to mind:

1. the necessity of irrigation, generally caused by the climatic situation and the environment;
2. favourable natural conditions for building an irrigation system;
3. the technical know-how for building it;
4. the "financial" means;
5. a stable, powerful government, or at least a community to carry out such an enterprise and to maintain it once it has come into use.

The possible effects are listed below in the form of advantages and disadvantages, their importance varying only according to the scale of the irrigation works.

Advantages
- agricultural intensification
- improved transportation system
- larger yields
- stabilization of income
- more regular settlement pattern
- occupation and exploitation of otherwise remote areas

- population increase
- stabilization of government, society and culture

Disadvantages
- salinization
- lack of floods
- environmental change

Even without listing all features it cannot be overlooked that the advantages outnumber the disadvantages in quantity and quality. At least superficially the disadvantages appear to be minor effects, although in the long run they may be disastrous.

It is obvious that the encountered features form a causal chain, leading to what may be generalized as "more civilization". On the negative side, they lead to deforestation and unwarranted exploitation of soils, flora and fauna, so that salinization, desiccation and devastation are the long-term (or sometimes the surprisingly short-term) consequences.

2 TELL SCHECH HAMAD

In this paper the effects of irrigation within a certain area and historical time range (3000-500 BC) are to be investigated. Until very recently any basic information on the subject in the fields of archaeology, history, (palaeo)botany, (archaeo)zoology, geomorphology and agriculture for this area has been very scanty. This situation may be explained by the lack of archaeological research, but even more by the lack of an interdisciplinary approach to the problems. Moreover, such questions were not even raised.

Being an archaeologist, I will restrict myself to field-archaeological and historical observations. But having initiated an interdisciplinary project in the area I will use some of the arguments and results my colleagues have arrived at so far.

The Khabur is the largest tributary of the Euphrates, carrying water throughout the year and with an average discharge of 50 cu m/sec. Its spring consists of thirteen karst depressions, one of the largest karst springs in the world. Geographically the Khabur region

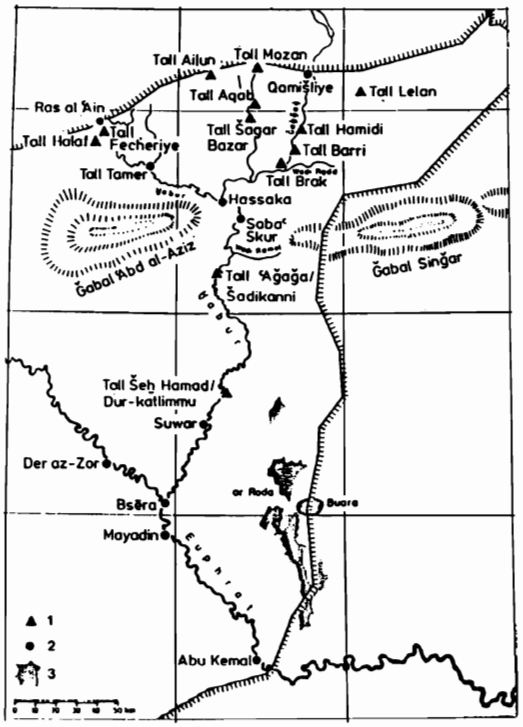

Fig. 1. Map of the Khabur region in northeastern Syria (Ergenzinger 1988). 1. Ancient site; 2. Modern town; 3. Salt-pan.

can be divided into two parts, the Upper Khabur, between Ras al-'Ain and Hassake, and the Lower Khabur, between Hassake and its junction with the Euphrates (Fig. 1). Included in the "Khabur region" is the fan-shaped area of its tributaries north of Hassake, draining a large part of the southern Turkish Taurus range. The river itself marks the western edge of this triangular area, flowing at first in a southeasterly direction to Hassake. Because of the volcano Kaukab, just east of Hassake, and because of a southward-stretching volcanic ridge, the river is diverted to a straight southward course which it maintains until its confluence with the Euphrates. The course of the river passes through three zones of precipitation. The spring lies in a zone of 300 to 400 mm average annual precipitation, the town of Hassake and a narrow zone up to 80 km south of it receive between 300 and 200 mm rainfall. The area south

