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## Medieval Egyptian Economic Growth: The Maryūt Basin

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**Abstract**

The Maryut Basin was famous in antiquity for its freshwater lake and brisk economic activity. The basin was later infamous as a saltmarsh in the Ottoman period. In between (from the Islamic Conquest - 640 CE – to the end of the Mamluk period – 1517) – the basin it is said to have been a neglected brackish lake where freshwater from the few remaining irrigation canals from antiquity did battle with seawater from the Mediterranean. This article will argue that irrigation system development (1170-1315) may have allowed for farming (summer cropping in particular) of the south-east half of the Maryut Basin. The hypothesis is therefore that: the south-east section of the Maryut Basin and the lands bordering the basin, were part of a thriving and growing agricultural economy in the 1170-1315 period



The Maryūt Lagoon, early 1800s

(with south-east basin is identified by arrow)

(The contours of the lagoon in 2012 are indicated by the shaded area, upper left)

Sketch by author based on the maps of the Napoleonic Expedition to Egypt

The subject of this article is the medieval Egyptian economy (c. 1170-1315 CE) and its irrigation system. Egypt's economic growth can be glimpsed through the lens of irrigation development and expansion; the economic history of Egypt can in fact be interpreted from a number of different perspectives, and scale – temporal and spatial – can be important. Different

perspectives are useful: sometimes the macroeconomic picture of long-term change is the most illuminating approach, but at other times, local history and its wealth of specifics can be highly informative. In this case, both irrigation and the local perspective are attempted via a focus on irrigation in a small section of the Nile Delta province of Buhayra: the south-east section of the Maryut Lagoon and the agricultural lands around it.<sup>1</sup>

This local chapter of economic history was driven by irrigation system growth. Irrigation system expansion and development was in essence the underlying process that made all other forms of economic growth possible. Indeed, the irrigation system was the fulcrum, the agrarian economy the lever, which made rural commerce, rural proto-industry and the urban economy possible. However, it seems fair to say that Egypt's irrigation system in the Islamic period (c. 640-1800 CE) has received little scholarly attention, with a few notable exceptions.<sup>2</sup>

<sup>1</sup> A good introduction to the medieval terrain is Christian Decobert, "Maréotide médiévale. Des bédouins et des chrétiens." *Etudes Alexandrines* (2002): 127-167. For exploration and mapping of this lagoon, see Wilson, Penelope, "Recent Survey Work in the Southern Mareotis Area," in *Lake Mareotis: Reconstructing the Past*, vol. BAR International Series 2113 (presented at the Proceedings of the International Conference on the Archaeology of the Mareotic Region, Archeopress BAR, 2010), 119-125; Ismael Awad, "A study of the evolution of the Maryut Lake through maps" in: L. Blue, E. Khalil (Eds.), *Lake Mareotis: Reconstructing the Past*, Proceedings of the International Conference on the Archaeology of the Mareotic Region Held at Alexandria University, Egypt 5th-6th April 2008, University of Southampton Series in Archaeology, vol. 2, BAR S2113, Oxford (2010), pp. 11-33; idem, "Lac Mariout: L'eau dans tous ses états cartographiques." *Hairy I. (éd.), Du Nil à Alexandrie: Histoire d'eaux, éd. Harpocrates, Alexandrie* (2009): 190-205; Blue, L., Khalil, E., Trakadas, A. (Eds.), 2011. A Multidisciplinary Approach to Alexandria's Economic Past: The Lake Mareotis Research Project. University of Southampton Series in Archaeology, vol. 5. Bar International Series 2285, Oxford, p. 313; Chen, Z., Warne, A.G., Stanley, J.D., 1992. Late quaternary evolution of the northwestern Nile Delta between the Rosetta promontory and Alexandria, Egypt. *Journal of Coastal Research* 8 (3), 527e561; Blue, L., Khalil, E. (Eds.), 2010. *Lake Mareotis: Reconstructing the Past*. Proceedings of the International Conference on the Archaeology of the Mareotic Region Held at Alexandria University, Egypt, 5th-6th April 2008.

<sup>2</sup> Among the few exceptions to this general rule: the works of Omar Toussoun from the 1920s: Toussoun, O., 1922. *Mémoires sur les anciennes branches du Nil, époque ancienne*. In: *Mémoire de l'Institut d'Égypte*, vol. 4. IFAO, Le Caire; Toussoun, O., 1925. *Mémoire sur l'histoire du Nil*. In: *Mémoire de l'Institut d'Égypte*, vol. 18. IFAO, Le Caire, pp. 366e404; Toussoun, O., 1926. *La géographie de l'Égypte à l'époque arabe*, tome 1, partie 1. In: *Mémoire de la Société Royale Archéologique d'Alexandrie*, tome, vol. 8. IFAO, Le Caire Alan Mikhail, whose archival research and analysis has produced a wealth of information about the system in the Ottoman period. See Alan Mikhail, "Middle East Environmental History: The Fallow between Two Fields." In *Water on Sand: Environmental Histories of the Middle East and North Africa*, edited by Alan Mikhail. New York: Oxford University Press, 2013; *Idem*, "From the Bottom Up: The Nile, Silt, and Humans in Ottoman Egypt." In *Environmental Imaginaries of the Middle East and North Africa*, edited by Diana K. Davis and Edmund Burke III. Athens: Ohio University Press, 2011. *Nature and Empire in Ottoman Egypt: an environmental history*. Cambridge University Press, 2011; see also Tsugitaka Sato, *State and rural society in medieval Islam*. Leiden: Brill, 1997; *idem*, "Irrigation in Rural Egypt from the 12<sup>th</sup> to the 14<sup>th</sup> Centuries," *Orient* 8 (1972): 81-92; Stuart Borsch, *The Black Death in Egypt and England* (Austin: Texas University Press, 2006); *idem*, "Nile Floods and the Irrigation System," *Mamluk Studies Review* 4 (2000), 131-145; *idem*, "Environment and Population: the Collapse of Large Irrigation Systems Reconsidered," *Comparative Studies in Society and History*, Vol. 46, No. 3 (Jul., 2004), pp. 451-468. Another exception would be the Islamic Fayyum, but that was in many respects a different type of system. For the Fayyum's system, see Yossef

This article will try to shed light on the irrigation system by studying its operational characteristics and quantitative dimensions in the vicinity of the Maryut Lagoon. The discussion that follows is in the manner of a hypothesis constructed of historical building blocks; it seeks to account for the appearance and disappearance of economic activity (c. 969-1517 CE) in the wider outskirts of Alexandria – a hypothesis that is intimately connected to the functioning of the irrigation system. The hypothesis itself is that the south-east section of this lagoon, a ruinous saltmarsh (“sabkha”) in the Ottoman and Modern periods (c. 1500-1850 CE) was once fertile agrarian land.<sup>3</sup>

While scholars of Ptolemaic and Roman antiquity are well aware of the bygone historical prominence of this lagoon (in antiquity the scene of lively economic activity), the widely held consensus of historians and archaeologists is that this area was a backwater of little importance in the Islamic period – and only became functional again in the nineteenth century (with colonial and modernizing attention). Summing up scholarly consensus on the subject of the Maryut Basin, Emad Khalil notes that: “The relationship between Lake Mareotis and the Nile terminated by 12th century AD due to the silting of the Canopic Branch and all the canals that had fed the lake. As a result the supply of fresh water to the Alexandria region diminished and the level of Lake Mareotis fell, so that the lacustrine depression became a series of salty marshes and sabkhas. Mareotis thus became a closed lagoon without a constant supply of water, and due to increasing evaporation, its size decreased significantly and the once-rich fertile regions to the south and west of Alexandria disappeared. It was not until 1892 when the major irrigation projects in the western Delta were established, that the depression started receiving agricultural runoff and irrigation water carried by a number of canals and drains, filling the depression and creating the present Maryut Lake.”<sup>4</sup> Valerie Pichot’s apt characterization of economic Maryut’s history also resonates with the prevailing consensus, “Les population bedouin colonisent

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Rapoport and Ido Shahar. "Irrigation in the Medieval Islamic Fayyum: Local Control in a Large-Scale Hydraulic System." *Journal of the Economic and Social History of the Orient* 55, no. 1 (2012): 1-31; Alan Mikhail, "An Irrigated Empire: The View from Ottoman Fayyum." *International Journal of Middle East Studies* 42, no. 04 (2010): 569-590. Related to irrigation and Nile water supply in the Islamic period, see, Eric Chaney, “Revolt on the Nile, Economic Shocks, Religion, and Political Power,” *Econometrica*, Vol. 81, No. 5 (September 2013), pp. 2033-2053; Fekri Hassan, “Extreme Nile floods and famines in Medieval Egypt (AD 930-1500) and their climatic implications,” *Quaternary International* 173-174: 101-112.

<sup>3</sup> For the well-documented case that the Maryut basin was a sabkha in the Ottoman era, see the archaeological work of Clément Flaux, Mena El-Assal, Nick Marriner, Christophe Morhange, Jean-Marie Rouchy, Ingeborg Soulié-Märsche, and Magdy Torab. "Environmental changes in the Maryut lagoon (northwestern Nile delta) during the last~ 2000 years." *Journal of Archaeological Science* 39, no. 12 (2012): 3493-3504. Among other things their research, textual and archaeological notes a likely connection between the Black Death and the basin’s transition to saltwater swamp in the 1400s to 1800s. The connection with plague is established not only by their soil samples, but also by their reading the work of Nicolas Michel’s. His study (“Villages Desertes,” 2002) of an early Ottoman cadaster gives evidence of plague depopulation from the mid-fourteenth century to the early sixteenth century.

<sup>4</sup> Emad Khalil, “The Sea, the River and the Lake: All the Waterways Lead to Alexandria,” *On line* 1: 33-48.

progressivement les terres. La province passe alors d'une économie fondée sur une exploitation intensive de la terre à une économie fondée sur l'élevage extensif et la culture de petite parcelles. La plupart des infrastructures mises en place pour accueillir les pèlerins ou liées aux productions agricoles sont abandonnées...les canaux navigables qui alimentent le lac en eaux douces ne sont plus entretenus.”<sup>5</sup> Finally, Ismael Awad notes that it became an “étang pendant 700 ans .. suite à l'abaissement du niveau d'eau dans les branches du Nil qui se versaient dans le lac.”<sup>6</sup>

If this hypothesis is correct, it would certainly fly in the face of scholarly consensus. (Flaux et al. are the only ones that I know that have in any way challenged the prevailing conclusions.)<sup>7</sup> And scholarly consensus may be absolutely right – and this contention that there was a period of economic prosperity in this far corner of western Buhayra completely off; this article presupposes that it's worth taking a second look at this situation. There is also something familiar about this scholarly consensus; it seems to fit too easily with the old notion that in the period between the splendor of Greco-Roman civilization and the modernizing influence of enlightened Europe, there was a long interval of decadent Muslim (or “Mameluke”) rule. The salient point about this notion regards the irrigation system; during this interval it is imagined that it was – for the most part – barely functional, and that much of it fell into decay. It seems to me that evidence does support the assertions at either end of this interval: Roman Egypt's irrigation system was indeed a substantial achievement – and the system of 1798 was in very poor condition (in the Delta and Upper Egyptian peripheries at least). This being said, curiosity provokes a second look at this interval.

