The Nile in the Fayum

Strategies of Dominating and Using the Water Resources of the River in the Oasis in the Middle Kingdom and the Graeco-Roman Period

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1. Introduction

The Fayum is usually called an oasis, but unlike the *real* oases in the western desert, which are irrigated by the underground Nubian aquifer, the Fayum receives its water supply exclusively from the Bahr Yusuf, a side branch of the Nile which leaves the river in the area of Assiut and enters the Fayum at the *Lahun Gap*.[1] Thus, the Fayum was (and is) subject to the same conditions as the floodplains in the Nile valley.

The Fayum is a depression west of the Nile valley measuring roughly 70 x 60 km. At its lowest point, which lies in the north, it reaches to 53 m below sea level, while the Bahr Yusuf enters the depression in the south at approx. 25 m above sea level. These two points mark the extremes of a sloping, oval-shaped landscape, covered for millennia by a lake and a swamp with changing tides according to flood or drought seasons; only the plateau approx. 23 m of height in the south-east of the depression where the Bahr Yusuf first enters emerged from the swamp; on this plateau, the only settlement built in the centre of the Fayum prior to the Middle Kingdom was located: Shedet, from the Ptolemaic period onwards called Arsinoe or Krokodilopolis, renamed at the end of the second century B.C. Ptolemais Euergetis, and is now known as Medinet el-Fayum, the

1 The Lahun Gap lies west of the modern town of Beni Suef at 29°13’07.94’’ N, 30°57’21.27’’ E.

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capital of the province. As long as no measures were taken to regulate the water stream coming in with the Bahr Yusuf, the *Land of the Lake* (= Fayum) was to remain largely covered by the huge swamp, home of the crocodile god Sobek.

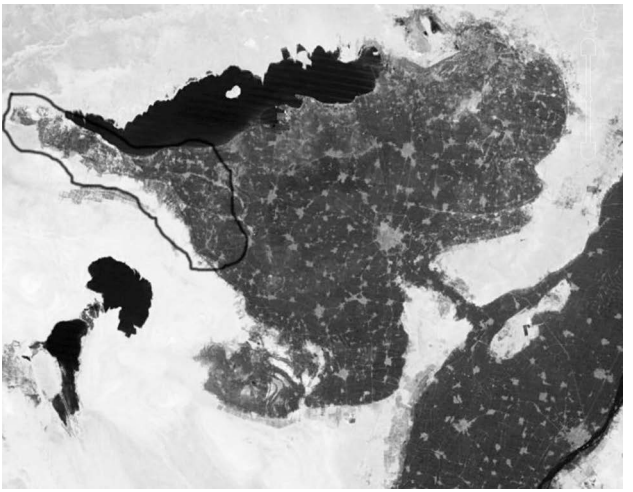

Figure 1. The Fayum Oasis; in the north-west, the area of the archaeological survey of the Fayum Survey Project is encircled. (Google Earth).

The problem here was and is that the Fayum, unlike the Nile valley, does not have an exit at the other end of the depression as does the Nile to the Mediterranean.[2] All water coming into the Fayum collects in the lake in the north, today the Birket Qarun, of which the deepest point lies at -53 m. Whoever wanted to make this sloping depression fertile and useful had to control the water coming into it, and by doing so diminish the swamp and the lake. The task was therefore, on the one hand, to make sure not to allow too much water into here in order to reduce the level of the lake and, on the other, to provide enough water for the fields which had emerged from the shrinking lake and the surrounding marshes.

The development of this swampy depression into one of the most fertile areas of Egypt with extensive fields bordering a shrunken lake to the north, from prehistoric to modern times can only be outlined briefly here.[3] There were two

2 For a supposed underground exit of the lake see below.

3 For a very short overview with impressive maps see Hassan/Tassie, 2006, p. 37–40; more elaborate and focussing on the prehistoric period: Hassan, 1986, p. 483–501.

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periods, in which the Fayum received special attention from the rulers of Egypt who saw the potential of this landscape.

The first highlight of the development of the Fayum dates to the period of the Middle Kingdom, the second to the early Ptolemaic period. At both times strategies were found to reduce the expansion of the lake and to enlarge the area of arable land between the plateau and the lake.[4]

2. The First Golden Age of the Fayum: the Middle Kingdom

The Pharaohs of the Twelfth Dynasty, in particular Amenemhet III (who was still venerated as a god in the Ptolemaic and Roman periods) managed to stabilise the level of the lake at between 17 and 20 m above sea level, while the first

4 I do not share the new view on the irrigation problems of the Fayum, as proposed by Haug, 2013. Haug claims that the Fayum did not receive a perennial water supply from the Bahr Yusuf, but was irrigated only during flooding times, whereas the Bahr Yusuf would dry out in winter. This led, so Haug, to the unstable situation at the fringes of the Fayum until the nineteenth century when the Ibrahamiya Canal was built along the Bahr Yusuf in the Nile valley. While there is no doubt that the centre of the Fayum around Arsinoe has always been more fertile (and still is today), there is also no doubt that the fringes were highly developed agricultural land for many centuries during the Ptolemaic and Roman periods. Haug's view is mostly based on the observation of a British traveller who visited the Fayum in 1830: St. John, 1845; he seems to describe a barren Bahr Yusuf in the winter; however, both citations, introduced by Haug, fail to convince: on p. 182 St. John describes the scene at an unknown river bed, where a local man seems to have indicated a wrong name for the canal the travel group was crossing (a little later, we hear of rich water streams; where would that water come from, if not from the Bahr Yusuf ?); on p. 192 we hear of the northern continuation of the Bahr Yusuf at Maidum, not about the Bahr Yusuf in the Fayum. Throughout his travelogue, St. John hails the fertility of the Fayum. Also Haug's claim that "the irrigation system was unable, on the whole, to efficiently transport Nile mud to the margins in significant quantities", is not correct. During the drillings in the canals and excavations at Philoteris at the far end of a feeder canal (see below) we found rich silt sediments both in the canals and the adjacent fields (forthcoming in my "The Fayum Survey Project. The Themistou Meris"). Mud bricks used here had (at least in part) the same magnetic value as bricks in the Nile valley.