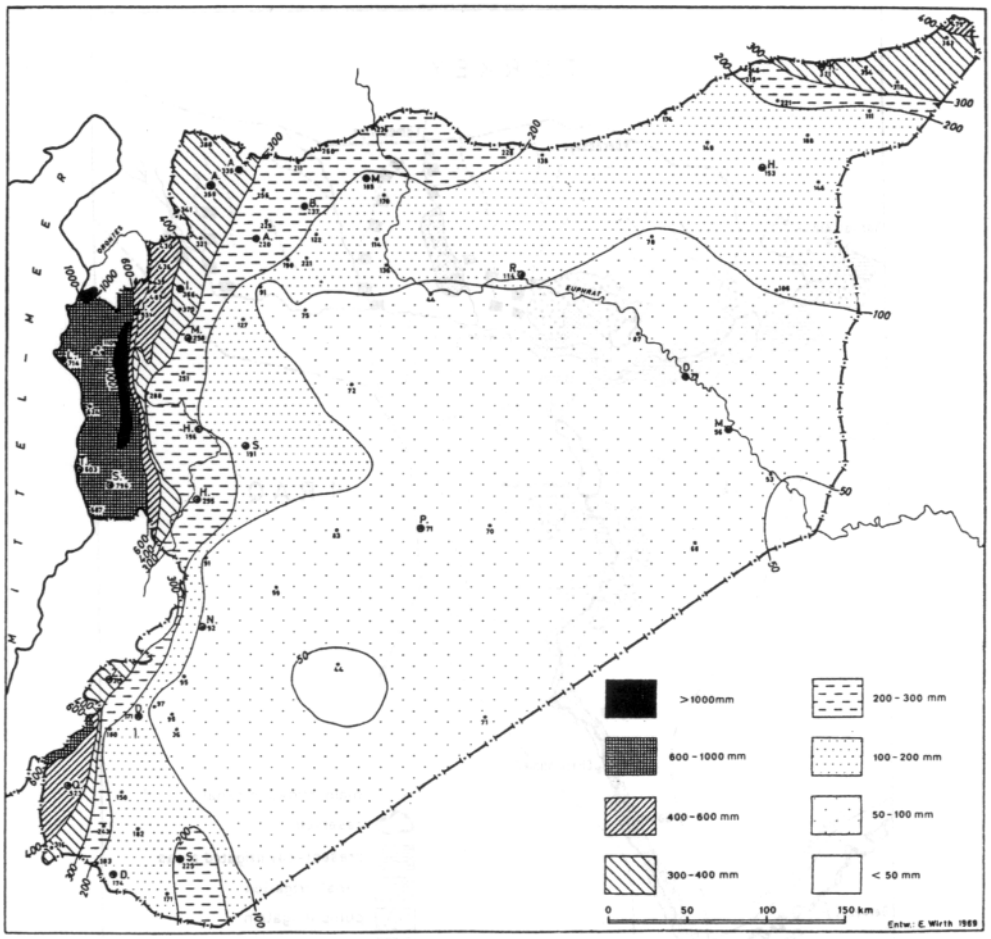

Fig. 2. Mean annual precipitation in the dry years 1958-1960 (Wirth 1971, Map 4).

of this line gets less than 200 mm precipitation. The area of the tributaries barely extending south of Kamishli, which might be regarded as a fourth zone, receives between 400 and 600 mm precipitation (Wirth 1971:Map 3).

According to a division of agricultural zones defined by the Food and Agriculture Organization of the United Nations and based on "intensity and reliability of rainfall", the Khabur region would meet the criteria of four types of zones (FAO 1982; Hopfinger in press). In other words, over a distance of roughly 300 km the Khabur passes through three zones of precipitation and four agricultural zones.

How sensitive the agricultural zones are to the intensity and reliability of rainfall is amply demonstrated in years of drought (Wirth 1971:Map 4; cf. Fig. 2). There are extreme shifts of the zones of precipitation to the north. The whole valley of the Khabur is then situated in the zone of less than 200 mm rainfall. Therefore it has been argued elsewhere (Kühne in press a) that the general geoclimatic and agronomical conditions along the Khabur necessitate a regional irrigation system. It is exactly this reason why the Syrian government is planning large water reservoirs, a dam and a regional canal project (Hopfinger 1984; cf. Fig. 3).

Archaeological research in the Khabur region has been fairly limited. Several explorers and travel-

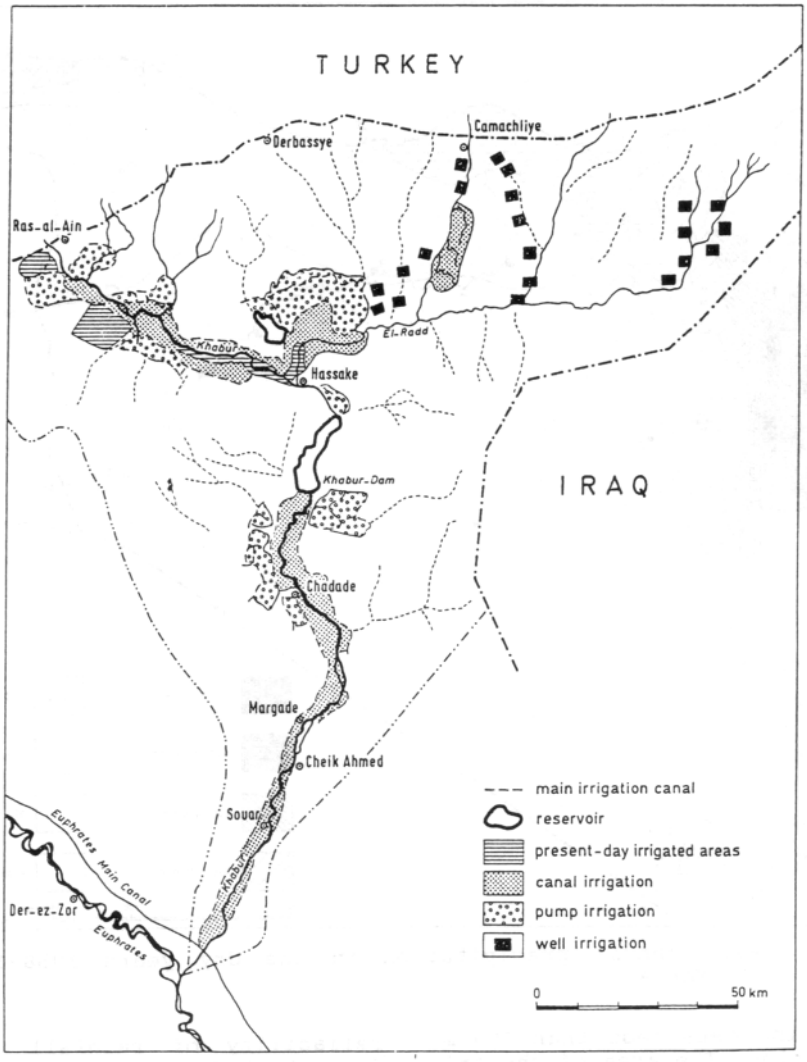

Fig. 3. Map of the planned Khabur irrigation project (Hopfinger 1984).

lers passed through the area during the second half of the last and the early part of this century, but only a few took a closer interest. From their observations the pioneering work of Oppenheim (1899-1900, 1931, 1943-1962), Sarre and Herzfeld (1911-1920), Poidebard (1934) and Mallowan (1947) ensued. But no systematic survey was made until the "Tübinger Atlas des Vorderen Orients" took up this challenge for the Lower Khabur in 1975 and 1977. The main points of interest for the TAVO were the historical periods of the Bronze and Iron Age (roughly between 3000 and 500 BC), the cuneiform sources of which mention a large number of villages and towns along the river. A fairly complete inventory of nearly 130 sites along the river banks was worked out (Kühne 1974-1977, 1978-1979), covering a time range between the Aceramic Neolithic (around 7000 BC) to the present. As a result of this survey, excavations were undertaken at Tell Schech Hamad in 1978 (Kühne 1984, 1986) and continued yearly since 1980. In 1983 an interdisciplinary programme was launched, endeavour-

ing to reconstruct the environmental conditions of the main settlement period of this site, the Assyrian Period, between 1300 and 500 BC.