### ***Introduction: The Geographical and Historical Context***

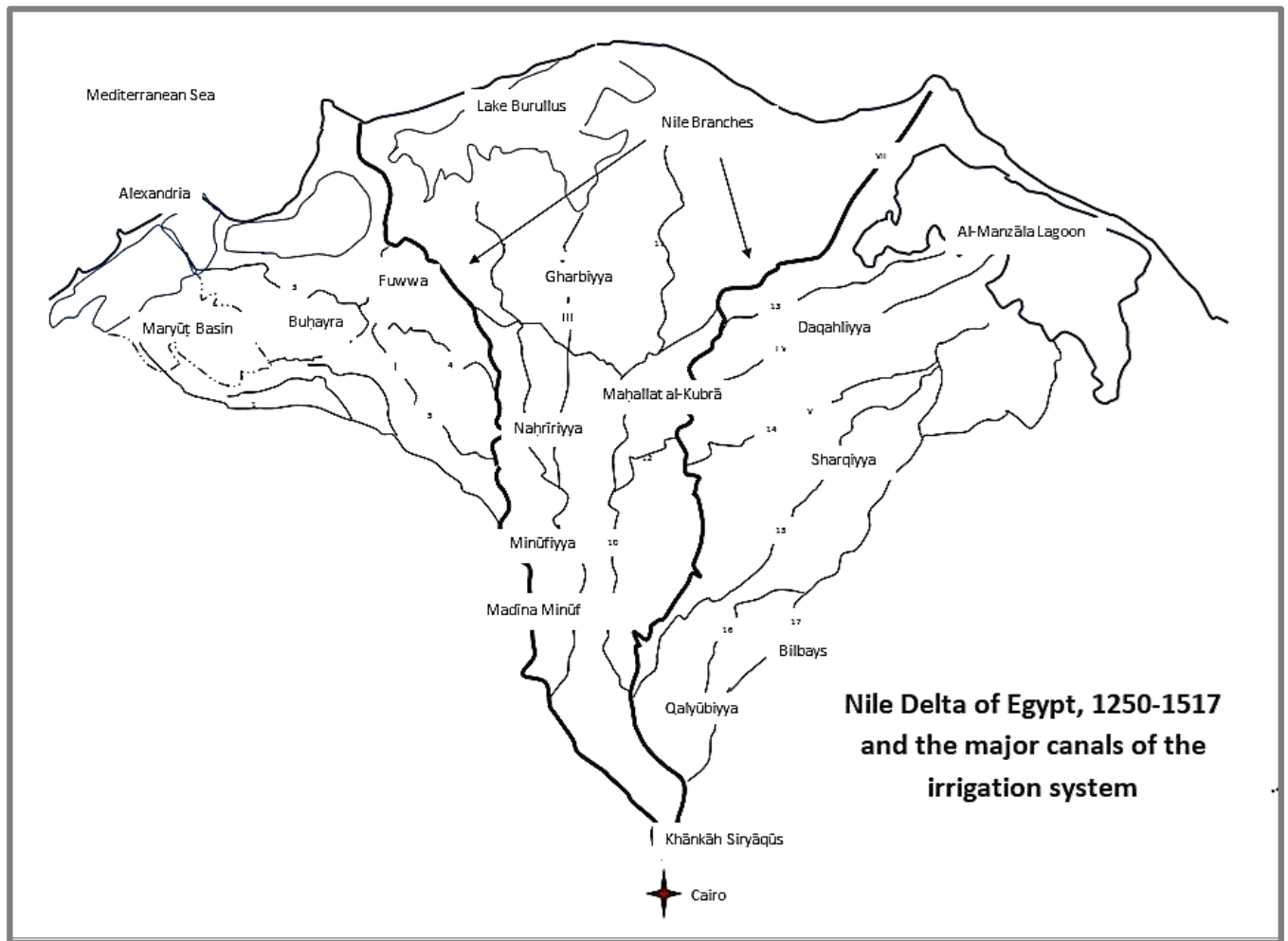
The Maryut Lagoon is located in west Nile Delta province of al-Buhayra, on the left hand side of the irrigation system map of Egypt below (for the Mamluk period, 1250-1517 CE ).

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<sup>5</sup> Valerie Pichot, “La mareotide histoires en eaux troubles” in *Hairy I.(éd.), Du Nil à Alexandrie: Histoire d'eaux, éd. Harpocrates, Alexandrie (2009)*, 162.

<sup>6</sup> Awad, “Le lac Mariout l'Eaux dans tous ses états cartographiques,” in *Hairy I.(éd.), Du Nil à Alexandrie: Histoire d'eaux, éd. Harpocrates, Alexandrie (2009)*, 193.

<sup>7</sup> Flaux et al., “Environmental” 2012.



The Medieval Nile Delta

(Showing major irrigation canals, based on medieval Arabic sources/sketch by author)

The western half of al-Buhayra bears resemblance to other areas of the Delta's periphery, in the sense that it is a low lying reservoir of irrigation system drainage, potentially high in salinity and waterlogged with undrained Nile floodwater. In the early nineteenth century, these endemic weaknesses had rendered much of the periphery as wasteland.<sup>8</sup> What can be seen in the contour

<sup>8</sup> Scholarship over the last 50 years affirms that western Buhayra, and in fact much of the rest of the Delta's periphery, was in very bad shape at the dawn of the early nineteenth century. A study by Sylvie Fanchette notes that the drainage of the periphery had largely failed, allowing the flood basins to sit drowned in water from October to April, after which evaporation would be accompanied by the buildup of salts. As Fanchette described the problem: "The periphery of the Delta, with the exception of areas near the Dumyāt and Rashīd branches of the Nile and along the lengths of some of the major canals, returned to its natural state, a vast marshy bog, bereft of inhabitants, the irrigated and cultivated area barely extended beyond the 3-4 meter contour lines." Sylvie Fanchette, *Le Delta Du Nil: Densités De Population Et Urbanisation Des Campagnes*, vol. 32 (Université Francois Rabelais, 1997), 38. Fanchette also notes that maritime influence at lower elevations led to considerable salinity problems that could prove intractable, if proper measures were not taken. A recent study using GIS mapping argues that essentially all areas of the Delta below 3 meters were uninhabited waste well into the nineteenth century. Saline soils and *sabkha*

map and surface relief below is the slope of elevation that leads downward from a point some nine meters above sea level in the south-west (the direction of Cairo) to the low point that is the Maryūt's declivity, some 2 meters below sea level.<sup>9</sup> As geographically geographically vulnerable terrain, areas like western Buhayra were the first to go if settled order retracted.<sup>10</sup> If it was not seawater, salinity, and run-off that claimed the area, it was the peripheral Bedouin tribes. While Bedouin tribes were themselves a hub of economic activity, they were often at odds with sedentary life and settled agriculture, a fact that is well established by accounts from the late Mamluk period.<sup>11</sup>

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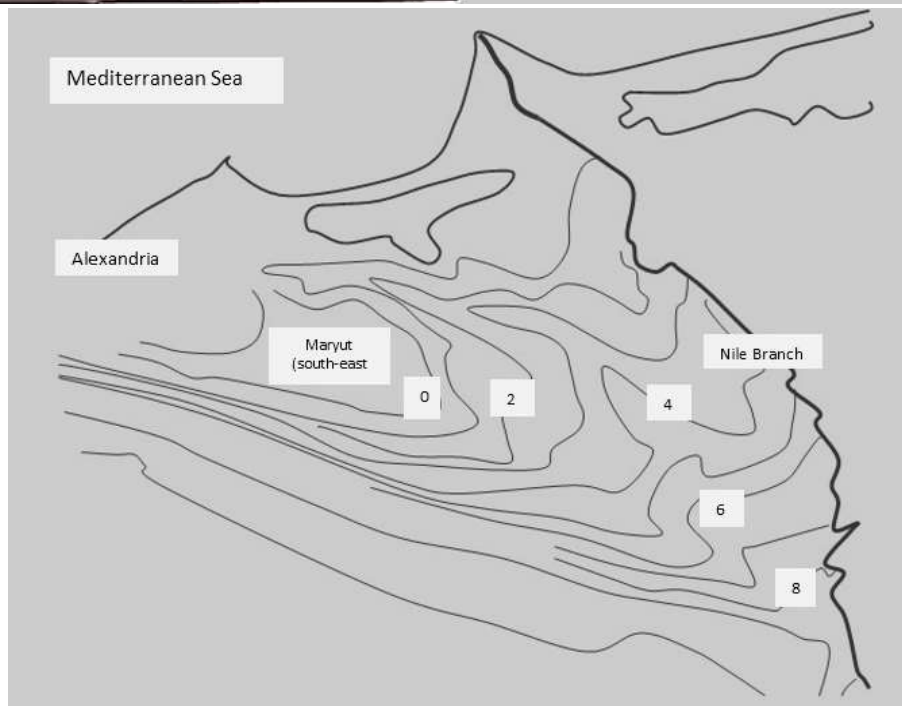
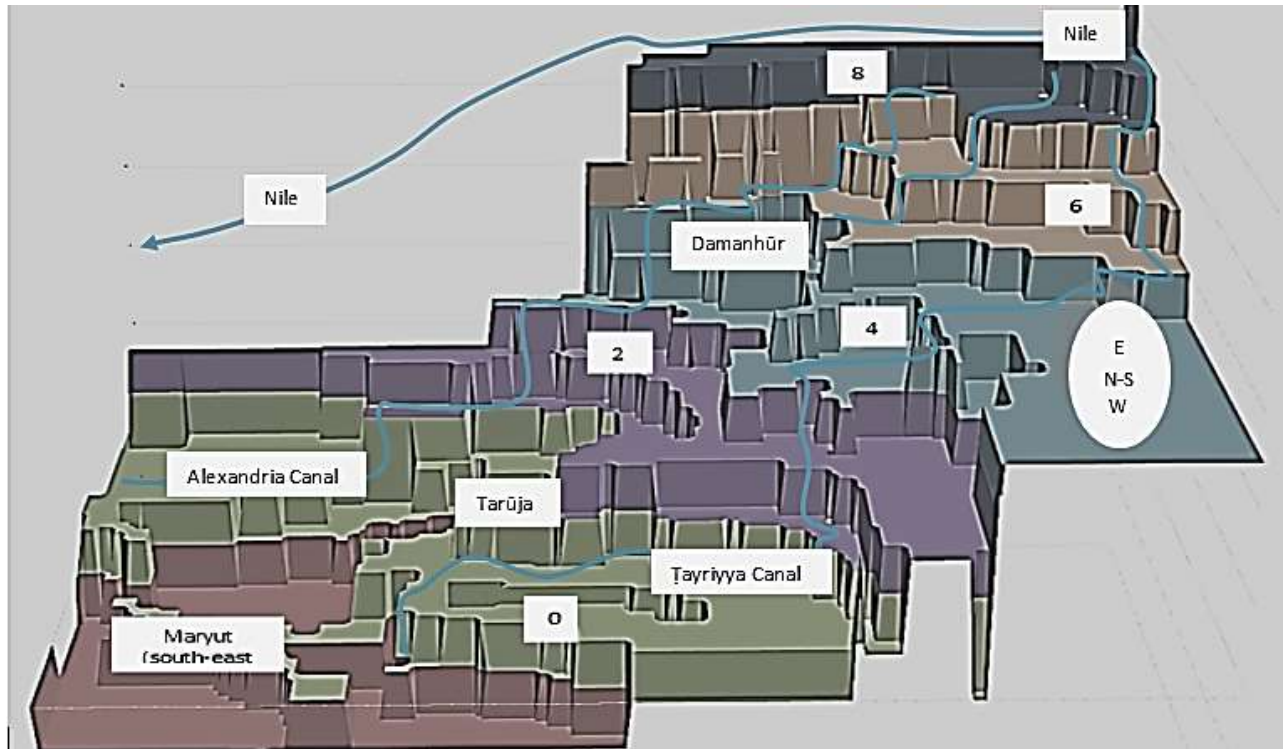
predominated. Drainages were often blocked by sand. Denser settlement only really began around 1805, by Alaaeldin's chronology. When and how the periphery of the Delta became waste is reflected in a number of different views and conjectures. Allaaeldin favors the notion that sea-level changes and/or subsidence of the northern coast, led to flooding of the Delta periphery. He notes that the endemic – geographically determined – problems with drainage made this area essentially uninhabitable.; Alaaeldin Elwas. *Siedlungsentwicklung im nordwestlichen Nildelta Eine Untersuchung unter Anwendung von Fernerkundungsdaten, GIS und Karteninterpretation*. Diss. Freie Universität Berlin, Universitätsbibliothek, 2002, 106-7, 124.