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Ptolemies took more radical steps to make the lake shrink down to approx. 45 m below sea level which more or less equals the measure of today.

In his study *Contribution to the Geography of Egypt* of 1939, John Ball gave what – at that time – was considered a thoroughly investigated picture of the development of changing levels, evaporation and salinization of the lake from prehistory to his own days.[5] Even though the main results of that study are still valid, many details have been reconsidered since then.[6]

Ball understood that Amenemhet's new water management in the Fayum had stabilised the lake to a level of between 17 and 20 m above sea level,[7] after it had been on a lower level for at least some time after the Old Kingdom.[8] The figure of 17-20 m is corroborated by the observation of location heights of known Middle Kingdom sites in the Fayum (from north to west, then south, and north again)[9]: Qasr el-Sagha (31 m a.s.l.), Soknopaiou Nesos (c. 20 m), Quta (20 m), Medinet Madi (26 m), cemetery at Tebtynis (24 m), Abgig (18 m) and Biahmu (18 m). When Herodotus saw the two monuments of Amenemhet III at Biahmu and described them as standing in the middle of the lake (II 149)[10], he was obviously visiting there when the lake was at its peak after the flooding.

5 Ball, 1939, p. 178–289; similar conclusions are reached by Shafei Bey, 1940, p. 283–327 and map in front of article. As the title says, Shafei's article is mostly based on An Nabulsi who was the governor of the Fayum under the Aiyubite Sultan el Salih Negm el Din in 1245-1246; An Nabulsi often seems to be too negative (longing for his Syrian homeland), and not very clear in his descriptions; however, in Shafei's article, it is doubtful whether misunderstandings were due to Shafei, or to Nabulsi himself. It is clearly impossible that the two ravines in the Fayum had not existed in Nabulsi's time (p. 286 and 301; see further below). On An Nabulsi see also Ball, p. 219–225. An English translation of An Nabulsi (approx. 50 % of the whole book) can be found on the web page of Queen Mary College, University of London, Rural Society of Medieval Islam (translation by Y. Rapoport). The description of the dam at the Bahr Yusuf in Chapter 1 is clearly a misunderstanding of what was going on at Lahun.

6 For the history of research on this subject after Ball see Hassan, 1986, p. 483–485.

7 On the activities of the Pharaohs of the Twelth Dynasty in the Fayum see Ball, 1939, p. 199–210; Hassan/Tassie, 2006, show the lake at +10 m and add: "although it fluctuated by +10 m from this level".

8 See Hassan, 1986, p. 491.

9 Measures are from Google Earth; cf. measures given in Davoli, 1998.

10 ἐν γὰρ μέςῃ τῇ λίμνῃ μάλιστά κῃ ἑστᾶσι δύο πυραμίδες.

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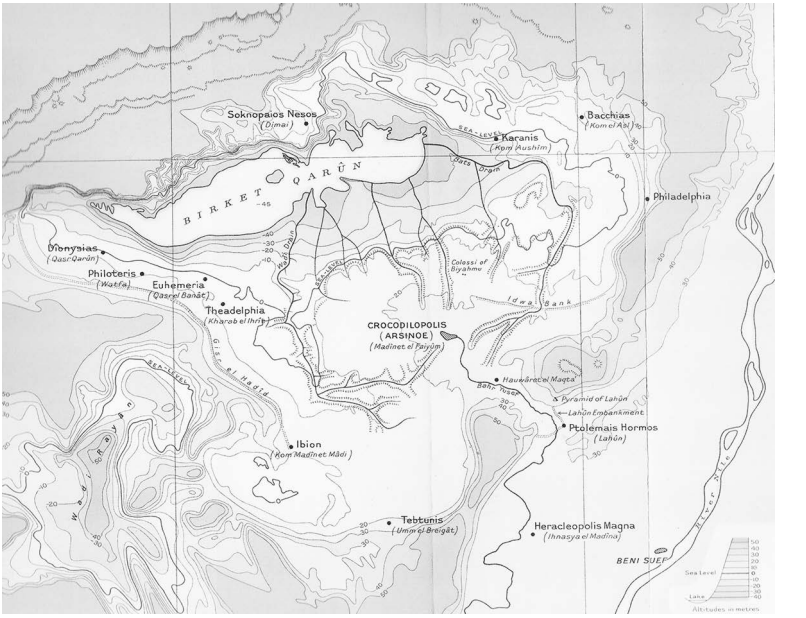

Figure 2. Map after Ball, *1939; p. 216.*

At that time (c. 425 B.C.) there may also have been the chance to observe that some of the water would flow back from the depression of the Fayum towards the Nile valley. Herodotus claims to have seen such a flow back (II 149)[11]. The high lake would have allowed that, according to Ball,[12] since the sediments in the Bahr Yusuf at the entrance to the Fayum at El-Lahun had not yet piled up to the height at which we find that area today (at 25 m). However, it seems possible that the extremely slow flow of some of the canals induced the beholders to assume that the water was flowing towards the Bahr Yusuf, not towards the lake.[13]

11 Τὸ δὲ ὕδωρ τὸ ἐν τῇ λίμνῃ αὐθιγενὲς μὲν οὐκ ἔστι (ἄνυδρος γὰρ δὴ δεινῶς ἐστι ἡ ταύτῃ), ἐκ τοῦ Νείλου δὲ κατὰ διώρυχα ἐσῆκται, καὶ ἓξ μὲν μῆνας ἔσω ῥέει ἐς τὴν λίμνην, ἓξ δὲ μῆνας ἔξω ἐς τὸν Νεῖλον αὖτις. "The water in the lake does not originate there (for the area is exceedingly arid), but is brought into it by a channel from the Nile; six months it flows into the lake, and six months back into the Nile".

