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● *Syrien, Hydrogeographie, Bewässerungstechnik*

Peter Ergenzinger (Berlin)

## Big Hydraulic Structures in Ancient Mesopotamia in North-East Syria

With 3 figures

**Zusammenfassung:** Entlang dem Wadi Habur (in NE-Syrien) gibt es auf beiden Seiten des Flusses Spuren von *ehemaligen Kanälen*. Jeder Kanal ist über 200 km lang. Da Regenfeldbau nur nördlich von Saddade (36°N) möglich ist, ist die Landwirtschaft südlich von diesem Gebiet auf die Zufuhr von *Bewässerungswasser* angewiesen. Die Kanäle sind meisterliche Wasserbauten und sind ein Schlüsselfaktor für die Umweltrekonstruktion im alten Mesopotamien.

**Abstract:** On both sides of Wadi Habur (north-east Syria) a more or less continuous line of relicts of *ancient water canals* has been discovered. Each canal has a total length of more than 200 km. Because rainfed agriculture was restricted to areas north of 36° N (Saddade) the tells (mounds) and towns south of this limit depended on the supply of *gravitational irrigation water*. The canals, masterpieces of hydraulic construction, are a key factor in the interpretation of environmental conditions in ancient times.

The meandering Habur is the last tributary river of the Euphrates with runoff throughout the year. Its main sources are situated near the Syrian-Turkish border at Tell Hallaf and Ras el Ain (*fig. 1*). They supply about  $40 \text{ m}^3 \text{ s}^{-1}$  of karstwater, which is generated in the southernmost part of the Taurus Mountains in Karaca Dag. The main tributary of the Habur, Wadi Gağgağ, joins it at Hassake. From there to Buser in the Euphrates valley, the Habur flows for 200 km from north to south, from the steppes into the desert. North of Saddade the basin averages more than 200 mm of precipitation; the southern part needs irrigation water for all kinds of intensive agriculture. Up to now there have been no indications of any dramatic change in these climatic conditions during the last 4000 years (compare Zeist, Bottema 1982).

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Following up the archaeological surveys by *H. Kühne* and *W. Röllig* for the »Tübinger Atlas des Vorderen Orient (TAVO)« (*Röllig, Kühne 1934*), the ancient canal systems of Habur were investigated and mapped in cooperation with *Kühne's* excavations in Seh Hamad. Based on *air photos* the *mapping* started in the surroundings of Tell Seh Hamad in 1983. Just north of this tell the eastern Habur canal had to cut through the *high Habur terraces*. In the terrace pebbles the entrenched canal has sustained erosion and looks rather young and fresh, whereas in the marly and loamy tertiary sediments it is rather difficult to trace the canals. During the first reconnaissance tours the western canal was also detected between Markada and Suwwer. After these encouraging results the further investigations were undertaken by a team consisting of *Friedhelm Botsch, Helga Sprenger, Carola Zellmer* and the author.

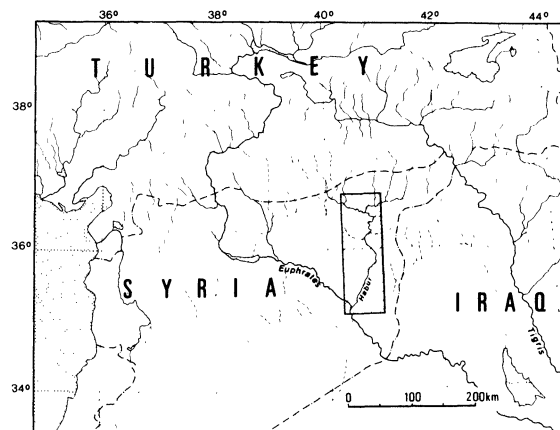


Fig. 1

The distribution of *relicts of the ancient canals* is depicted in *figure 2*. The head of the righthand canal was above Tell Hassake close to Tell Tamer, the lefthand canal was fed by Wadi Ġaġġaġ. Some relicts were mentioned in the literature (see *Liere, Lauffray 1954/55*), but they were interpreted as local canals. It is easy to distinguish the ancient canals from the younger, local ones. The more recent canals are always smaller than the ancient ones and occur only on the Habur floodplain. Since there has been intensive aggradation on the floodplain for the last 300 years all the canals on these plains are very recent. The same is true of the noria-wheel remains and the artificial dams in the modern Habur channel. This situation is shown in *figure 3* below Tell Kerma. This region is called Saba Sukur, the seven rapids. The rapids were created by the passage of the river of the uplift area between Gabal Abd al-Aziz and Gabal Gariba and the recent volcano Gabal Kaukab. Tell Kerma is an ancient head point above the main rapids with three small tells across the valley bottom. A rubble dam diverts the Habur water towards two small canals at both edges of the valley bottom. They carry irrigation water towards the area of Tell Tneir and are two to three kilometres long. In contrast to these local irrigation canals there is the relict of a much bigger canal only 300 metres east of Tell Kerma. The *upper traces of the ancient canal* are at the border of Wadi Amar and cross the gypsum layers east of Tell Kerma in a 200-m-long tunnel. Below, the ancient canal is well preserved over three kilometres. West of Tell Melebiya and Tell Bderi the big bend of Wadi Habur is shortened by the ancient canal. The traces run straight from Tell Tamir to Tell Taban, cutting the bend in a second tunnel. Below this tunnel there are two or even three traces of the ancient canal at different altitudes above Habur. The main impediments to building a canal across the area are the gypsum strata. An unsuccessful attempt was made to convey the water in the canal to Tell Taban at as high a level as possible. Small dolines caused by water loss collapsed at several points. A second, and logically even a third, canal was dug again in gypsum layers close to the Habur. Parts of this canal have now been eroded by the river. The lower canal can be traced down to Tell Taban and even further south.