Tell Schech Hamad thus became the first systematic excavation along the Lower Khabur. Because of irrigation plans of the Syrian government, a number of rescue excavations have been started in the northern third of the Lower Khabur. Among them is the excavation of Tell Bderi, under the direction of the present author, sponsored and financed by the Free University of Berlin and carried out by Peter Pfälzner (1988a) as field director. This site is situated about 100 km north of Tell Schech Hamad, also on the east bank. It was included in the interdisciplinary programme, as well as Tell 'Agaga, situated about 70 km north of Tell Schech Hamad on the west bank and excavated by As'ad Mahmoud, the director of the National Museum at Deir ez-Zor (Mahmoud 1984; Mahmoud et al. 1988). Thus, the interdisciplinary programme operating from these three base camps, was based on regional data.

None of the numerous sites on the Upper Khabur has been excavated so far, except Tell Halaf and Tell Fakhariyah (McEwan et al. 1958). Archaeological activity after the Second World War has concentrated on the sites situated in the fertile plains of the fan-shaped area of the Khabur tributaries. Several surveys were undertaken, one of which has been published (Meijer 1986), and excavations were carried out in Tell Brak (Oates 1987), Tell Barri (Pecorella and Salvini 1984), Tell Leilan (Weiss 1983), Tell Hamidiya (Eichler et al. 1985), and Tell Mozan (new excavation, directed by G.Bucellati).

Even during the first campaign in Tell Schech Hamad, the Assyrian name of the site had emerged from a Middle Assyrian archive: Dur-katlimmu (Röllig 1978). This name was already known from other Assyrian sources, mainly the Assyrian annals, which describe the town as one of the military stations along the river. After ten successive excavation seasons, the local function and development of this town is quite well understood (Kühne in press b). It may be summarized briefly as follows: Surface finds indicate a small, village-type settlement as early as in the Late Chalcolithic (late 4th millennium). It was continuously occupied throughout the Early and Middle Bronze Age until the Middle Assyrian period. Then, in the 13th century BC, King Salmanassar I of Assyria seems to have enlarged the settlement area; he fortified the place and established it as a provincial administration centre. The intramural settlement then covered an area of about 15 ha. During a period of political weakness of the Assyrians in the 11th and 10th centuries BC the town was taken over by the Aramaeans. It eventually returned to Assyrian supremacy in the 9th century BC. In the late 8th and during the 7th century BC the intramural settlement was enlarged to 55 ha. Adding the extramural settlement area of another 50 ha, the Assyrian town of Dur-katlimmu now covered an area of over 100 ha. Apparently, the town became a military base camp in addition to its former function. One century after the downfall of the Assyrian empire the enlargement was given up and the intramural settlement was reduced again to its original 15 ha.

Using conventional demographic factors (150 persons per ha of intramural settlement area) the population of Dur-katlimmu must have increased from 2250 in the 13th century BC to about 9000 in the 7th century BC (including the extramural settlement). At the end of the 6th and in the 5th century BC the population apparently dwindled to its original size of about 2250 persons. In comparison, the nearby modern village of Garibe has 2200 inhabitants. Economically, this population has reached the limits of the area's agricultural potential in spite of modern pump irrigation (Hopfinger in press).

What caused this Assyrian extension and how was it supported? It was this question which led to the above-mentioned interdisciplinary research. At present Tell Schech Hamad is situated about 50 km south of the 200 mm isohyet. This line is generally accepted as the border between rain-fed and irrigation agriculture. The sensitivity of the

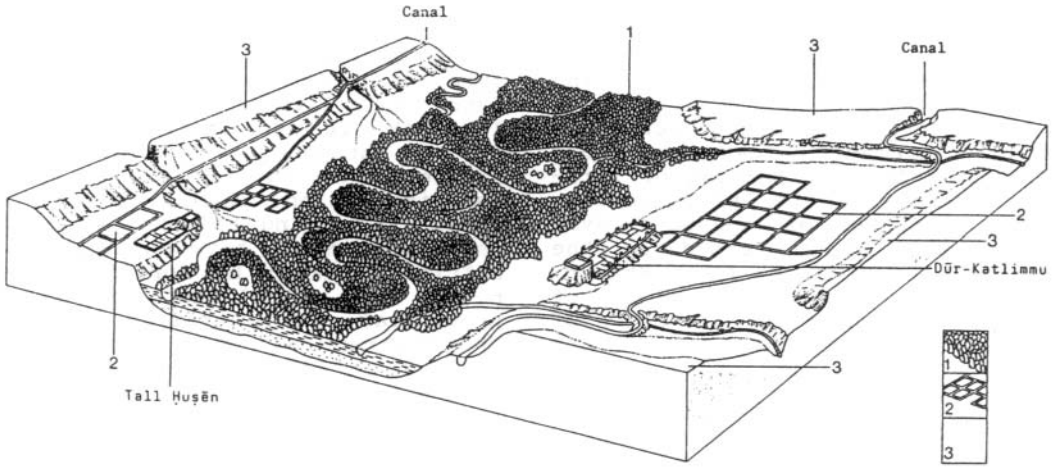

Fig. 4. Reconstruction of the surroundings of the Assyrian town of Dur-katlimmu (Frey and Kürschner in press). 1. Floodplain of the Khabur with Populetum euphraticae forest (Populus euphratica, Platanus orientalis, Tamarix spp.) and reedswamps (Phragmites australis, Typha sp.); 2. Irrigated field systems, partly on alluvial soil; 3. Upland with desert vegetation (Hammadetea salicornicae) and steppe vegetation (Artemisietea herbae-albae mesopotamica).

area to precipitation can be felt physically by driving from Tell Schech Hamad up north to Tell 'Agaga and Tell Bderi. But as mentioned above, in years of drought the whole valley of the Khabur moves into the zone below the 200 m isohyet. This means that irrigation is of essential importance to settled people in the area.