12 Ball, 1939, p. 204.

13 Today, it is sometimes difficult to understand the direction of the water flow; for the minimal speed of the canals see also Shafei Bey, 1940, p. 290; he observed a water level drop of only 5 cm over 21 km in the Bahr Wardan.

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Be that as it may, the idea that water was to flow back from the depression into the river makes sense only if we assume that at the point where the Bahr Yusuf entered the Fayum at El-Lahun, coming from the south, where there was also a channel allowing the water to escape toward the north; or in other words, a continuation of the Bahr Yusuf towards the north, if one did not want the water to proceed uncontrolled in that area. Such a continuation would finally re-join the river Nile. It is therefore strange that Ball does not indicate any sort of controlled waterway towards the north from the Bahr Yusuf on his otherwise splendid map (Figure 2). However, where else would the water go coming back out of the Fayum (certainly neither flowing upstream in the Bahr Yusuf, nor to the east towards the river Nile, because the path is blocked by a range of elevations)?

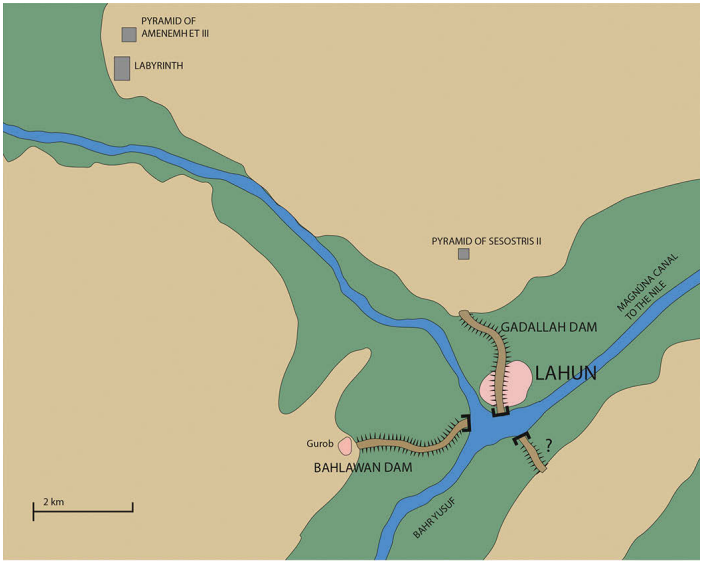

Figure 3. Map after Shafei Bey, 1940; drawing by I. Klose.

The entrance to the Fayum at the *Lahun Gap*, where the Bahr Yusuf coming from the Nile valley cuts through a range of elevations of approx. 80 m in height,[14] is marked by two pharaonic settlements, Gurob in the south – predominantly settled in the New Kingdom, but perhaps also earlier –, and Lahun – a Middle Kingdom cemetery and pyramid – in the north. Between the two, remains of two dams are still visible which closed the gap in a curving, bell shaped, line

14 The first breakthrough of the Bahr Yusuf at this point is supposed to have taken place in the mid-Pleistocene.

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towards the east (see figure 3).[15] One dam spanned the gap between the Bahr Yusuf and Gurob in the south (the Bahlawan Dam), the other ran parallel to the Bahr Yusuf between the village of El-Lahun and the height of the Lahun pyramid (the Gadallah Dam). After recent drillings in these dams, the Middle Kingdom date of the Gadallah dam has been corroborated: [16] During the Middle Kingdom, the Gadallah Dam and a continuation to the east (?) blocked the flow of the Bahr Yusuf towards the north; however, a sluice, most likely at the modern village of El-Lahun (in Ptolemaic and Roman times *Ptolemais Hormou*, *The Harbour of the Ptolemies*) may have directed this flow either to the west and into the Fayum depression (when the sluice was locked), or towards the north (when the sluice was open). It seems that the important step taken in the Middle Kingdom was to create means of controlling the water at the Lahun Gap with dykes, a sluice, *and* an *overflow* towards the north, the canal which is nowadays called the Magnûna Canal. The Bahlawan Dam, instead, now seems to be a construction of the Ptolemaic period.[17] It may have worked as an additional tool to regulate the influx into the depression at this point.

The existence or non-existence of such a continuation of the Bahr Yusuf towards the north is decisive not only for the question of whether or not we may assume that water flowed backwards out of the depression, but also with respect to the problem whether and to what degree the Fayum was used as an overflow for excess water from Upper and Middle Egypt during the Middle Kingdom. It seems that also excessive sudden floods could be controlled to a certain degree with the measures taken in the Middle Kingdom.