<sup>9</sup> Michel, "Villages Desertes, 200."

<sup>10</sup> For comparisons with other peripheral areas of the Delta, see Blouin's work on the Mendesian nome in Roman Egypt :Katherine Blouin, "The Agricultural Economy of." *The Roman Agricultural Economy: Organization, Investment, and Production* (2013); idem, "The Agricultural Economy of the Mendesian Nome under Roman Rule." *The Roman Agricultural Economy: Organization, Investment, and Production* (2013); idem, Blouin, Katherine. "THE REVOLT OF BOUKOLOI (NILE DELTA, EGYPT, CIRCA 166-172 AD): LOOKING ON THE SOCIO-ENVIRONMENTAL VIOLENCE." *PHOENIX-THE JOURNAL OF THE CLASSICAL ASSOCIATION OF CANADA* 64.3-4 (2010)

<sup>11</sup> For Bedouin, see Imād Badr al-Dīn Abū Ghāzī's *Ṭaṭawwural-Ḥiyāzatal-Zirā'īya Zamān al-Mamālīk al-Jarākisa* (Cairo: 'Ayn līl-Dirāsawa'l-Buḥūthal-Insānīyawa'l-Ijtimā'īya, 2000); Reuven Aharoni *Bedouin and State in the Egypt of Mehmet 'Ali 1805-1848* (Psychology Press, 2007); Stanford Shaw (Shaw, *The Financial and Administrative Organization and Development of Ottoman Egypt, 1517-1798*, 19 (Princeton University Press, 1962), 12-13) Sylvie Fanchette (*Le Delta Du Nil: Densités De Population Et Urbanisation Des Campagnes*, vol. 32 (Université François Rabelais, 1997), 43) and Garcin (J. Garcin, "C1. 1978' Note Sur Les Rappports Entre Bedouins Et Fellahs'aL'dpoque Mamluke.'," in *Annales Islamologiques*, vol. 14, n.d., 147–163, 156-161. See the discussion of the Bedouin and their impact on the irrigation system in Borsch, *Black Death in Egypt and England* (Austin: Texas University Press, 2005), 51-4, and idem, S. J. Borsch, "Nile Floods and the Irrigation System in Fifteenth-Century Egypt," *Mamluk Studies Review* 4 (2000): 132-145, 137-9. See also W. K. Mujani, "The Nile and Irrigation System During the Mamluk Period (1468-1517)," *Australian Journal of Basic and Applied Sciences* 5, no. 9 (2011): 2264–2268, 2267. A. Damurdāshī and D. Crecelius, *Al-Damurdashi's Chronicle of Egypt, 1688-1755: Al-Durra Al-muṣāna Fī Akhbār Al-Kināna*, vol. 2 (Brill, 1991), 81. Crecelius cites 'Abd al-Raḥīm, *al-Mughārība* 31-46 as well as Layla'Abd al-Laḥf, "Shaykh al-'Arab Humam wa Ḥukm Wilāyat Jirjī," unpublished MA thesis, Cairo University, 1970.





Contour Map and Surface Graph of al-Buhayra and the Maryūt Area  
 (Sketch and graph by author after Alaaeldin Elwan, 2002 and Sylvie Fanchette, 1997)

By the early 1800s, the entire basin had become a vast saltmarsh, watered only when the failure of sea-dikes let the Mediterranean's sea water in.<sup>12</sup> If this article's hypothesis is correct and some or all of the south-east basin had been flourishing agricultural land centuries before, then we would expect the following two assumptions to apply. The remainder of the article investigates these two propositions.

1. There was an effective irrigation system supplying water to the area.
2. There is evidence of lively economic – and agrarian - activity in the area.

### ***Section 1: Evidence of Supply - Irrigating the south-east Basin***

The subject of water supply prompts a few words about the functioning of this irrigation system. The annual flood of the Nile (in late summer/early autumn) was the source of the water for this system. Feeding off of the Nile's annual flood, basins (*ḥawḍ/aḥwād*) were the center of pan-village production, varying in size from as little as between 500 hectares and 20,000 hectares and some 4-20 villages per basin.<sup>13</sup> Large "sultani" canals supplied the basins with water, saturating the basins with 1.25 to 2 meters of water. Sultani dikes contained the basin floodwater (water 1.25 to 2 meters in depth) and varied in length from some 500 meters all the way up to 20km.<sup>14</sup> Villages were set at high points (koms, tells) and/or were at the edges of the flood basins. Within the confines of the individual village were its baladī systems; these local meshes of smaller dikes and canals were integral parts of the individual village and were supposed to be maintained by that village.<sup>15</sup>

<sup>12</sup> See Flaux et al., "Environmental changes," 3493-3504.

<sup>13</sup> Julien Barois, United States, and Army., *Irrigation in Egypt / Miller, Alexander M., ; Tr.*, [United States] 50th Cong., 2d Sess. House. Mis. Doc.,; 134; (Washington: Gov't print. off., 1889).

<sup>14</sup> For the dimensions of the dikes, see nineteenth century data in A. B. 1793-1868 (Antoine Barthélemy) Clot-Bey, *Aperçu Général Sur l'Égypte*, (Paris, Fortin, Masson et cie, 1840), 473-474 in Helen Anne B. Rivlin, *The Agricultural Policy of Muhammad `Ali in Egypt.*, Harvard Middle Eastern Studies,; 4; Variation: Harvard Middle Eastern Studies ;; 4. (Cambridge, Harvard University Press, 1961); and see below for an extended discussion of the dikes.

<sup>15</sup> The distinction is made clear in Ibn Mammātī, *Qawānīn*, 232-3 and also in al-Qalqashandī, 3: 515-16. See Aḥmad ibn `Alī al-Qalqashandī, *Subḥ al-a`shā fī sinā`at al-inshā*. 14 vols. 1913-1919.