Because of the climatic sensitivity of the area, it is obvious that even small oscillations could have far-reaching consequences for the economy of the area, for the subsistence of the people. Recent investigations by our botanical and palynological colleagues have resulted in the statement that no dramatic changes of climate have taken place (Gremmen and Bottema in press; Frey and Kürschner in press). The present natural vegetation is highly degraded due to deforestation, cultivation and overgrazing, but it is basically not different from the ancient vegetation. However, in Assyrian times the landscape must have looked quite different (Fig. 4). Within the 1.5 to 2 km wide river alluvium, several river beds can be reconstructed (Ergenzinger and Kühne in press; Frey and Kürschner in press) with marshy soils and rich vegetation of reeds, shrubs and a considerable amount of gallery forest, providing a natural habitat for the animals, whose bones were found in the excavation (Becker in press). Generally, this reconstruction must be correct, but some doubts remain, especially in view of the climatic sensitivity of the area. We must perhaps look for different indicators, which could be provided by the cuneiform texts of the 13th century, discovered at Tell Schech Hamad. This archive consists mainly of economic texts, loans and receipts concerning grain and cattle. Röllig (1987) concluded that the relation between seed corn and yield fluctuated between 1:1 and 1:9, averaging 1:3 or 1:4. Röllig suggests that this fluctuation is associated with rain-fed agriculture. This argument is taken up by Hecker (in Frenzel 1987), who adds some data from Nuzi to arrive at the conclusion that climate in the 13th century BC was moister than today, so that rain-fed agriculture was possible in the area of Tell Schech Hamad/Dur-katlimmu.

This suggestion is in contrast with the results Brentjes (1982, 1988) arrived at. He derived the climatic development from sea-level oscillations and related the

achieved optima and pessima to historical events. This leads him to postulate that especially the end of the second millennium BC was a climatic pessimum in the Eastern Mediterranean region, causing the migration of the sea people, the downfall of the Hittite and Babylonian empires and a weakening of the Assyrian empire. In the first millennium BC the provisioning of the postulated increase of population in the region of the Khabur created an even larger problem. Brentjes (1982, 1988) and Hecker (in Frenzel 1987) agree that climate then was a little moister than today. Even so, Dur-katlimmu may have been situated at best at the periphery of rain-fed agriculture. The larger population was even more in need of a guaranteed subsistence. Any crop failure must have been a catastrophe. To support a population of 9000 three times as much grain as is harvested today was needed. For growing that amount of grain crop additional water would be required. Where, then, did the water come from?

In 1983, an artificial depression, 2.4 km east of Tell Schech Hamad, was discovered (Kühne 1984). It had been noticed already by Van Liere and Lauffray (1954-1955) and must be interpreted as an ancient canal. It can easily be distinguished in the landscape, because there is no other regular depression of this size. It was surveyed at three points, viz. near Hassake, Shaddada and Marqada. Disregarding the dams, the depression is 8-6 m wide and 1-3 m deep.

The first impression of a local system for irrigating the area of Dur-katlimmu soon proved to be wrong. Airphotos showed longer sections of two canals still visible along both sides of the Khabur. It was possible to verify most of these on the ground (Ergenzinger 1987). The western canal (Fig. 5) can be traced from the Upper Khabur down to the junction with the Euphrates with its head south of the Ras al-'Ain, near the mouth of Wadi Girgib. It amounts to a length of about 250 km. The eastern canal cannot be traced along the Upper Khabur (Fig. 5). This is due to a southern ridge of the volcano Kaukab which also causes the river to change its direction. It was not

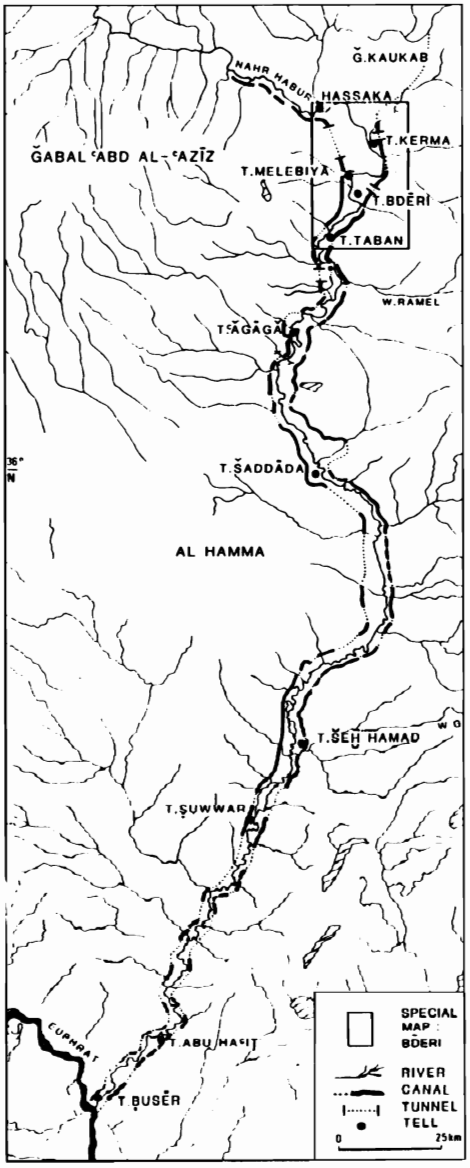

Fig. 5. Map of the Assyrian canals (Ergenzinger 1987).

possible for the builders of the canals to penetrate this ridge. A natural configuration of several rapids near Tell Kerma, south of Hassake, seems to indicate the head of the canal (Ergenzinger 1987; Ergenzinger et al. 1988). Later investigations suggested that the water from the river Gaggag, northeast of Hassake, had been diverted

to the canal, bypassing the volcano Kaukab in the east (Ergenzinger and Kühne in press). Thus, the eastern canal reaches a length of about 220 km, down to the junction of the Khabur with the Euphrates, where it most probably joined a canal on the north bank of the Euphrates (Geyer and Monchamber 1987).