2.1 Appendix: Was there an underground exit of the lake?

It is rather unlikely that the lake ever had an underground exit, as Herodotus had been told by the locals (II 150)[18], and Ball continued to believe. Ball based

15 For this Middle Kingdom dam see Garbrecht/Jaritz, 1990, p. 140–149; Ball, 1939, p. 212–213 still considered at least part of this wall the work of the early Ptolemies, corroborated by Hassan/Tassie, 2006, p. 40.

16 See Hassan/Tassie, 2006, p. 40.

17 Ibid.

18 ἔλεγον δὲ οἱ ἐπιχώριοι καὶ ὡς ἐς τὴν Σύρτην τὴν ἐς Λιβύην ἐκδιδοῖ ἡ λίμνη αὕτη ὑπὸ γῆν, τετραμμένη τὸ πρὸς ἑσπέρην ἐς τὴν μεσόγαιαν παρὰ τὸ ὄρος τὸ ὑπὲρ Μέμφιος. “The locals told me also that the lake has an underground outlet to the Libyan Syrtis, turning into western direction and into the continent and running parallel to the mountains which are above Memphis”.

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that assumption mostly on the salinity of the lake, which he considered to be too low for being a result of evaporation only, however, admitting that such an underground exit had most likely not existed anymore from the middle of the nineteenth century.[19] Such an exit would, according to Ball, have been level with the Nubian aquifer and at least part of the water would have gone to the Wadi Rayan by percolation. Shafei Bey's calculation of the salinity did not lead to such an assumption; he called the lake "water proof as if lined with Indian rubber".[20]

It has to be said that Ball's assumption rests on incorrect measures of the lake in Ptolemaic and Roman times.[21] Ball does not take into consideration that, by the dramatic enlargement of the arable areas at that time, much more water was distributed and used before it reached the lake. We now know that at that time the lake stood more or less at the same level as today, at –45 m; the well dug in the area to the east of the lake (north of Karanis) in the early Ptolemaic period,[22] obviously drawing from an underground basin and reaching down to –4.6 m, is therefore obviously not connected to the level of the lake, but to the surrounding canals. The same applies to a rectangular pit which was connected to a 34 m long underground tunnel, and which reached to +5 m. Beside the fact that the levels of these two installations do not match the level of the lake at that time, it is unlikely that there was an aquifer (coming underground from the lake) somewhere here, because that would have been used more extensively. However, this area was never impressively fertile.[23] The same observation should be applied to a well found by the American excavators in Karanis which reaches down to -7 m. This well cannot have been connected to the lake, but was certainly drawing from the nearby Bahr Wardan.[24]

19 Ball, 1939, p. 285–289.

20 Shafei Bey, 1940, p. 293.

21 Ball, 1939, p. 286.

22 Ibid., fig. 24 on p. 211, and fig. 25 on p. 212, both after Caton-Thompson/Gardner, 1934, p. 17–18; Ball, 1939, insists that the entire system of channels up here to the north of Karanis must have been fed by underground water from the lake (p. 217). However, as is the case today, this part of the Fayum most likely received its water supply from the Bahr Wardan, of which a side arm branches off before arriving at Karanis. See also note 23.

23 Cook, 2011.

24 With a different interpretation Ball, 1939, p. 218–219.

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3. The Second Golden Age of the Fayum: From the Early Ptolemaic into the Roman Period

The first Ptolemies recognised the opportunities to create new fields for the thousands of new settlers who flocked into the land on the Nile during the third century B.C.; they used the potential of this landscape by enforcing measures to reduce the level of the lake more extensively than before.

When Ptolemy I, son of Lagos, had himself crowned as Pharaoh of Egypt in Memphis in 306 B.C., he must already have had the plan to make Egypt heir and representative of the Greek culture, which until then had flourished in mainland Greece and particularly in Athens. Ptolemy initiated the Museum and the Library in Alexandria; his son, Ptolemy II, continued in his footsteps, intensifying the work of his father. According to the teachings of Aristotle that all visible phenomena in the world can be investigated and compared with each other to draw the right conclusions about their existence and their meaning, the natural sciences were also fostered in Alexandria, and flourished: medicine, astronomy, geography, hydrology and agriculture.[25]

The Greeks felt enormous admiration for the age and depth of Egyptian culture; they had been educated for this admiration after Herodotus had visited the country on the Nile; however, taking the stimulus of the teachings of Aristotle's school, the Greeks occupied Egypt with new ideas about how to use its natural resources, how to improve the crops to be planted and how to gain more land for agricultural use. On the estate of Apollonius, the financial minister of Ptolemy II, at Philadelphia in the eastern Fayum, experiments were carried out with new crops, for instance poppy seeds for the production of oil and irrigation facilities.[26]

Of course, for Ptolemy I and then Ptolemy II, the development of the Fayum was not just a test model. The Ptolemaic kings needed soldiers and administrators for their government; tens of thousands of Greek speaking settlers flocked into Egypt within the first half of the third century B.C., looking for a better and peaceful life. They all expected fields and housing to be given to them. The Ptolemies tried to solve that problem in a civil manner: they did not take land away from the indigenous people of the occupied territory on a grand scale, but

25 For the Greek culture, which gave so many new impulses to the Egyptian culture, see Fraser, 1972.

26 A short introduction to the activities on that estate and its manager Zenon is given by Clarysse/Vandorpe, 1995, in particular p. 93; for innovations in agriculture in the Fayum at this time see Thompson, 1999, p. 123–138.

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sought to develop new areas for settlements and agriculture. The Fayum became the centre of their efforts, but reclamation programmes were initiated also in the Nile valley and the Delta land.

Looking at the situation in the Fayum at that time, it must have been clear to the Ptolemaic kings that it would not be an easy task to transform that swampy depression west of the Nile valley into a fertile landscape.