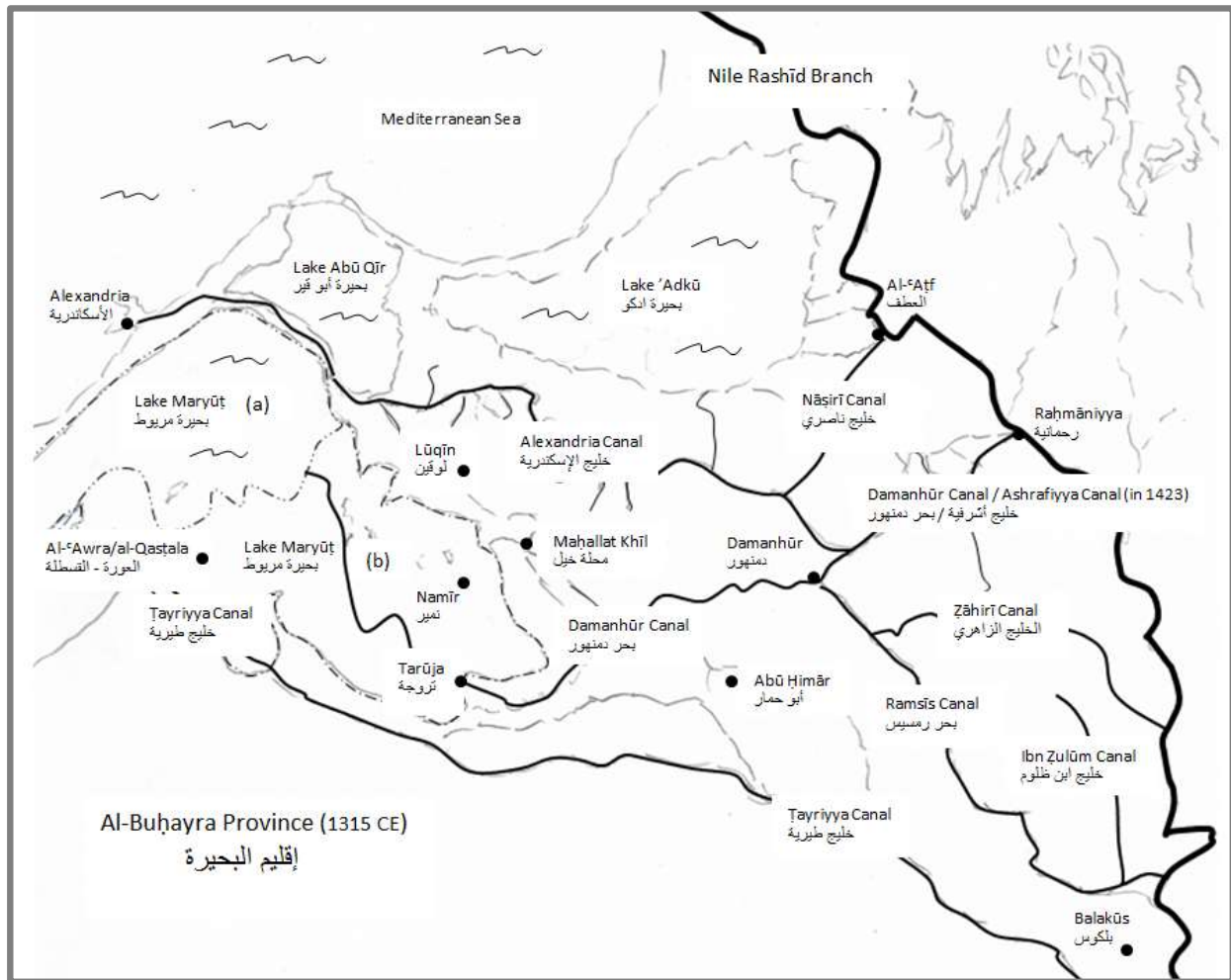
Simple Flood Basin

Triangular Basin with Five Villages, Two Dikes and the Nile River  
 Macharis and Danzamet Dikes (2-3 km long; enclosing some 3,000 hectares)

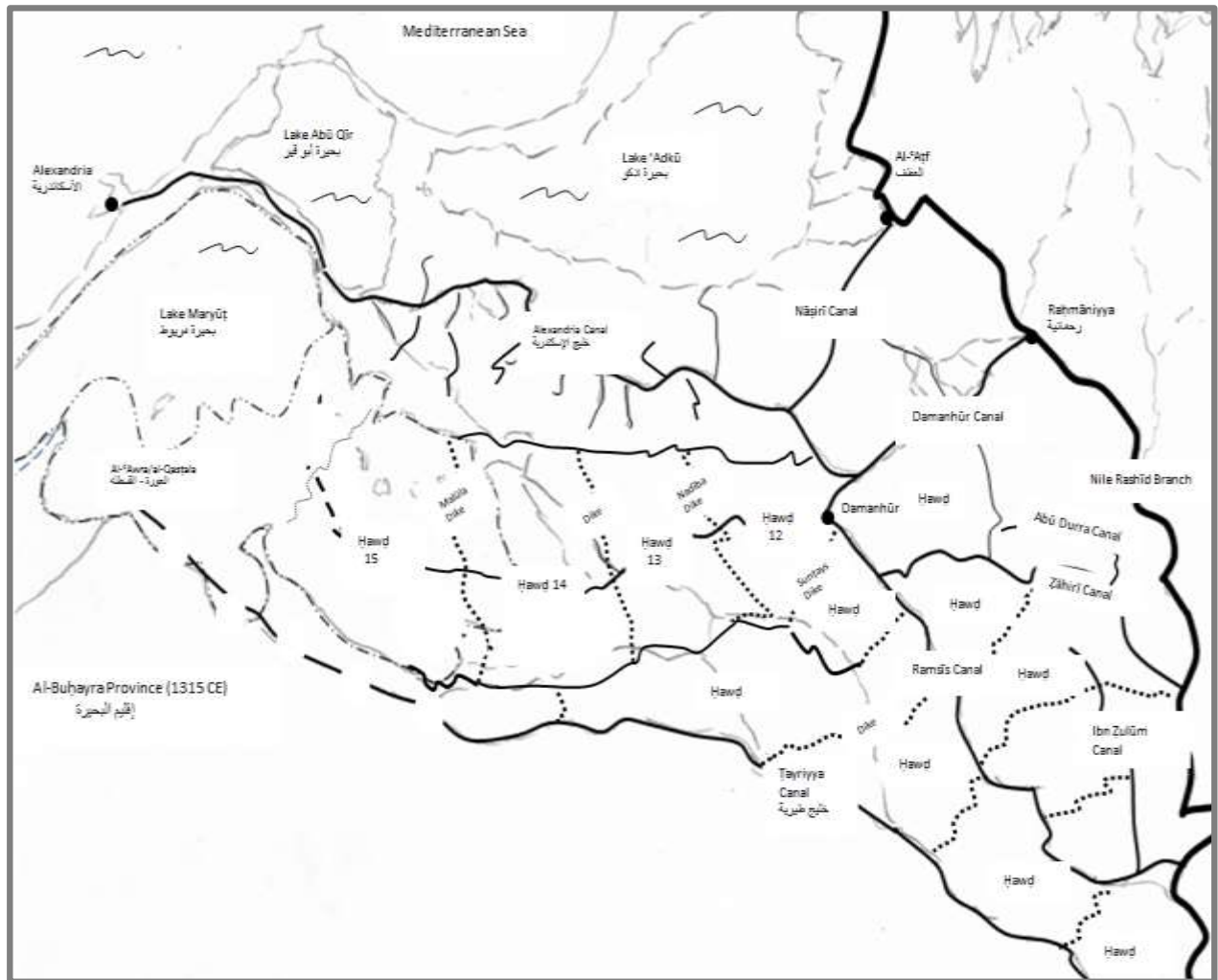
From *Description de l'Egypte* (Province of Thebes)

(Reproduced with the kind permission of David Rumsey Map Collection)  
 (www.davidrumsey.com )

It was this flood recession system that would have furnished floodwater for agricultural activity along and in the south-east basin of the lagoon. The historical record suggests that the local source of this water would have been two major canals: the Bahr Damanhur and the Khalij Tayariyya (though the Alexandria canal would count as a minor feeder to the north). The following maps show these two canals in what was their setting amid the irrigation system of this province in this 1070-1315 CE interval.



Map showing the canal layout for the Damanhūr, Ramsīs, and Ṭayriyya Canals (sketch by author based on Fatimid, Ayyubid, and Mamluk-era sources)



Map showing the basin chain layout for the Damanhūr, Ramsīs, and Ṭayriyya Canals (sketch by author based on Fatimid, Ayyubid, and Mamluk-era sources)

The functioning of these two canals, the Baḥr Damanhūr and the Khalīj al-Ṭayriyya are investigated here in two ways: for the Damanhur canal, a set of operating instructions for the irrigation system in flood, and for the Tayriyya canal the historical record of its excavation and expansion. For the first of these then, the Baḥr Damanhur, there are then two texts that follow. These are a rare and valuable part of the historical record for flood recession control in the Delta. They convey orders by which the system was to be operated, and are among the few surviving specimens of medieval Egypt's "water law," the Qanun al-Riyy.<sup>16</sup> The Qanūn al-Riyy specifically directs the opening and closing of dams and dikes for the Damanhur canal (see map above). It was part of a larger set of instructions that controlled the province – and the Delta – as a whole. The first of the two texts was passed down to us by al-Makhzumi in the late 1100s, the second is a variant from Ibn Mammātī some 20 to 30 years later.<sup>17</sup> The variation between the two texts seems to reflect alterations to the system, alterations driven by irrigation construction and expansion in the province at this time. What can be seen via these texts and the embedded schematics is that they trace the contours of the Damanhur flood basin chain along the lines of the numbering system used here. The numbering system is a template provided by Omar Toussoun's schematics from the 1920s and his labeling from east to west, the *Ḥawḍ/Aḥwāḍ* (flood basins) 12 through 15.

<sup>16</sup>See discussion in Cooper, Richard. "The Assessment and Collection of Kharaj Tax in Medieval Egypt," *Journal of the American Oriental Society* 96 (1976): 91-102; idem, "Land Classification Terminology and the Assessment of the Kharaj Tax in Medieval Egypt." *Journal of the Economic and Social History of the Orient* 17 (1974) 91-102; idem, idem, "Ibn Mammātī's Rules for Ministries." Ph.D. Dissertation, University of California, Berkeley, 1973; the term is ubiquitous and is encountered throughout the literature in Ibn Mammātī, *Qawānīn*, al-Qalqashandī, *Ṣubḥ*, Nuwayri, *Niḥayāt*, 8: 247-251, and frequently appears in references to the irrigation system. Apropos here might be a reference to orders in an edict from Sultan Qalāwūn to his son al-Malik al-Ṣāliḥ °Alī, in A. Morberg "Regierungspromemoria eines ägyptischen Sultans," G. Weil ed. *Festschrift Sachau* (Berlin 1915) 406-21, where provincial governors are expressly commanded to follow the exact instructions of the *Qawānīn al-Riyy*: (... يتقدم الولد الى الولاية بالاجتهاد في رى البلاد (... وتحدّرهم من ان يبور منها قعر قصبية او ان تهمل امور قوانين الرى) and not to ignore any aspects (*tuhmal 'amūr qawānīn al-riyy*) of these instructions.