The canal-builders had to deal with a number of obstacles. Numerous wadis had to be crossed, most probably by earth dams, since no remains of constructions such as stone dams or bridges have been discovered so far. Earth dams must have been subject to frequent damaging or destruction. It appears therefore that a number of settlements very near to crucial points of the canal were founded for the purpose of regularly observing and maintaining the canals (Kühne in press a). Another obstacle was the wide gypsum and limestone mountainnous area which had to be crossed. This was done by tunnelling. Two tunnels have been traced in the vicinity of Tell Bderi, and one large one on the west side south of Hassake.

Subsystems have been traced in patches only. Branches of subcanals can be observed fairly frequently, but ancient field irrigation has almost completely been destroyed by later agricultural activity. Two field systems have been surveyed, one at Shaddada and the other near Tell 'Agaga, leading to Tell Maraza. Both had been observed already by Van Liere and Lauffray (1954-1955).

At two points drill sections were taken: near Tell Bderi and Tell Schech Hamad. The gradient near Tell Bderi was 0.09%; near Tell Schech Hamad 0.17%. Over a longer distance the gradient averaged 0.35%. The velocity of the water was 2.5-3.5 cu m/sec. The loss of water by seepage through the canal bed must have been about 400 l/sec, which amounts to about 13% on a distance of 200 km. This figure probably has to be doubled because of water seepage on the slopes. The discharge of the Khabur averaged 50 cu m/sec (see above) prior to modern motor pumping. Given this figure, about 10% of the Khabur water was diverted into the canals.

To construct these canals must have been a major task. Their main function must have been that of irrigation. Van Liere and Lauffray (1954-1955) calculated that the four canals had irrigated about 30,000 ha between Ras al-'Ain and Tell Schech Hamad (they assumed that the eastern canal had ended at Tell Schech Hamad). According to our calculations, the irrigable land around Tell Schech Hamad/Dur-katlimmu was tripled by the use of the canals in comparison to modern pumping irrigation, thus providing means of subsistence for a population three times as large as today's. Thus, the above-estimated figure of 9000 inhabitants for ancient Dur-katlimmu is almost exactly met by a completely different approach.

Another function of the canals may have been traffic routes. Ergenzinger and Kühne (in press) have said that the size of the canals and the size of Babylonian tow-barges fit well, according to Salonen (1939). The necessary power to tow a load of 10 tonnes upstream along a canal was less than 600 Newton, less than two horses can pull. Thus, a cheap means of transportation of heavy goods was available. Tow-barge navigation on the Khabur, on the other hand, can be ruled out because the reconstructed vegetation and environmental situation would not allow for a tow-path.

The most crucial point is the dating of the canals. A trench through the dam of the canal near Tell Schech Hamad revealed no architectural remains. Only two sherds of Late Roman/Byzantine brittle ware were found in the second layer. The lower layers were sterile. On the surface of the area around the excavation 32 sherds were collected. Later on, another 20 sherds in the adjacent areas were sampled. The oldest sherds belong to the chaff-tempered Assyrian ware, the largest amount of pottery is Late Roman sandy ware, and some sherds are glazed Islamic ware. These assemblages suggest a date for the construction of the two canals and their first functioning in the Neoassyrian period, in the 8th or 7th century BC. The canals were continuously used until the Mongol raid in the 13th century AD, which totally devastated the Khabur valley (Ergenzinger et al.

1988:122).

The Assyrians are well-known as constructors of long-distance irrigation canals, the tradition starting as early as the 14th century BC. If Reade (1978) is right in stating that "there is evidence that Sanherib and some other Assyrian kings built canals almost anywhere that it seemed practicable to do so", then we need not even wonder why there is no written evidence so far on the Khabur canals. It may be an Assy-rian understatement to the effect that they regarded the construction of the Khabur canals as an everyday task.

3 THE EFFECTS OF IRRIGATION AGRICULTURE

To come finally to the effects of irrigation agriculture on the Khabur, it has to be stressed that, to judge these effects, our data are as yet rather scanty and unreliable. It has been argued elsewhere (Ergenzinger et al. 1988) that the most indicative effects of irrigation would be reflected in the settlement pattern, but the archaeological evidence is very poor. For although we assume the existence of these older irrigation works, we cannot trace them on the ground, and even if we could, we often cannot date them. It has to be considered also that earlier irrigation works have been destroyed in the course of repairing them or building new ones.

Of major importance is also the reconstruction of the history of climate. It has been demonstrated above, that the Lower Khabur valley is a very sensitive area to minor climatic changes. As was shown also, there are few data, and worse than that, it seems that there are few if any methods of reconstructing regional climatic fluctuations. The analysis of molluscs from Tell Schech Hamad (Reese in press) and Tell Bderi may shed some light on this problem. In other fields the situation is no better: little is known for example about the effects of irrigation agriculture on soils in this particular area and time range (Van Liere 1965; Mousli 1979). An investigation of the soils and a classification have been carried out during the last two seasons by the pedologist U. Smettan (Figs. 6 and 7) within the environs of Tell Schech Hamad, in order to estimate the agronomic potential of the Assyrian town of Dur-katlimmu. According to her results, the agronomic soil potential around Tell Schech Hamad to be irrigated by the ancient canal amounts to about 500 ha, not sufficient to nourish 9000 people. Other areas north and south of the wadis limiting this potential must have been included in the catchment area of Dur-katlimmu. These and other data make it worthwhile to re-evaluate the relationship between the canal and the development of settlements as an indicator of irrigation agriculture. It has to be kept in mind that our general assumption is that the settlements had to rely on irrigation because the climate never was sufficiently favourable for rain-fed agriculure to be carried out without risk.