During the time of the Ptolemies and the Romans, the shore line of that lake was more or less at the same level as it is now, namely at -45 m.[27] This is corroborated by three archaeological sites in the east which lie on that level close to the lake, one of them being Qaret Rusas; they are unpublished until now.[28]

Thus, the big drop of the lake level from +20 to -45 m most likely occurred only step by step when the first Ptolemies took an interest in that landscape, because there are no settlements registered anywhere in the Fayum foundet in the period between the Middle Kingdom and the Ptolemaic period.

What did the Ptolemies do, and why were they so much more successful than the Pharaohs of the Middle Kingdom?

The Ptolemies added to the installations at the Fayum Gap by constructing a dam west of the Bahr Yusuf before it enters the gap (see above with footnote 15 and figure 3). It is also clear that they maintained the northern extension of the Bahr Yusuf towards Memphis with its sluice at El-Lahun = *Ptolemais Hormou*, *The Harbour of the Ptolemies*.[29]

Here, the transshipment from larger onto smaller boats took place for those who wanted to go on further into the Fayum.[30] The northern extension of the

27 Hassan/Tassie, 2006, show the lake during the Roman period at -40 m, and comment: "although the lake fluctuated by +40 m and -13 m from this level". During the Roman period, they show the lake at -30 m, and comment: "although the lake fluctuated by +30 and -23 m from this level". The life-spans of the villages in the east of the lake, Qaret Rusas and the other two settlements, have not yet been published, but they all seem to have been inhabited through the Ptolemaic and Roman periods; this makes it very unlikely that such large fluctuations of the lake were possible. Ceramics and the rare stone objects on the site of Qaret Rusas show salt incrustations, so that the flooding of the village for a longer period at a time is certain.

28 I owe this information to Willeke Wendrich, who is working on these sites.

29 El-Lahun is from Egyptian "The mouth of the canal of Moeris"; the Greek literally means "Ptolemais of the anchorage".

30 Römer, 2010, p. 607–608.

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Bahr Yusuf continued to offer a direct connection to Memphis. For the Ptolemaic and Roman periods, the Barrington Atlas of Greek and Roman World[31] shows – correctly, as I believe – the continuation of the Bahr Yusuf towards the north as a canal which passes by the harbour of Kerke, reaching Memphis and beyond. There is enough evidence to be sure that this canal existed during the Graeco-Roman period. A good piece of such evidence is P. Phrur. Diosk. 17, a letter from Dioskurides, the commander of the castle in Heracleopolis, to his father in Memphis from 5 Phaophi 151 or 140 B.C. In this letter, Dioskurides assures his father that a messenger has been put into a boat to bring him his monthly ration and a coat to Memphis. The planning of a trip by water from Herakleopolis, located on the Bahr Yusuf, to Memphis only makes sense if there was this continuation of the Bahr Yusuf to the north. Kerke, the harbour of Philadelphia in the eastern Fayum, which was to be reached from Philadelphia on land over a hilly area and approx. 10 km away, was most likely located between this canal on its western side and the Nile on its eastern side. P. Mich. Zen. 61, 16 – 20 (248 B.C.) renders the stops of a journey from Krokodilon Polis to Kerke as: "From Krokodilon Polis ... to Ptolemais (Hormou), and from Ptolemais to Kerke".[32]

The Greek engineers[33] who came to the Fayum after Alexander the Great had taken Egypt, will have observed that the main problem of the depression now consisted in two ravines (most likely visible only during the winter, when the waters were low), which had their roots close to the course of the Bahr Yusuf where it enters the Fayum; one ravine led to the north and then in a long western curve towards and into the lake (today called the Bats Drain); the other one departed in the south, and continued straight ahead to the north and also into the lake (today called the Wadi Drain)[34]. Without any special measures, enormous water masses found their way directly from the Bahr Yusuf into the ravines and further on to the lake, on the one hand being without any benefit for agriculture, on the other augmenting the lake. At both drains, the Ptolemies installed heavy dams to prevent the water from proceeding down these drains uncontrolled. At

31 Talbert, 2000.

32 For the harbour at Kerke see Clarysse, 1980, p. 95–97.

33 Names of two of the early engineers are known from a papyrological archive: Kleon and Theodorus, whose files cover the time between 260 and 238/37 B.C.; there is a still unpublished PhD Dissertation on this archive at the Katholieke Universiteit Leuven by Van Beek, 2006 (forthcoming in Collectanea Hellenistica); for the archive see the Internet page of Trismegistos, Archives; cf. Cook, 2011, p. 45–47.

34 Also called the Wadi Nazlah after the main settlement on its course.

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the starting point of the Bats Drain they threw up a dyke in the area of the village of Hawaret el-Maqta which guided the waters further to the north-east and around the northern fringe of the Fayum through a canal, which is called the Bahr Wardan today and which terminates in a blind end.[35] At the roots of the Wadi Drain, a 9 km long dam was built, which still stands in parts between the modern villages of Itsa and Abu el-Nur (Figure 4). This dam channelled the floods further to the west and into the area of the north-western Fayum, up to the villages of Theadelphia, Philoteris and Dionysias. Today that canal is called "Bahr Qasr el-Banat"; as all distributing waterways, this canal also terminates in a dead end.

There is no doubt that the two ravines had existed already for a long time. Gardner considered them to "have been initiated on the fall of the Neolithic Lake".[36] Their existence during the Graeco-Roman period is corroborated by the line of ancient villages following the Wadi Drain on its eastern fringe (from south to north: Kom el-Arka, Abu Dinqash, Tell el-Kinissa),[37] and by the clear dating of the Itsa-Abu el-Nur dam to the Ptolemaic-Roman period; this dam does not make any sense without having been connected to that ravine close to it in the north.