<sup>17</sup>Abū al-Ḥasan °Alī ibn °Uthmān al-Makhzūmī (d. 1189), *Kitāb al-minhāj fi 'ilm kharāj Miṣr* as cited in Ṭāqī al-Dīn al-Maqrīzī (d. 1442), *Kitāb al-mawā'iz wa'l-i'tibār bi-dhikr al-khiṭaṭ wa'l-āthār*, 2 vols. Cairo: 1853-1854, 1: 170; °As°ad bin Mammātī (Ibn Mammātī, d. 1209), *Kitāb al-qawānīn al-dawānīn*, edited by A.S. Atiya. Cairo: 1943, 226-7. The original manuscript from *al-Minhāj* was long thought lost and although parts of the manuscript have been found, the specific excerpt here concerning the *Baḥr Damanhūr* has never been located. For the sections of *al-Minhāj* that were found by Claude Cahen (British Museum MS. Add. 23,483), see Abu al-Hasan °Ali ibn °Uthman Makhzumi, *al-Muntaq'a Min Kitāb Al-minhaj Fi 'ilm Kharaj Misr / Cahen, Claude, Mulhaq Hawliyat Islamiyah; Al-'adad Raqm 8; Variation: Supplément Aux Annales Islamologiques; Cahier No 8. (al-Qahirah: Institut français d'archéologie orientale, 1986). With regards to the transmission of al-Makhzūmī's text, al-Maqrīzī names al-Makhzūmī as he quotes him, but Ibn Mammātī does not, and his variant seems too divergent for a simple case of mis-transcription. I propose that both he and al-Makhzūmī are transcribing or reading from a third source. Linda Northrup suggests this possibility in, *From Slave to Sultan: The Career of Al-Manṣūr Qalāwūn and the Consolidation of Mamluk Rule in Egypt and Syria (678-689 A.H./1279-1290 A.D.)* (Stuttgart: Steiner Verlag, 1998), 255-6. Ibn Mammātī's *Qawānīn al-dawāwīn* variation diverges sharply from the *al-Minhāj* and appeals to a sense of precision hydraulic control. We examine the two variants below as we interpret the basinchain flow-dynamic.*

The control of this basin chain was tightly linked to the operation of the *Baḥr Ramsīs* basin chain. (The latter included five basins for which filling closely coordinated with the western section of the *Baḥr Damanhūr*.<sup>18</sup>) Control on a provincial level by a governor (*wālī*) at the capital seat of Damanhūr, was the *sine qua non* of the *Qanūn al-Riyy*.<sup>19</sup> The schedule here is for the filling of basins, periods of eight and/or ten days correspond to the specific hydraulic dimensions of (1) the Damanhūr Canal in terms of velocity and cross-section, and (2) the volume of the basin in question.<sup>20</sup>

<sup>18</sup> Comparison between al-Maqrīzī's rendition of al-Makhzūmī and Ibn Mammātī's source invites speculation here. It is proposed that Ibn Mammātī's version of the *qanūn al-riyy* for basin chains 12-15, *Baḥr Damanhūr*, and basin chains 4-8, *Baḥr Ramsīs*, might be older than the al-Makhzūmī version. To begin with, the area is explicitly referred to as *Ḥawf Ramsīs*, an archaic territorial designation standing for the nome-level structure and control that was operational in the Fatimid period but not in the Mamluk period. (In the latter era, larger-scale - much larger-scale - provincial structure and provincial control, an altogether different entity, prevailed.) Ibn Mammātī's version of the Ramsīs basin chain also stops at *Abū Ḥumār* and *al-Buhūṭ*, and, following instructions for the *Baḥr Damanhūr* then takes up a very different set of conditional clauses and provisional instructions that involve the interaction of *Baḥr Ramsīs*, *the Tur'a Tabarīna*, *the Baḥr Damanhūr*, *Ḥawḍ 8*, and *Ḥawḍ 12*. Conditional "if/then" clauses are the hallmark of a more finely-tuned complex system, and in this case they reflect the specific temporal and geographic nature of this setting. See Ibn Mammātī's text, *Qawānīn*, 225-7.

<sup>19</sup> In al-Buḥayra, the operation of the system by the governor's authority was mandated by the *Qanūn al-Riyy*. The immediacy and urgency of control is reflected by the mandate for the irrigation bureaucracy to use carrier pigeons (*al-ḥamām al-risālī*) for rapid communication during the rising flood, and for the coordination of dike and canal openings. For carrier pigeons, and the emphasis on *remote control*, *extra-local control*, *top-down control*, by the governor, see A. Morberg "Regierungspromemoria," 406-21, where provincial governors are expressly commanded to follow the exact instructions of the *Qawānīn al-Riyy*: (... يتقدم الولد الى الولاية بالاجتهاد في رى البلاد وتحذّرهم ... (من ان يبور منها قعر قصبية او ان تهمل امور قوانين الرى tuhmalā 'amūr qawānīn al-riyy) of these instructions. Compare these instructions with a similar *tadhkira* (from the same Sulṭān, Qalāwūn), for the year 1281 CE, which can be found in Tsugitaka Sato "A Memorandum to Amir Kitbughā," in *State and Rural Society in Medieval Islam* (Leiden: Brill, 1997): 105-123. The mandate for regional remote control, *from a distant center*, was a geographically specific aspect of the *Qanūn al-Riyy*, where the nature and level of control for the Delta differed broadly from that of Upper Egypt. For the latter, sulṭānī component density was much lower, and less convoluted; control was correspondingly simpler: the system was *simple*. For the Delta, control was on a higher level. We propose that al-Buḥayra may have been subject to a particularly high level of control, corresponding to the high density and compactness of its mesh of canals and dikes, which were both more extended and more intense than were components in the core areas of the Delta. Construction of this system, which for the western half of al-Buḥayra probably meant construction in the eleventh through early fourteenth centuries, resulted in a configuration that was relatively more *complex*. Simplicity and complexity, fluctuating according to time and place, were thus highly variable aspects of the Egypt's irrigation structure and operation. I.e., these aspects varied according to factors geographical (where built) and temporal (when built).

<sup>20</sup> For example, 8 days are designated for the filling of *Ḥawḍ 13*. A schematic of this basin suggests dimensions of some 10 by 10 kilometers, indicating a potential floodwater volume of 200 million meters cubed. Let us suppose the *Baḥr Damanhūr* to be something like an "average" sulṭānī canal. Use the Alexandria Canal as a rough guide here, a canal for which we have the dimension of 30.8m wide, while depth might be significantly less than the Alexandria canal (as the latter was a summer [*ṣayfī*] canal). Let us say that depth might be some 4 meters, if one assumes that 4 meters was the average depth of a *nīlī* canal (Rivlin, *Agricultural*, 213). Allow for a velocity of 2 m/s, and so a volumetric flow of 246.4 meters cubed per second; this would fill *Ḥawḍ 13* in 9.4 days – i.e. very close to the target, 8. The numbers are hypothetical, but do suggest filling intervals that could work with these plausible canal

A. *The Bahr Damanhur and the Qanun al-Riyy according to al-Makhzumi*

For the Damanhur canal,

المقريزي (الخطط 1: 170)  
 تراخ بحر دمنهور يفتح في العشرين من مسرى إلى سادس توت  
 و يروى منها بعض طاموس، و بعض كنيسة الغيط، و قرطسا و دمنهور  
 و اما بحر دمنهور فإنه يسد على سلطيس إلى سبع عشر توت  
 و منه تشرب سلطيس و زهرا و بعض طابوس و بعض قرطسا و بعض كنيسة الغيط و دمنهور  
 ثم يقطع سد نديبة و هو محدث فيقيم ثمانية أيام و منه تشرب نديبة و دقرس و لعميرية و النسرين  
 ثم يفتح و يسد على محلة خفص و محلة كيل و محلة نمير  
 ثم يقطع سد سلطيس و هو محدث فيقيم عشرة أيام بعد اختلاط الماءين ببحر دمنهور و رمسيس  
 ثم يقطع جسر ملولة و منه تشرب تروجة و أرسيس و المراسى و غابة الأعساس و بعض سمرو و محلة نمير و يبقى هناك  
 إلى إنقضاء النيل.

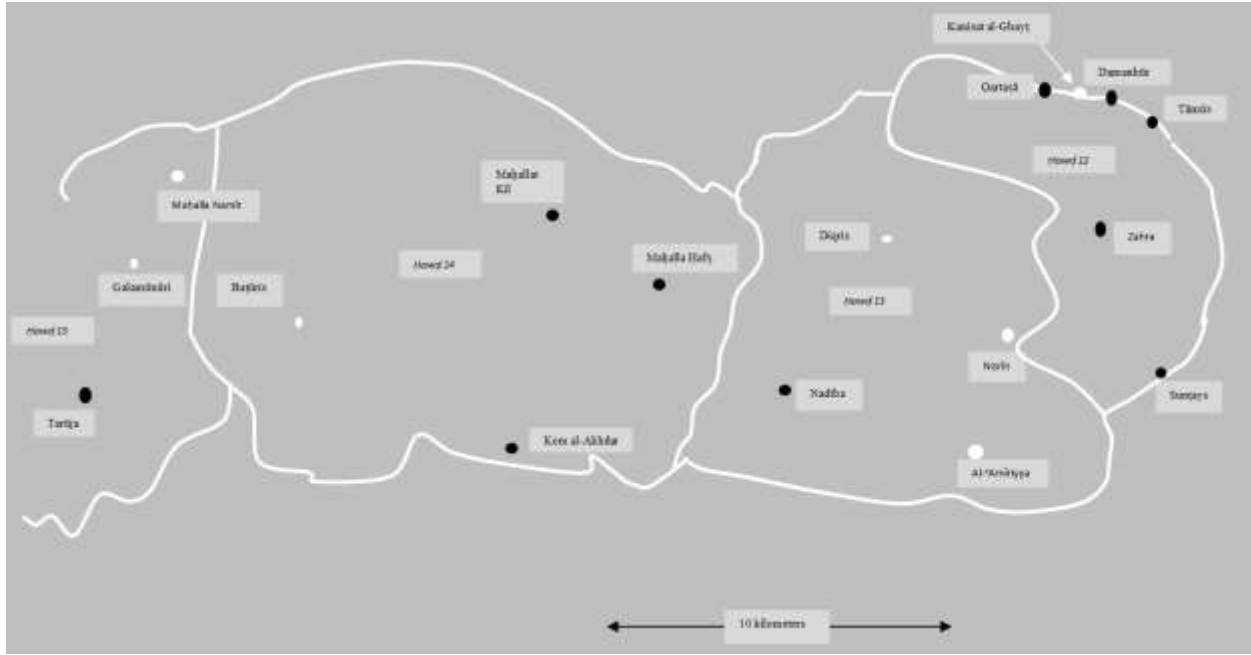
## Translation

"The canals that feed off of the Damanhūr canal are kept open from the 20<sup>th</sup> of Misrā (13 August) to the 6<sup>th</sup> of Tūt (17 September). Floodwater is supplied to irrigate sections of Ṭāmūs, Kanīsat al-Ghayṭ, Qarṭasā – and Damanhūr ... [break in text] ... the Damanhūr canal is dammed at Sunṭays (dike) until the 17<sup>th</sup> of Tūt (29 September). Floodwater is supplied to the Sunṭays and the Zahrā village district areas and to (sections of) Ṭāmūs, Kanīsat al-Ghayṭ, Qarṭasā, and Damanhūr areas. The Nadība dam (of recent construction) is then cut/broken open. The floodwater is retained there for eight days. Water is supplied to areas of Nadība, Diqris, al-°Amīriyya, and al-Nisrīn. The dike for the next basin is then cut/broken open and dammed shut to supply floodwater to the village districts of Maḥallat Ḥafṣ, Maḥallat Kīl, and Maḥallat Numayr. Then the Sunṭays dam (of recent construction) is cut/broken open and the water is held there for ten days, whereby the waters of the Damanhūr canal and the Ramsīs canal are allowed to mix. Then the Malūla dike is then cut/broken open and the following village areas are provided with floodwater: Tarūja, °Arsīs, al-Marāsī, Ghābat al-°A°sās, (sections of) Samrū and Maḥallat Numayr. And the water is held there until the Nile flood recedes."