From the beginning of the Early Bronze Age (roughly 3000 BC) down to the end of the Middle Bronze Age (around 1500 BC) only local systems of irrigation seem to have existed along the Lower Khabur, concentrating in the northern part of it while the southern part remained rather remote. In the Early Bronze Age the alignment of settlements at Tell Kerma, Tell Raga'i and Tell Ga'bi on the east bank, Tell Mullamatar and Tell Gudede on the west bank, or Hirbat al-Banat, Tell Snetle and Hirbat Snetle a little further south, could be interpreted as an indicator of local irrigation systems. The fact that these sites were settled almost exclusively during that period, could underline the reliance on such local irrigation works. On the other hand, centres in the steppe, such as Tell Malhat ed-Deru, Tell Mu'azzar, Tell Matiyaha, Tell Murtiya south of the Jebel 'Abd al-'Aziz, and - just to mention a couple north and west of the Jebel 'Abd al-'Aziz - Tell Mabtuh-West and Tell Huera which also flourished almost exclusively during the Early Bronze Age, existed without irrigation (so far no traces of irrigation works have been discovered).

It cannot be denied that these two assumptions are contradictory to a certain extent. Why should the settlements on the Khabur need

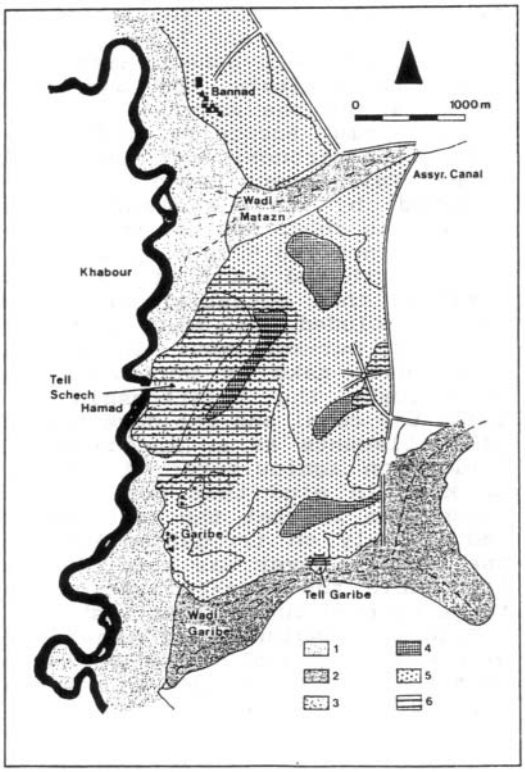

Fig. 6. Classification of soils around Tell Schech Hamad, according to U. Smettan. 1. Floodplain sediment of loamy clay; 2. Wadi sediment of sandy and argillaceous loam; 3. Tell deposits of silt and loam; 4. Silt on argillaceous loam; 5. Silt on sand and gravel; 6. Neo-Assyrian pottery sherds.

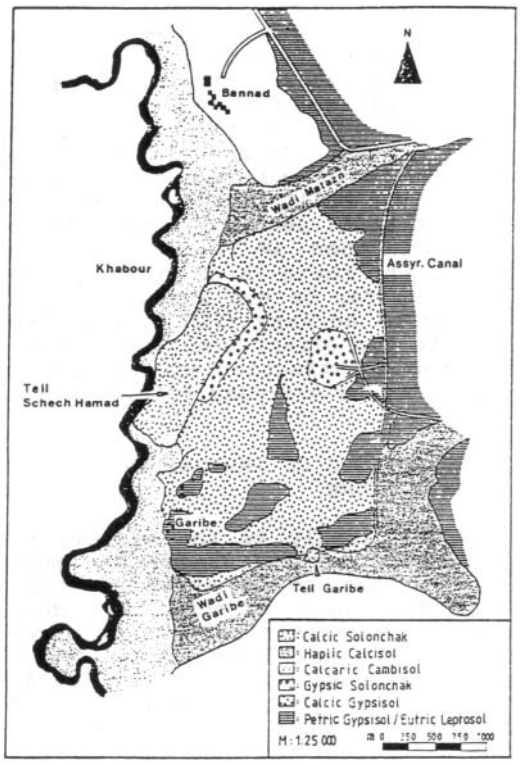

Fig. 7. Classification of soils around Tell Schech Hamad, according to U. Smettan.

local irrigation systems while the settlements in the steppe existed on rain-fed agriculture? One could argue that the settlements on the Khabur used the natural resources for irrigation to exclude any risk. This does not explain the existence of the settlements in the steppe south of the Jebel 'Abd al-'Aziz. A solution is offered by climatologists, suggesting a moister climate in the third millennium BC (Brentjes 1982:471). At the end of the Early Bronze Age, both the settlements in the steppe and those along the river declined, possibly because the climate became drier (Brentjes) and because of political factors which coincided with this development (Moorgat-Correns 1972; Kühne 1976).

In the Middle Bronze Age (roughly between 2000 and 1500 BC) the situation is much more difficult to explain. The settlement pattern along the Khabur does not show any characteristic alignment betraying a possible irrigation system. Moreover it lacks any true centres although on the grounds of written evidence one has to assume that they existed. One can only speculate that local irrigation works did exist.