The dam has been studied thoroughly by Garbrecht and Jaritz, [38] who – in my view – did not always draw the correct conclusions. Nevertheless, they gave a thorough description of the dam and recognised various building phases:

In a first phase, an earthen dyke had been backfilled between Itsa and Abu el-Nur in the early Ptolemaic period.[39] In a second building phase, a solid wall reinforced the original dyke; the wall was made of limestone; according to the authors, this process goes back to the very early time of Roman government in Egypt.

35 For a thorough interpretation of their activity in this area see Kraemer, 2010, p. 365–376; Garbrecht/Jaritz, 1990, p. 153–164; they date the dams at Hawaret el-Maqta to the same period as the dam between Itsa and Abu el-Nur, i.e. to the early Roman period. However, most likely, also in this area as at Itsa, the early Roman dam replaced the Ptolemaic earthen dam.

36 Caton-Thompson/Gardner, 1934, p. 17–18.

37 See Römer, The Fayum Survey Project, The Themistou Meris (forthcoming).

38 Garbrecht/Jaritz, 1990.

39 The Ptolemaic date of a dam here has been corroborated now by drillings in the earthfill core of the limestone dam; see Hassan/Tassie, 2006, p. 38 with photo.

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Figure 4. Fragment of the late-Ptolemaic limestone wall between Itsa and Abu el-Nur, (Photo by the author).

And finally, in the third building phase, the limestone wall was replaced by a wall made of fired bricks.[40] Garbrecht and Jaritz also observed evidence that the old wall had broken down. There must have been problems with this wall at some stage; such problems would have immediately led to problems with the water supply down to Dionysias.[41] I think it is pretty obvious that the problems with this dam could have given the final blow to the villages in the north-western Fayum during the fourth century A.D. If that dam broke, the water would not have reached very far to the north.

4. The north-western Fayum as a test case for the use of the river Nile in the Fayum

The area of the north-western Fayum is most distant from the Fayum's source of the water supply; the water reaching the fields here had to flow approx. 60 km (as the crow flies) from where the Bahr Yusuf enters the depression coming from the Nile valley.

This landscape was special in several respects:

40 Ibid., 2006, date the "majority of the brickwork" to the Ottoman period.

41 See Römer, 2013, p. 169–179.

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It was created from the drawing board in the third century B.C. and was abandoned and taken back by the desert during the fourth century A.D. The archaeological and even more the rich written evidence shows a part of the Fayum oasis which flourished despite of its distance from the Lahun Gap for approx. 700 years.

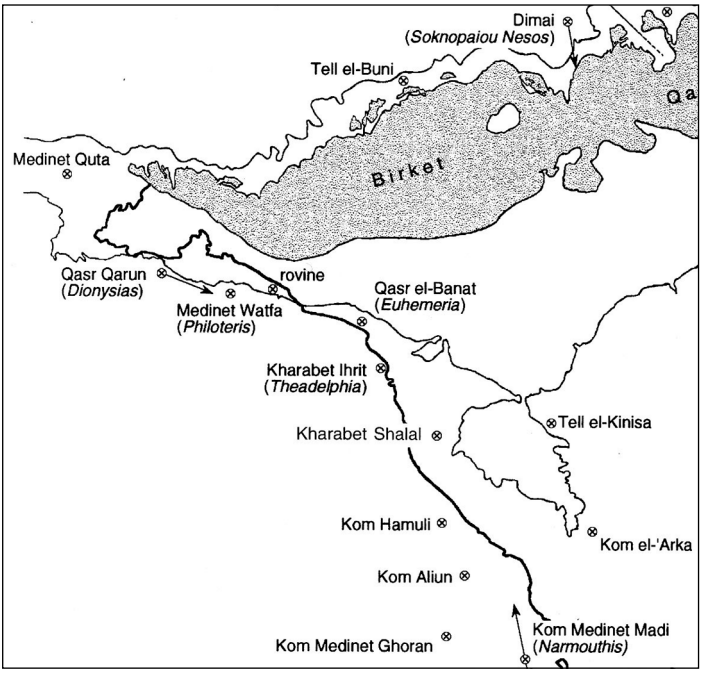

Figure 5. The north-western Fayum with the most important Graeco-Roman sites, see DAVOLI *1998, p. 367.*

It is this particular part of the Fayum, where we carried out an archaeological survey in the villages of Dionysias, Philoteris, Euhemeria and Theadelphia, all four settlements of the early Ptolemaic period, as their names and the written evidence from the sites tell; from the far end of the feeder canal upstream: Dionysias, the village of the Greek wine god, Philoteris named after one of the sisters of Ptolemy II, Euhemeria a speaking name of good omen to be translated as "the village where the day is nice", and finally Theadelphia, the village of the divine siblings, namely Ptolemy II and his sister-wife Arsinoe II. Despite their names, the main god here was the crocodile god Souchos, venerated under many different names such as Soknopaios, Psosnaus, Soxis etc. Temples here were

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built in purely Egyptian style and were erected side by side with Greek style public bath houses.