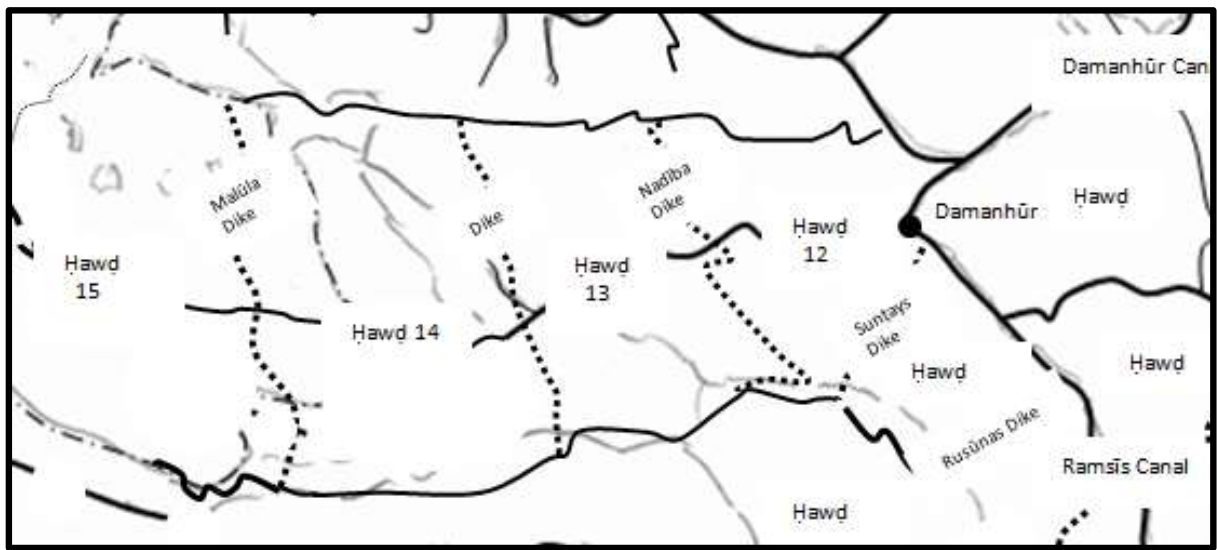
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dimensions. A question then, an open question: given skill in numbers, skills that clearly extended to trigonometry as well as algebraic manipulation, is it possible that volumes and volumetric flows were quantified and recorded evidence here





Plot of village locations and suggested basin boundaries by current village locations  
Sketch by author based on Google Maps/Google Earth



Damanhūr Basin Chain 12-15  
Sketch by Author

### B. *The Baḥr Damanhur and the Qanun al-Riyy according to Ibn Mammati*

إبن مماتي (قوانين الدواوين 226-227)  
يسد على سلطيس إلى عشر توت, و يشرب منه ما يأتي ذكره: سلطيس, زهرا, بعض طاموس, بعض قرطسا, بعض  
كنيسة الغيط, و دمنهور.  
سد نديية يقطع و يقيم ثمانية أيام و تروى منه نديية و دقرس, و العميرية, و الدير:  
ثم يصرف ما يأتي ذكره: محلة حفص, محلة كيل, محلة نمير:  
ثم يصرف إلى سلطيس و يقيم عشرة أيام  
ثم يقطع على جسر بلولة فتشرب منه تروجة, أرسيس, المراسى, غابة الأعشاش  
و يبقى إلى إنقضاء النيل

#### Translation

“The canals feeding off the Baḥr Damanhūr are kept open from the 20<sup>th</sup> of Misrā (13 August) to the (9<sup>th</sup> of Tūt? ... the canal is dammed at the Sunṭays (dike) until the 17<sup>th</sup> of Tūt (29 September) and the following village areas are watered: Sunṭays, Damanhūr, and sections within Ṭāmūs, Qarṭasā, and Kanīsat al-Ghayṭ. The Nadība dam is then cut/broken open and water is held there for eight days. The following areas are irrigated: Nadība, Diqris, al-‘Amīriyya, al-Dayr. The following areas are then drained: Maḥalla Ḥafṣ, Maḥalla Kīl, Maḥallat Numayr. The water is then drained to Sunṭays and the water is kept there for ten days. Then the Balūla [Malūla] dike is cut/broken open and the following areas are supplied with water: Tarūja, ‘Arsīs, al-Marāsī, Ghābat al-‘Aṣās, (sections) of Samrū and Maḥallat Numayr. Water is held there to the end of the flood season.”

#### *Analysis: the Damanhur Crossroads*

Curiously, Toussoun doesn’t show a line for the Damanhūr canal west of Damanhūr. Its existence seems obvious at the outset; it is clearly specified by al-Makhzūmī and its trajectory from east to west is logically bound to the basin arrangement, and, given the villages named in the basins, it is clear that the basins are oriented and placed in more or less the right order. *Description de l’Egypte* shows what might be a trace of a canal. We can’t be certain that this trace is the dried up remnant of the western half of the Damanhūr canal; it is quite possible that Napoleon’s savants took little notice of the meager remnants of this canal – even though it had once perhaps been as large as the Ramsīs Canal, the Ṭayriyya Canal, or even the Alexandria Canal. There is however one clear marking on the expeditionary map for this area. The mouth of this canal trace can be seen feeding off of the Alexandria canal, just next to the rural district of Iflāqa, which matches exactly the sequence and location of the mouth of the Baḥr Damanhūr in the medieval Qanūn al-Riyy.



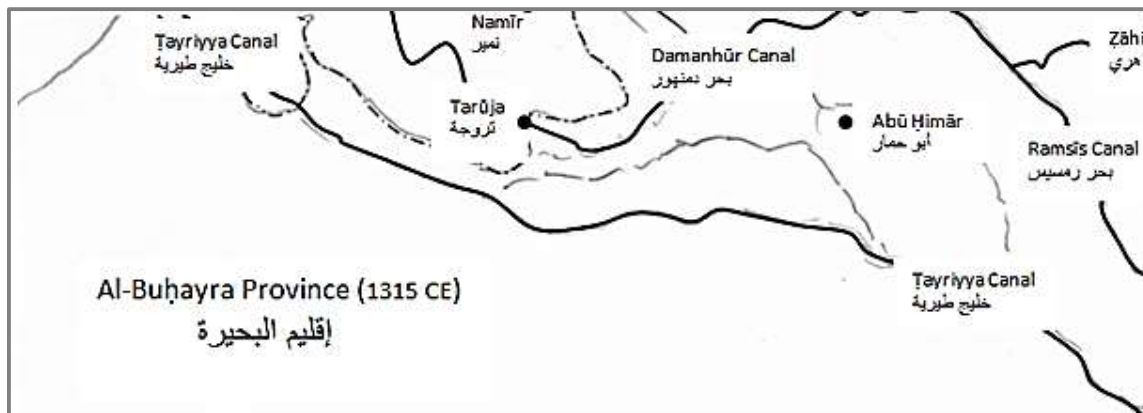
Mouth of the Baḥr Damanhūr in the early 1800s

From *Expedition de l'Egypte*

(with the permission of David Rumsey Maps)

### ***Water Supply from the South-East: The Tayriyya Canal***

The Tayriyya canal had its own set of operating rules, which were similar to that of the Damanhur canal in many respects. However, it seems clear the section of the canal that concerns the south-east of the Maryut Lagoon either hadn't been excavated – or had fallen into disuse. In 1283 this canal was extended by about 25 kilometers to the north-west. It is highly probable that this extension was directed at the area of the south-east Maryut basin, as Makhzumi and Ibn Mammati make no mention of any village districts north-west of Ṭiba and Qamḥa, which are about 25 kilometers to the south-east of the south-east Maryut basin (in the vicinity of the Tarruja district).



The Tayriyya Canal  
(sketch by author)

This excavation project began on the 5<sup>th</sup> of Muharram 682/12 April 1283 (Tropical, 5 April Julian) and Sultan Qalāwūn himself came to direct work. It was apparently a very substantial project, as recruitment of labor was not confined to the Buhayra province: orders went out to the governors of all the provinces and amirs were assigned to supervising the work details.<sup>21</sup> The canal, when completed, was of a width of some 13 meters and a depth of approximately 10 meters. The fact that this canal was so deep is of importance: it meant that the canal could supply water all year round – i.e. a supply for summer crops with lift irrigation. Summer canals – the “*ṣayfī*” canals – were deep – usually more than 6 meters deep. By contrast, flood canals – the “*nīlī*” canals – were only 4 meters in depth and functioned only during the principal autumn month of the flood, i.e. late August to early November. (That is, late *Misrā* to early *Hātūr* in the Coptic Christian calendar that was used for the agricultural cycle. ) New arable was created for irrigation and people came and settled in the area. Apparently, the new lands, assigned as *iqṭāʿ* were quite fertile and yielded very substantial revenue. Ibn ʿAbd al-Zāhir notes that “the reclaimed lands began to be counted among the landed estates with high revenues. Most of this land was distributed as *iqṭāʿ*.”<sup>22</sup>

The Tayriyya canal work seems to have been a significant accomplishment – and the Tayriyya canal was one of the most substantial canals in the Delta. It is worth noting that centuries afterword when Linant, the French advisor to Muhammad `Ali, looked at this region with plans for development, the Tayriyya canal was his first choice.<sup>23</sup> This canal was the means by which he

<sup>21</sup> The excavation is described by Ibn ʿAbd al-Zāhir (*Tashrīf* 25-26). See also Northrup’s description of this excavation (*Slave to Sultan*, 258) and notes/partial translation in Tsugitaka Sato (Sato, *State*, 229).

<sup>22</sup> Ibn ʿAbd al-Zāhir, *Tashrīf*, 26; Northrup, *Slave to Sultan*, 258.

<sup>23</sup> The nineteenth century advisor to Muhammad `Ali, Linant de Bellefonds proposed that the Tayriyya canal, long defunct by the early 1800s, be re-excavated so as to admit water to the 20,000 hectares (Linant’s figure) of the south-east Maryūt basin and so to wash it (“lavons”) of the salts that had built up over time. It would after that he argued, become valuable agricultural land and so reap rich dividends. His plan was very long in coming. Maurice

had hoped to “wash” the saltmarsh that was the south-east basin of the Maryut Lagoon. It seems highly probable that its waters made a big difference in the medieval period as well.