THE ANCIENT HABUR CANALS IN NORTHEAST SYRIA

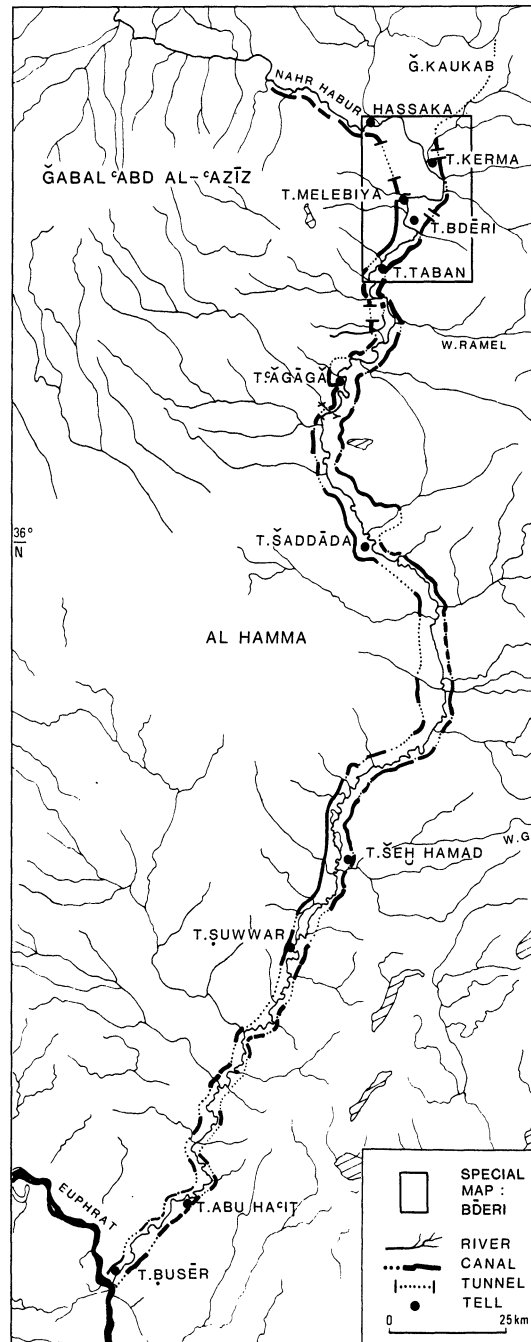


Fig. 2

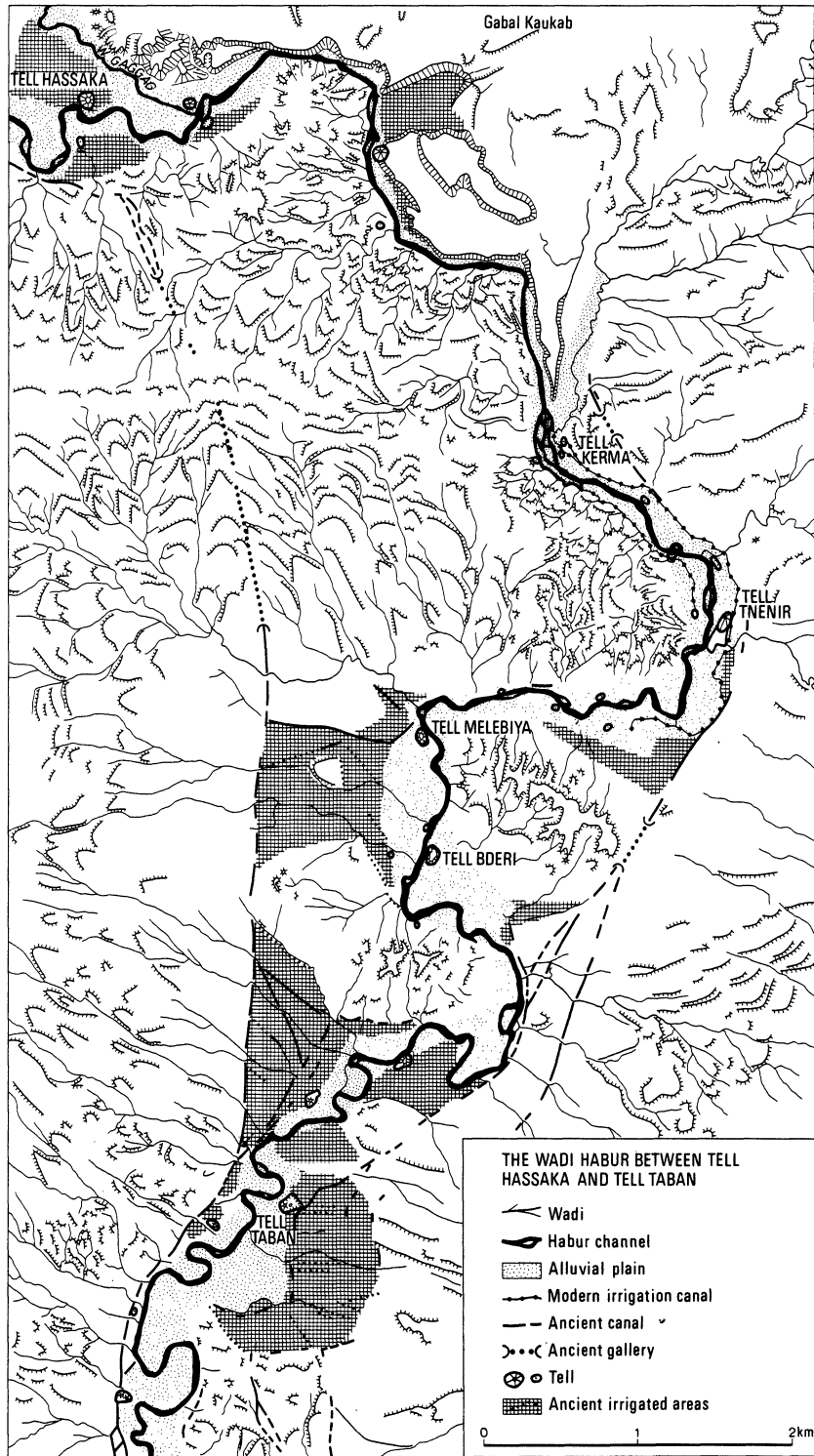


Fig. 3

Almost all the ancient canals are situated above the floodplain, at the level of the old lower terrace of the Habur. The relicts of these canals are distributed according to the local geological and geomorphological conditions. They are easy to spot in gypsum (north of Tell Taban) and in Quaternary coarse-grain terraces (north of Tell Seh Hamad or Tell Suwwer). In these cases the canals are very well preserved for there is no agricultural land use in these areas at present and the erosion rate is low. In soft material the traces of the canals are often eroded or buried below more recent accumulations. Air photos show the differences in soil water conditions between the fill and the surrounding material. At escarpments close to the valley the Habur often undercuts the slopes. In order to avoid river erosion the ancient canals were artificially entrenched 50 to 100 m behind the cliffs. These trenches were often more than 10 m deep and, in most cases, they are still well preserved. Near Hassake the ancient western canals passed through an *underground tunnel* excavated in gypsum and marl layers. The tunnel stretched from the area south of Tell Hassake to the area west of Tell Melebiya and was almost 2 km long. Surface evidence of this tunnel is provided by an extremely straight modern valley and a line of small dolines.

The diversion works of the western Habur canal must have been close to the *karst sources* of Tell Hallaf, but we failed to determine the location. The diversion works of the eastern Habur canal were situated below the swamps of Wadi Gağgağ, close to Tell Brak. The uppermost traces of the canal are east of the volcano Gabal Kaukab and run from there down to Tell Kerma at the Habur.