Taking the cuneiform sources into account, two canals (Isim Jahdunlim, Igi.Kur (Groneberg 1980:299, 291)) are mentioned in connection with place names (Dur-Jahdunlim (Groneberg 1980:60)) which have to be located near the junction of the Khabur with the Euphrates and along the Euphrates. Only one canal - if it is one - is mentioned along the Khabur; its name is Khabur-ibal-bugas, situated between Dur-Isarlim and Dur-Igitlim (Groneberg 1980:59, 284). If Röllig (1978:420) is right

in assuming that Dur-Igitlim could be the Old-Babylonian place name of Dur-katlimmu/Tell Schech Hamad, a local or possibly a regional irrigation system may be indicated. The problem is where to locate Dur-Isarlim. According to the archaeological evidence there is not too much choice: Tell Asamsani and Tell Fadgami in the northern vicinity; one of them is to be identified with Qattunan (Kühne 1980; Nashef 1983). Namliya in the south bears very little evidence, and Tell Abu Ha'it further south is probably to be identified with Saggartum (Kühne 1974-1977). Granted a local system, Dur-Isarlim could be modern Tell Husen just opposite Tell Schech Hamad. Otherwise only Tell Fadgami/Tell Asam-sani or Tell Namliya can be considered.

Equally interesting is the mentioning of small harbours at Tabatum and Qattunan (Groneberg 1980:243,189). For reasons which have been discussed above, this cannot be interpreted in favour of a navigable river Khabur; it would instead favour the idea of a regional irrigation system.

In the Late Bronze Age (roughly between 1500 and 1200 BC) the archaeological evidence suggests the presence of regional irrigation canals (Ergenzinger et al. 1988: 118 ff.). Cuneiform sources so far fail to provide any information on irrigation in the Lower Khabur valley (Nashef 1982); so does the newly found archive of Dur-katlimmu. It has been demonstrated by pottery typology that Tell Asamsani, Tell 'Agaga and Tell Ta'ban should be considered to have been subcentres under the rule of the fortified provincial centre of Tell Schech Hamad/Dur-katlimmu (Pfälzner 1986). So far two of them can be identified: Tell Schech Hamad/Dur-katlimmu and Tell 'Agaga/Sadikanni. Lacking these arguments is Tell Hassake, but it should be added because of historic-geographical arguments which indicate identity with Magarisi (Kühne 1980). Kessler (1987) suggests Tell Abu Bakr which is situated opposite Tell Hassake. Otherwise a surprisingly small number of settlements of that period can be mapped (Ergenzinger et al. 1988:122, Fig. 6). It has been argued that one should expect more numerous settlements if a regional irrigation system had existed.

By now, more and important information is available. In one of these small settlements, Tell Bderi, which had been a centre during the preceding Mitannian period, Assyrian inscribed cylinders have been excavated in 1987 and 1988 (Pfälzner in press). An eponym dates them to the reign of king Tiglat-pilesar I (1112-1074 BC). It is possible to identify Tell Bderi with a hitherto unknown place, namely Dur Assur-kitte-lisir (the reading was provided by S. Maul; Pfälzner (1988b) used the first reading Dur Assur-napistir-lisir). The person in honour of whom the place was named, is a prince of a local dynasty of Tabete. The town should be the same as Old-Babylonian Tabatum (Groneberg 1980:243).

There remains little doubt now that both should be identified with modern Tell Tabun which lies only 10 km south of Tell Bderi (Kühne 1980; Nashef 1983; Kessler 1987). The texts of Tell Bderi leave no doubt that Dur Assur-kitte-lisir was a small, dependent settlement of Tabete. The importance of this information lies in the fact that for the first time a glimpse is offered of the extent of the territory of such subcentres. Calculating that the catchment of these subcentres may have been about 15 km in radius and applying it to the map, a very interesting statement is possible: the three centres Magarisi, Tabete and Sadikanni controlled the northern half of the Lower Khabur in regularly arranged districts. The area between Sadikanni and the next centre further south, Qatni, is characterized by a mountainous ridge north of modern Saddada. This explains the longer distance between these two districts. The distance between the districts of Qatni and Dur-katlimmu is regular again. South of Dur-katlimmu no Assyrian settlement was found (Fig. 8).

Historically this observation is of great importance. It proves that the Lower Khabur valley was under firm and well organized Middle Assyrian administration, the centre of which, with a governor (bel pahete) was Dur-katlimmu. As for the settlement pattern, one cannot expect more centres; the subdivi-