The conclusion I draw from the evidence of canal operation and canal dredging and extension is that an operationally effective irrigation system served the south-west corner of Buhayra and the south-east area of the Maryut Basin in the period under consideration: 1170 to 1315 CE. It should be emphasized that if extends this timeline up to the later 1300s, these conclusions bear some similarity to those of the Clement Flaux’s archaeological team. Flaux et al. noted that for the “~ 13<sup>th</sup> to ~ 16<sup>th</sup> cal. centuries,” time period the analysis of soil samples, “indicates a perennial reconnection of the lagoon with the Nile, after the dessication phase.”<sup>24</sup> Desiccation phases occurred when there was little in the way of Nile floodwater draining into the basin. The desiccation phases, wherein they suggest that the irrigation system may have been functioning poorly, bracket the phase we are studying, more or less. The first desiccation began at the end of late Antiquity, c. 800 CE, which is in accord with the traditional timeline of Egyptian irrigation’s rise and fall (and is also when the Canopic branch of the Nile is said to have silted up). The second desiccation phase began sometime in the 1500s and lasted through the 1700s.<sup>25</sup> The timing of the second desiccation phase, for which they cite Michel’s evidence (“Villages desertes, 2002) and the travel reports of European observers, is in sync with timeline for the decay of irrigation infrastructure in the wake of the severe plague depopulation that began in the mid-1300s with the Black Death.<sup>26</sup>

However, that there was a viable system, in good working order and that this system drained into the Maryut basin does not by itself affirm this article’s hypothesis of an active agrarian economy around and in the south-east basin of the Maryūt Lagoon. This area could still have been nothing more than a drainage repository for the dregs of the Nile flood. This flood basin (Ḥawd 15 on the map above) at the western end of the Bahr Damanhur could have been nothing more than a narrow and thinly settled pastoral perimeter. It might not entirely explain the Tayriyya canal work, but certainly the Bahr Damanhurs’ evidence would still work from this perspective. What I intend to show next is that there is good quantitative evidence of substantial agricultural activity in this area, enough so that it is hard to account for based on a thin perimeter alone.

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Adolphe Linant de Bellefonds, *Mémoires sur les principaux travaux d'utilité publique exécutés en Egypte depuis la plus haute antiquité jusqu'à nos jours: accompagné d'un atlas renfermant neuf planches grand in-folio imprimées en couleur* (Arthus Bertrand, 1873), 108 ; 407-8.

<sup>24</sup> Via examination of the soil samples, they note that their results, “could reflect that the proximity of M4 (facies) to Nile flow input through canals and important dilution of lagoon water by freshwater input, probably during seasonal floods or multi-annual periods of high river discharge.” Flaux et al., “Environmental,” 3500.

<sup>25</sup> Flaux et al., “Environmental,” 3499-3500.

<sup>26</sup> Borsch, *Black Death*, 2005

## Section 2: Quantitative Evidence of Economic Production

A qualitative and quantitative analysis of 1315 data for the *Damanhūr Basin Chain*, with a detailed analysis and discussion of the southern Maryūt lagoon (basin), focused upon the village district of *al-Tarūja*. Here we locate the villages that were in the southern Maryūt basin in 1315 CE.<sup>27</sup> For these villages, analyze the revenue and acreage figures from the 1315 Rawk and calculate the probable dimensions of this “*Hawd 15*.”

### (A) *Al-Tarūja*: the Epicenter

The Qanūn al-Riyy – and the record of canal excavation - gives us every reason to believe that Nile floodwater was being supplied to the area. The fact that the Ṭayriyya canal was so deep (~ 10m) strongly suggests that it was not only being provided with floodwater, but also with irrigation water all year-round, and so a suitable area for rich summer cropping; a factor taken up in the arguments below. What we look at now is perhaps the most substantial evidence in favor of this hypothesis: Tarūja at the corner of the south-east Maryūt basin. Tarūja in the 1070-1315 period was a (nāḥiya) a rural district. Rural districts were not individual villages per se, but rather conglomerations of a primary village (qarya) and smaller satellite villages (kafr). This should be born in mind as we discuss the magnitude of its revenue; there is reason to believe that its acreage (misāḥa) was quite extensive. Tarūja is apparently very rich and extensive as quantified by the 1315 land survey.<sup>28</sup> Its revenue, which is the surplus extraction i.e. rent to the landholder was 72,000 dinars jayshī at this time.<sup>29</sup> The 1315 survey does not include acreage for this rural district, but the revenue says that it was large and productive: 72,000 dinars jayshī made Tarūja equal the worth of some 20 average rural districts. Using the average rural district acreage as a guide (~ 1000 hectares), Tarūja acreage might have been something like 20,000 hectares in extent. If this estimate is in any way correct, one would have to include the south-east Maryūt basin as part of its cultivated area, the perimeter area would not account for this much acreage by itself.

Since Tarūja is so much larger than the other districts in the Buḥayra province, one might be tempted to dismiss this reading as a statistical outlier, and likely a copying error on someone's part. While it is somewhat reassuring to know that an alternate copy of the 1315 survey, from another source, records the same revenue figure, it still leaves the door open to some sort of

<sup>27</sup> Using schematics and data from a number of sources, including Heinz Halm, *Ägypten Nach Den Mamlukischen Lebensregistern*, Beihefte Zum Tübinger Atlas Des Vorderen Orients : Reihe B (Geisteswissenschaften); Nr. 38; (Wiesbaden: Reichert [in Komm.], 1979); Muhammad Ramzi, *al-Qamus Al-jughrafi Lil-bilad al-Misriyah, Min `ahd Qudama al-Misriyyin Ila Sanat 1945*. (al-Qahirah, Matba`at Dar al-Kutub al-Misriyah, 1953).

<sup>28</sup> For the figures used from the Rawk al-Nāṣir, see Ibn al-Ji`ān (d. 885/1480). *Kitāb al-tuhfa al-saniyya*, edited by Mortiz. Cairo: 1898; Heinz Halm; Ibn Duwmāq.

<sup>29</sup> See Ibn al-Ji`ān's record of the 1315 survey, Tuhfa, 124; The figure for Ibn Duqmāq comes from Halm, *Agypten*, 2: 458.

mistake in the original record made in 1315.<sup>30</sup> Independent confirmation of these revenues is quite hard to find in the narrative sources.<sup>31</sup> While the records of charitable endowments (waqf) do give indications of the actual proceeds of land parcels, Tarūja was never part of an endowment.<sup>32</sup>

We are however extremely fortunate in so far as the famous traveler Moroccan traveler, Ibn Baṭūṭa turns out to have paid a visit to this rural district in 1346 – and of all the information he might have acquired from his visit to Tarūja he ends up getting into a conversation about its agrarian revenue, and confirming that 72,000 was indeed the official revenue estimate for this village.<sup>33</sup> The text and translation of this passage follows:

قال ابن بطوطة بعد خروجه من مدينة الاسكندرية: ووصلت قرية تروجه "وضبطها بفتح التاء الفوقية وواو وجيم مفتوحة"، وهي على مسيرة نصف يوم من مدينة الإسكندرية. وهي قرية كبيرة بها قاضٍ ووالٍ وناظر، ولأهلها مكارم أخلاق ومروءة. صحبت قاضيها صفي الدين وخطيبها فخر الدين وفاضلاً من أهلها يسمى بمبارك، وينعت بزین الدين

<sup>30</sup> These two are the Mamluk-era sources for the 1315 survey data. Ibn al-Jīʿān, *Tuhfa*, 124. The figure for Ibn Duqmāq comes from Halm, *Agypten*, 2: 458.

<sup>31</sup> An example of independent confirmation in the mid-fifteenth century is al-Zāhirī report of the revenue of two large districts, al-Manzāla and Fāriskūr, in the province of Daqahliyya. Both are apparently doing well, in fact somewhat better than recorded in the 1315 survey. (al-Zāhirī, *Zubdat*, 34) 70,000 dinars to the Diwan al-Mufrad. Al-Zāhirī also found some specific information about the revenue (the *mutahaṣṣil* not the *ibra*) of the Diwan al-Mufrad, the sultan's special fisc. He informs us that it was worth more than 400,000 *dinars* in specie and 300,000 *ardabbs* in mixed crops/wheat/barley/broad beans. (See al-Zāhirī, *Zubdat*, 107.) These numbers indicate decline, sharp decline. In fact half the revenue of this section of the government seems to have vanished. If one calculates the revenue of the Diwan al-Mufrad by 1315 survey numbers, a method of extrapolation, the result is 1,413,858 *dinar jayshī*. (See Igarashi, "Establishment," 140.) If we compare with al-Zāhirī, writing sometime around 857/1453, we might speculate a potential drop in revenue of some 50% (i.e., taking the two figures above as 700,000/1,413,858) from 1315 to perhaps a generation (?) before al-Zāhirī. Nowadays, he says, i.e. in 857/1453, no one knows anything at all as to what the revenue is, no one has the foggiest idea (أما الآن فلا أعلم من حاله شيئاً), the latter an acknowledgement of the disorder and disarray of the late Mamluk bureaucracy (see al-Zāhirī, *Zubdat*, 107.) Compare with Ibn al-Jīʿān's comments on the sad state of the bureaucracy and general disarray in estimates of *ibra* and *mutahaṣṣil* in *Tuhfa* 3. Actually, this is not surprising given the times, the plague depopulation and economic chaos. See Borsch, *Black Death*, for more detailed figures.

<sup>32</sup> Regarding the notion of using waqf proceeds against rural district revenue estimates, see Carl Petry, "A Geniza for Mamluk Studies? Charitable Trust (Waqf) Documents as a Source for Economic and Social History." *Mamluk Studies Review* 2 (1998): 51-60; there has been work along this line in Gilles Hennequin, "Waqf et monnaie dans l'Égypte mamluke." *Journal of the Economic and Social History of the Orient* 38 (1995): 305-12; data from the Fayyum in the 1200s provides a basis for these calculations but we lack any such comprehensive record of actual proceeds vs. revenue estimates for the rest of Egypt. For the Fayyum the source is Nabālūsī, () and all of his data has been transcribed into Excel and is available on 18 downloadable spreadsheets provided online by Yossef Rapoport and Ido Shahar ("Rural Society in Medieval Islam" at <http://www2.history.qmul.ac.uk/ruralsocietyislam/index.html>) and further information in Rapoport and Shahar. "Irrigation in the Medieval Islamic Fayyum: Local Control in a Large-Scale Hydraulic System." *Journal of the Economic and Social History of the Orient* 55.1 (2012): 1-31.

<sup>33</sup> Gibb, *Travels of Ibn Baṭūṭa* (New Delhi, Munshiram, 1993), 1: 29.