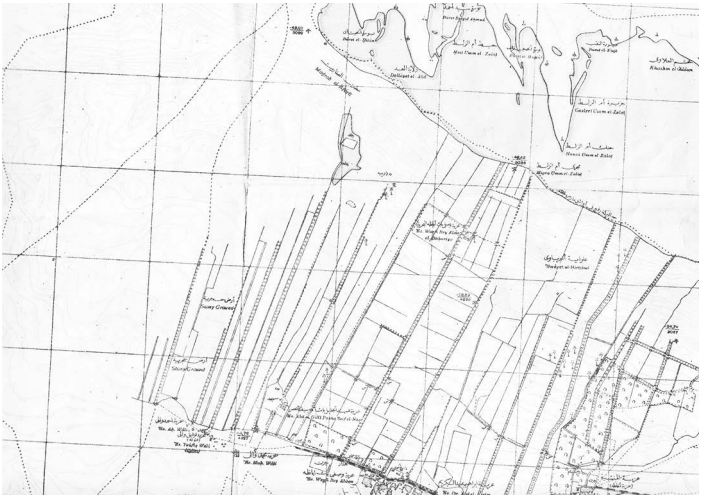

Figure 6. Survey of Egypt Map, 1989; canals descending from the main feeder canal towards the lake west of Dionysias.

During the Middle Kingdom, the entire area here had been under water, the villages having been located between 8 m above s.l. and the zero-line. Thanks to the abundant written evidence from papyri found in this area or in cartonnage from the Ptolemaic period, we know many details about the life in these villages. Euhemeria (at +7 m) is first mentioned in a papyrus dated to 243/242 B.C.[42] Since Dionysias lies on the zero-line, the lake must have been down to that measure by 229/228 B.C. at the latest when that village is first mentioned, but still called *the new village*.[43] At least 60 years, if not more, before that date, the work on the 9 km long dyke between Itsa and Abu el-Nur must have started. The entire Ptolemaic enterprise in the Fayum will have been already initiated around 300 B.C., when Ptolemy I was ruling.[44]

42 P. Petrie III 82, 8 (with BL 9, p. 211).

43 P. Lille Dem. 110, Vo col. 3, 13 "the new village"; Vo col. 1, 1 – 2 "the new village also called Dionysias"; De Cenival, 1980, p. 193–203.

44 For the calculation of the necessary timespan to bring the lake down from +20 to -45 m see Ball, 1939, p. 213–214; he calculates that this process cannot have taken more than 40 years and no less than 12 years; however, Ball bases this calculation

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During the second half of the third century B.C., Dionysias had 732 tax-paying inhabitants, 391 male and 341 female, plus an estimated 250 soldiers with their families; two thirds of the population was Egyptian, one third Greek. That takes us to an overall population of approx. 1200 people who lived here. The numbers for Philoteris from the same document are nearly the same; [45] so it seems that, in the beginning, the villages were laid out for the same number of people. This detailed evidence comes from the tax-lists written on papyrus in Demotic and Greek.[46]

The prestigious names of these villages, which we do not find in any other part of the Fayum in such numbers, show the pride which Ptolemy II took in this development; and indeed, it was an extremely difficult task to bring water up to here on a regular basis in order to make these villages prosper.[47]

But once the dyke stood at the beginning of the main feeder canal, the Bahr Qasr el-Banat, the connected canals up to Dionysias and beyond could be activated. The task was now to bring the water from a level of approx. 16 m maximum, from where the canal started, to *line 0* at around Dionysias.

The construction of these ancient canals is clearly visible in some places in the farthest north-west of the Fayum: over long stretches, at least between Theadelphia and Dionysias, they were cut into the bedrock, as was the case also to the north of Karanis.[48]

As today, the canals had to be maintained; from the Roman period, we have abundant evidence of corvée work which had to be carried out by the locals to keep the canals clean. Every male inhabitant had to do 5 days of cleaning every year, mostly in June, before the flood, when the level of the water in the canals was at a minimum. We have more than 230 of the so called *penthemeros* certificates issued by local overseers to those who had been working for the 5 days. Most of these certificates date to the Roman period.[49]

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mostly on the evaporation on the surface of the lake, not taking into consideration the extended and ever more expanding fields from which water also evaporated.

45 P. Count 11, Col. II 11–14 from 243–217 B.C.

46 A new edition of these tax lists and a thorough interpretation is given by Clarysse/Thompson, 2006.

47 For a thorough description of the dam and its location and significance see Römer, 2013, p. 169–179.

48 See Cook, 2011, Photos 63 and 64 e.g.

49 Sijpesteijn, 1964; for most recently published examples see Claytor, 2013, p. 49–75.

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Methodologically it seems right to assume that the ancient canals provided the bed for the new canals built at the end of the nineteenth century over long stretches. The landscape itself offers an ideal line for the waterways; the ancient construction followed this ideal line as far away from the lake and as high above the lake as possible, to make the slope between canal and the lake as wide as possible; now, as during Ptolemaic and Roman periods, fields are irrigated by *gravity irrigation* via the vertical canals, which were branching off the main feeder canal and cutting through the slope (Figure 6). It is interesting to see very few waterwheels, or today diesel pumps, in this part of the Fayum. They are not needed here, for the natural flow of the water from the canal above provides sufficient irrigation.

A closer look into the location and the environment of one of the Ptolemaic villages reveals some further features which show the water management in this part of the Fayum.

The village of Philoteris as it shows itself now, does not stimulate much enthusiasm in archaeologists, I must admit. Remains of walls are scanty, single buildings difficult to identify. Most of the mud brick walls have been carried away by the farmers who installed new fields around here since the beginning of the twentieth century. But the site itself has been spared from agricultural activities.