Botsch (1986) calculated that about 2 m<sup>3</sup>/s were conveyed in each canal with a velocity of about 0.3 m/s. The ancient Habur canals are 6.5–7 m wide and 0.6–1.2 m deep. These dimensions remain the same from the head area to the Euphrates valley. Normally, a decrease in the size of irrigation areas is paralleled by a decrease in the size of the canals and ditches. Since the Habur canals do not follow this rule, we argue that they must have served not only as irrigation canals but also as important *navigation canals* (Botsch 1986). There are ancient canals of a similar size in the region of the Euphrates. The

Habur canals were only a comparatively small part of an even bigger network.

There are no reports of the Habur canals in ancient literature. The Mari reports (Archives Royales de Mari 6, 1–12, and 12–19) mention several cases of damage to the »Isim-Jahdun-Lim« canal. But this Ancient Babylonian canal was restricted to the lower Habur valley (Tell Abu Hait?). The Habur canals are obviously more recent. The Assyrian town of Katlimmu (= Tell Seh Hamad) had a branch channel to the left-bank Habur canal; may be the big administrative town was founded (in 1300 B.C.) as a consequence of the installation of the Habur canal (Kühne 1984).

The new facilities provided by the canals made possible the colonization of desert areas but failed in times when there was no centralized resource management to maintain the vulnerable earthworks and to regulate the water distribution along the canals. However, it is now clear that hydraulic structures on the Habur are key factors with a long tradition reaching back to Ancient Babylonian times and continuing up to the present day: construction work is about to begin on a new dam and new canals (Hopfinger 1984).

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