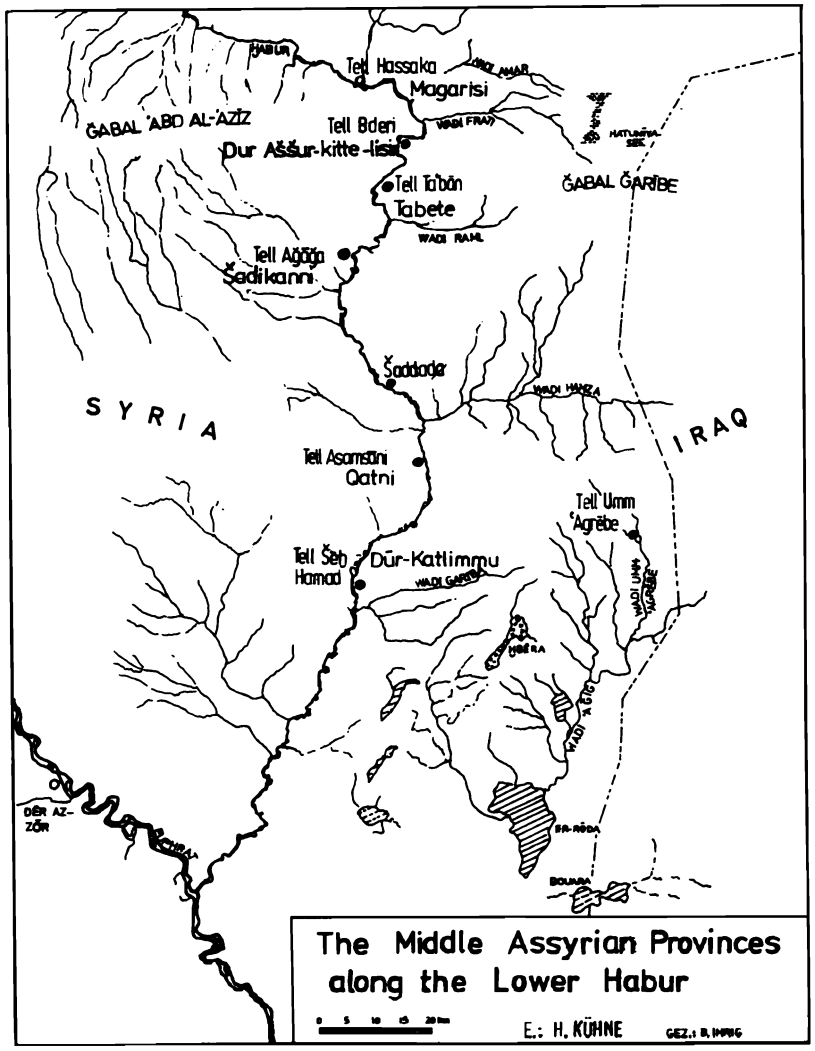

Fig. 8. Middle Assyrian administrative centres along the Lower Khabur, according to H. Kühne.

sion is complete. Yet to be found are the smallest settlements, hamlets and the like, some of which will certainly have been overlooked in the survey. The well-established Middle Assyrian administration of the Lower Khabur, beginning with the reign of King Salmanassar I and ending with the reign of King Tiglat-pilesar I (1273-1074 BC), is a strong argument in favour of the postulated canal and of large-scale irrigation agriculture. The canal would have to be reconstructed from near Tell Kerma in the north, down to Dur-katlimmu (Ergenzinger et al. 1988:118). The agricultural potential may well have been the motive for King Assur-bel-kala's unsuccessful attempt to regain the area from the Aramaeans and for the Assyrian kings of the late 10th and 9th century BC, Adad-nirari II, Tukulti-ninurta II and Assurnasirpal II, to campaign along the Khabur and to firmly re-establish their supremacy.

The need to construct this canal may have been caused also by the climate - this would be an argument in favour of the suggested pessimum (cf. Brentjes 1982, 1988). In con-

nection with this hypothesis one hitherto unknown site has to be considered, Tell Umm 'Aqrebe. This site is situated about 40 km east of Tell Schech Hamad, within the steppe, on a straight route to the capital Assur. The surface collections leave no doubt about a settlement during the Middle Assyrian period. The specific pottery found there even argues in favour of a function similar to that of the above-mentioned subcentres (Pfälzner 1986). But when the area suffered severe drought, how could the population in a place with this geographic position possibly survive?

The most important function of the site was surely one of a traffic station with some additional administrative tasks. Considering its position on the direct route to the capital Assur this makes sense. It certainly was not an agricultural centre, as a neighbouring site became in Neoassyrian times. For survival there is plenty of groundwater right beneath the surface (even today) which is quite sufficient for drinking water and possibly some irrigation agriculture to feed a few families in Tell Umm 'Aqrebe.

Tell Umm 'Aqrebe favours the hypothesis of a climatic pessimum (Brentjes 1982, 1988); it does not strengthen the idea of dry farming (Röllig 1978, 1987; Hecker 1987). But mostly it confirms the reconstruction of a tight and well-established Middle Assyrian administration on the Lower Khabur region.

Summarizing, the Bronze Age habitation along the Lower Khabur (and probably along the Upper Khabur as well) must have been based primarily on irrigation agriculture. During the Early and Middle Bronze Age local irrigation systems seem to have prevailed. It cannot be excluded, though, that, especially in the south of the Lower Khabur, a larger irrigation system connected with the Euphrates existed. Politically the Lower Khabur was dependent on Mari and Hana in the Middle Bronze Age, both situated in the southeast, on the Middle Euphrates. In the first half of the Late Bronze Age (the Mitanni period) the Lower Khabur does not seem to have been settled densely. During the second half of the Late Bronze Age, the Middle Assyrian period, the Lower Khabur was under firm Assyrian control. The well-organized administration favours the postulation of a regional irrigation system, extending to near Tell Schech Hamad/Dur-katlimmu.

The Neo-Assyrians took advantage of the well-prepared and organized settlement pattern along the Lower Khabur that their predecessors had left. After a period of weakness in the late 11th and 10th century BC, during which the Aramaeans settled down in all the centres, they re-established their supremacy in the 9th century and kept it until the downfall of the Assyrian empire at the end of the 7th century BC.

Even if there had been no dating evidence at all for the canals, the settlement pattern in the 9th to 7th centuries BC strongly suggests a regional irrigation system. The regular arrangement of the towns and villages, much closer together in the northern half than in the southern half of the valley, the newly established sites south of Dur-katlimmu in that remote part of the Lower Khabur, and the settlement clusters in the steppe east of the Khabur could not be explained without a flourishing agriculture, with high yields to support a growing population, the cause of which must have been large-scale irrigation. This in turn must have strengthened the communities as it did the provincial centres, as is known from the excavations in Tell 'Agaga/Sadikanni and Tell Schech Hamad/Dur-katlimmu (Ergenzinger et al. 1988).

The cluster of settlements east of Tell Schech Hamad/Dur-katlimmu has to be emphasized. There is no reason to believe that the former route to the Assyrian heartland no longer existed. Along this route and centring around Tell Umm 'Aqruba and Gilib al-'Amah an astonishing number of hamlets was recognized in the field, strongly suggesting a colonization of the steppe. It cannot be imagined that this rather unattractive area would have been chosen for agricultural acitivity if the climate had been as unfavourable as before.

The agricultural richness of the Lower Khabur is amply demonstrated

by the settlement pattern of the later Hellenistic, Roman, Byzantine and Islamic periods. It was based on large-scale irrigation, provided by regional canals which were constructed first by the Assyrians and probably destroyed by the Mongols. Lacking a firm administration, the area was taken over by nomadic Arab tribes, who became sedentary only a generation ago and took up motor-pumping irrigation.

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