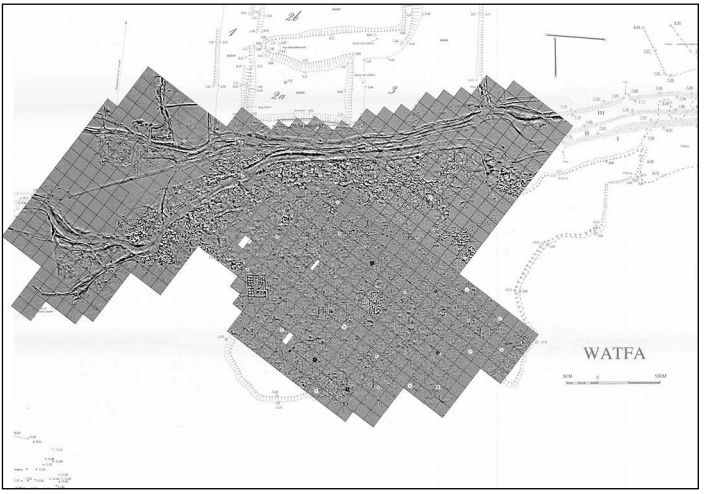

Figure 7. Geomagnetic map, produced by T. Herbich and his team 2011/2012.

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During the archaeological survey[50] we already noticed that there were two canals approaching the village from the east, one flowing by directly, the other continuing along the village farther to the north and on a lower level. It seemed that the "upper canal" was built to transport the water further on to Dionysias – indeed, until 6 years ago we could follow it to that next village over a distance of 5.5 km – while the lower, receiving water from the upper, fed huge basins in the north (Figure 8). These basins are of different sizes, the largest measuring 28,000 m^2 with a capacity of 57,000 m^3, the smallest measuring 1,225 m^2. The basins are interconnected and were obviously supervised by a guard who resided on the ridge between the two largest basins. The purpose of these basins was clearly to store water, not to offer space for fields. Basin irrigation was practised in Graeco/Roman Egypt also in the Fayum, those basins being called περιχώματα or ὑδροστάσια in the papyri;[51] however, where we have information about their sizes in the Fayum they were ten times larger than all the basins in Philoteris combined (P. Lille 1).

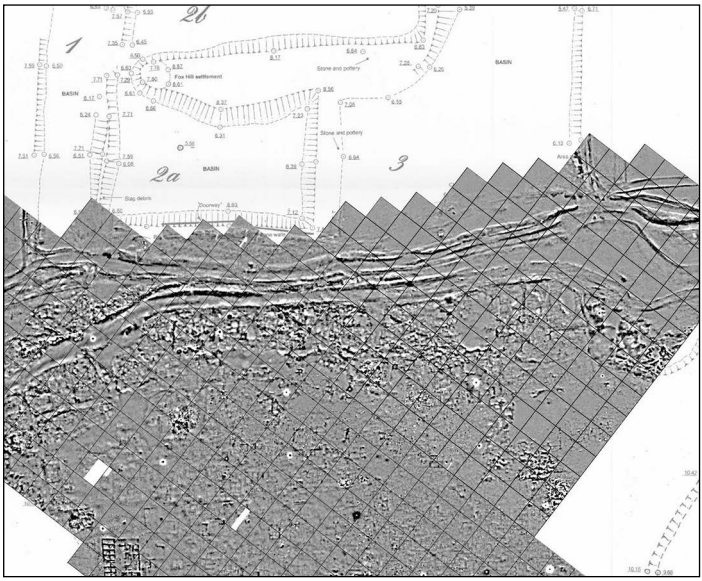

Figure 8. The basins in the north of Philoteris, canals and village; see Römer, 2004, Map in cover of volume, and Herbich in season 2011/2012.

50 Römer, 2004, p. 281–305.

51 Bonneau, 1993, p. 45–47. See now also Rapoport/Shahar, 2012; p. 1–31; basin irrigation was used in the Fayum in the area of Philadelphia, but not elsewhere.

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It seems that the huge basins in the north were water storage basins meant to prevent the worst case scenario, which finally became true in the middle of the fourth century, when the entire area dried out.

The drillings and the small-scale excavation in November 2012 have given us new information about the levels between village, canals and basins. They have revealed another interesting feature of these basins. They were connected underground to a well above, which was built with carefully hewn lime stones on top of the bedrock. As in the cemetery to the south of the village, the bedrock is only approx. 60 cm thick here before it gives room to a hollow space which obviously extended largely under the village and the adjacent areas. The well was not fed by water from the canal above, but would fill from the hollow underneath which is positioned at the same level as the basins. The situation of the installations north of Karanis (see above) may the similar.

By drillings in the canals, their width and depth became clear. The upper and the lower canals were 7 to 8 m wide, the upper being at least 2.30 m deep. Here, boats may have travelled up to the landing places at the village.

In this area, more than 70 km away from the Nile, people used the water resources of the river for at least 700 years. In the Fayum, they celebrated the Katachyteria, the festival for the first arrival of the flood at Elephantine,[52] named their children Nilus or Nilammon,[53] and struggled with low or excessive floods.

5. Conclusion

Thanks to the new technical achievements of Google Earth, geomagnetic surveys, and intensive archaeological work it is now possible to understand better the measures taken to advance agriculture in the Fayum during the Middle Kingdom and the Graeco-Roman period. Today, the Fayum belongs to the poorest regions of Egypt and the interest in the water management of the past (in the Graeco-Roman period fields covered larger areas than today in some parts of the Fayum) is increasing.

52 P. Cairo Zenon II 59176, 39–40, from 255 B.C.

53 See the papyrological Database “Trismegistos”, People.

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