ونزلت بها على رجل من العباد الفضلاء كبير القدر يسمى عبد الوهاب. وأضافني ناظرها زين الدين بن الواعظ وسألني عن بلدي وعن مجباه، فأخبرته أن مجباه نحو اثني عشر ألفاً من دينار الذهب. فعجب وقال لي: رأيت هذه القرية فإن مجباها اثنان وسبعون ألف دينار ذهباً. وإنما عظمت مجابي ديار مصر لأن جميع أملاكها لبيت المال

## TRANSLATION:

After my departure from Alexandria, I came to the village of Tarūja, about a half-day away from Alexandria. (And this name, “Tarūja,” is vocalized with a fatha, a wāw, and an open jīm.) Al-Tarūja is a large village with a judge (qāḍī), a governor (wālī) and a financial inspector (nāẓir). The people of al-Tarūja are respectable, moral and generous. The leader of this village is the Qāḍī Ṣafī al-Dīn and its Friday-prayer speaker is named Fakhr al-Dīn. Of great honor in this village is a man named Mubarak, known by the nickname Zayn al-Dīn. I stayed in the village with a man of good reputation, a sincere and pious man, named ʿAbd al-Wahhāb.

The financial inspector (the nāẓir), Zayn al-Dīn bin al-Wāʿiz, hosted me and he asked me about my home town and its tax revenue. I told him that its tax revenue was 12,000 gold dinars (per year). And he marveled, and he said to me, “look at al-Tarūja; its revenue is 72,000 gold dinars (per year)! Its revenue is so high because it belongs to the Bayt al-Māl.<sup>34</sup>

Notable from this dialogue is the fact that Tarūja not only had a financial inspector (nāẓir) to look after its enormous revenue, but also had its own governor (wālī), not something one would find in any regular village and usually a sign that the place in question was at least a large town, if not a city. Only four places in the area of Buḥayra actually had governors, one of them was Alexandria of course. The other was the port city of Fuwwa on the Nile and the third was the provincial capital itself, Damanhūr. Comparison with the prominence of other towns and cities can also be made on the basis of economic information. The pricing of goods suggests something along these lines: the listing of comparative prices at different locations is quite infrequent in the narrative chronicles; usually the list of prices is for Cairo alone, but sometimes other locations are mentioned. This might be a province or a large city, Alexandria most often. But Tarūja is named several times in the chronicles, with Alexandria (as it was within its economic orbit) but also separately.<sup>35</sup>

<sup>34</sup> With reference to Gibb’s translation: H. A. R. Gibb, *The Travels of Ibn Battuta: AD 1325–1354*, translated with revisions and notes from the Arabic text edited by C. Defremery and B.R. Sanguinetti, 3 vols. (New Delhi, The Hakluyt Society, 1993), 1: 29.

<sup>35</sup> See Ibn Qāḍī al-Shuhba, *Tarīkh*, 4: 404, 407 for the listing of Tarūja by itself and al-Maqrīzī’s text for listing Tarūja together with Alexandria: al-Maqrīzī, *Iḡāthah*, Adel Allouche, trans., *Mamluk Economics*, 78.



Another indication of size is suggested again by Ibn Baṭūṭa; its wealth, he is told all goes to the Bayt al-Māl, i.e. the central treasury of the Egyptian Mamluk regime. That Ibn Baṭūṭa's host makes the connection between this treasury and the high revenue of Tarūja is not surprising: Tarūja was a holding of the Diwān al-Khāṣṣ, which was more or less the sultan's private fisc. This diwan typically held in its possession the most valuable and productive landed estates and rural districts in Egypt. Most often, these holdings were in the most fertile and dependently well-irrigated areas of the Delta, interior provinces like Minūfiyya or Qalyūbiyya. Buḥayra was not a frequent target of royal attention but Tarūja was evidently an exception. Noteworthy in this respect is the fact that when the most valuable landholdings were later (at the end of the fourteenth century) transferred to the new bastion of central power, the Diwan al-Mufrad, Tarūja was again on the list of the sultan's possessions.<sup>36</sup>

The survey figures, the testimony of Ibn Baṭūṭa's *Riḥla*, and other landholding information is helpful, but it doesn't quite close the case on the question of economic activity in the south-east Maryūt basin area. Taking a step backward and looking at this area in larger perspective is important: Tarūja was by no means alone, and there is certainly more to the picture than the quantification of Tarūja's revenue. A key issue is a less statistical and more qualitative: where exactly would this revenue have come from? What were the specifics of this agrarian economy – if it was agricultural and not pastoral, as most scholarship indicates?<sup>37</sup>

Here we have some information about specific crops that were grown, and they tell us something important about what we should look for: cumin was apparently the crop of choice for Tarūja, something that the area specialized in.<sup>38</sup> Cumin had high value, which helps account for the richness of this particular area. Cumin was also a summer crop, and this is a very significant indicator of the type of agriculture we are talking about: not so much flood basin irrigation, though I think that was part of the picture, but lift irrigation: irrigation via apparatus like the animal-driven *ṣāqiya* that Egypt was famous for. What this means is that the area was specialized and rich in a way that would have clearly attracted the attention of revenue hungry agents of the sultan.

There is in fact quite a lot of evidence that summer crops played a key role in the economy of this area, and that summer cropping was an integral part of the scheme for economic (and irrigation system) growth that was clearly a priority in the 200 years or so that preceded the Black Death. Chronicles make note of specific attention given to the development of summer

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<sup>36</sup> Al-Qalqashandī, *Ṣubḥ* 3: 522-4, writing his chancery manual (1402 to 1412) notes that Tarūja belonged to the Diwan al-Khāṣṣ, but it is also listed as such in the 1315 land survey. The update of 1477 notes that it is held by the Diwan al-Mufrad. See Ibn al-Jī'ān, *Tuhfa*, 142; Ibn Duqmāq, *al-Intiṣār*.

<sup>37</sup> See discussion in the introduction above.

<sup>38</sup> Muhammad Ramzī, *Qamūs* vol. 1 (190) notes that the area of Tarūja was planted in cumin; Toussoun, *Geographie*, 1: 181; Ibn Mammātī, *Qawānīn*, 264; Ibn Ḥawqal.

crops in this area; actually there are a number of telling indicators, and we have seen a couple of these already in the discussion of irrigation system functioning and development. The dredging and extension of the Ṭayriyya canal was part of this, and it was essential enough that Sultan Qalāwūn himself came from Cairo to direct the project in 1283. But he was not the only ruling sultan to come to this area and “get his hands dirty” in agrarian matters: before Qalāwūn, Sultan Baybars came specifically to Tarūja for the building of infrastructure – particularly water channels for the water lifting saqiya of summer cropping.<sup>39</sup>

Cumin was a valuable summer crop, and if the renumerative value of summer crops says something more about the credibility of high revenue in this region.<sup>40</sup> A couple of points about summer cropping here: it is clear that the early Mamluks were busy with irrigation development in the western half of Buhayra. Not only that, they were particularly keen on the expansion of the summer cropping industry. That they provided infrastructure for a process of expanding irrigation – and expanding summer crops is amply evident from the historical record. In addition to the extension, expansion, and deepening of the Khalij Tayriyya, a summer canal aimed directly at the Taruja area, early Mamluk work in western Buhayra was reaches its most impressive with the re-excavation and reworking of the Alexandria canal in 1310 CE. This project, like the Tayriyya extension, had as a central aim, perhaps the central aim, the building of wiers along the length of the western end to facilitate the lifting of water via saqiya for summer crops. The deep canal, the weir and the saqiya joined together as the fulcrum for raising the low summer waters of the Nile to the fields where summer crops were grown. In fact, this information helps us visualize the sequence here. That is to say that royal authority gets involved with local development in the area, with the local infrastructure (Baybars). This in turn generates wealth, but it also generates the problem that the Ṭayriyya project must clearly have been there to solve: a growing demand for water in the region and – most specifically – for a very deep canal that could bring summer water to the area during the Nile’s low months.

The Ṭayriya canal thus makes sense then from this perspective, and furthermore the connection between the growth and development of summer crops and irrigation system growth is confirmed by a collateral process for which we have more information: the renovation and remaking of the Alexandria canal, its new lease on life established by its new incarnation as a very deep perennial canal. The story of the Alexandria canal at this time is a long story and is for the most part outside of this very local chapter of history. But some parts of this local region were actually served by this canal and what is more the canal gives evidence that summer cropping was indeed the big money goal in western Buhayra.

<sup>39</sup> Al-Maqrīzī, *al-Sulūk* 1: 498-500. The word used for the water channel is b’ir, which can mean well, but in this context a channel for feeding water to šāqiyas. See Nuwayrī’s usage in *Nihāyat* 8: 266

<sup>40</sup> See Sato, *State and Rural Society*, 198-9 for taxation of summer crops.

The Alexandria canal job seems to have first been advanced by economic interests in Alexandria, and pitched by the Amir Baktūt to the ruling sultan of the time, al-Nāṣir Muhammad. The sultan readily agreed to the idea (he had a good eye for irrigation projects, according to another source).<sup>41</sup> In 1310 an unprecedented 40,000 irrigation workers were drafted, and paid it seems, to carry out the project. In the end, the success story of the Alexandria canal included the expansion of agrarian acreage by some 100,000 feddans (63,000 hectares) and 40 new villages, but most notably, numerous new estates for the growing of summer crop, including the building of some 600 new saqiyas.<sup>42</sup>

As it seems that summer cropping is a very feasible explanation for this area's wealth, it helps to take measure of a wider set of quantitative figures. What we can do is to pan out – and in fact draw a circle around the area: starting suitably enough from an epicenter within the south-east basin itself, near the village of Buṭūris (inside the south-east basin) we can trace a 15-kilometer circle around this village to see what specifics can be discerned within this compass. And it turns out that there is indeed more than a little quantitative distinctiveness here: the circle thus drawn includes the largest and richest of the villages in this province – all likely associated with summer cropping, whether fed by the new Alexandria canal in the north, or the refashioned Ṭayriyya canal in the south. (The Baḥr Damanhūr may or may not have been a perennial canal, one can't say either way, but there are some telling indications that adjustments to the Qanūn al-Riyy, some of which were noted above, may have been driven by a growing water need in the south-east Maryūṭ basin area.)<sup>43</sup>

What can be seen in the figures below is that the 15 rural districts within this perimeter had very high revenues. In number they made up less than 7% of the province's total, but in terms of revenue they account for more than three times that amount 22.5% of the total provincial revenue. Summer crops help explain why these revenue figures were so high: summer cropping tied to development schemes that made this area particularly valuable.

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<sup>41</sup> See the details of irrigation expansion in the 1330s of the Sharqiyya province on the other side of the Nile Delta.

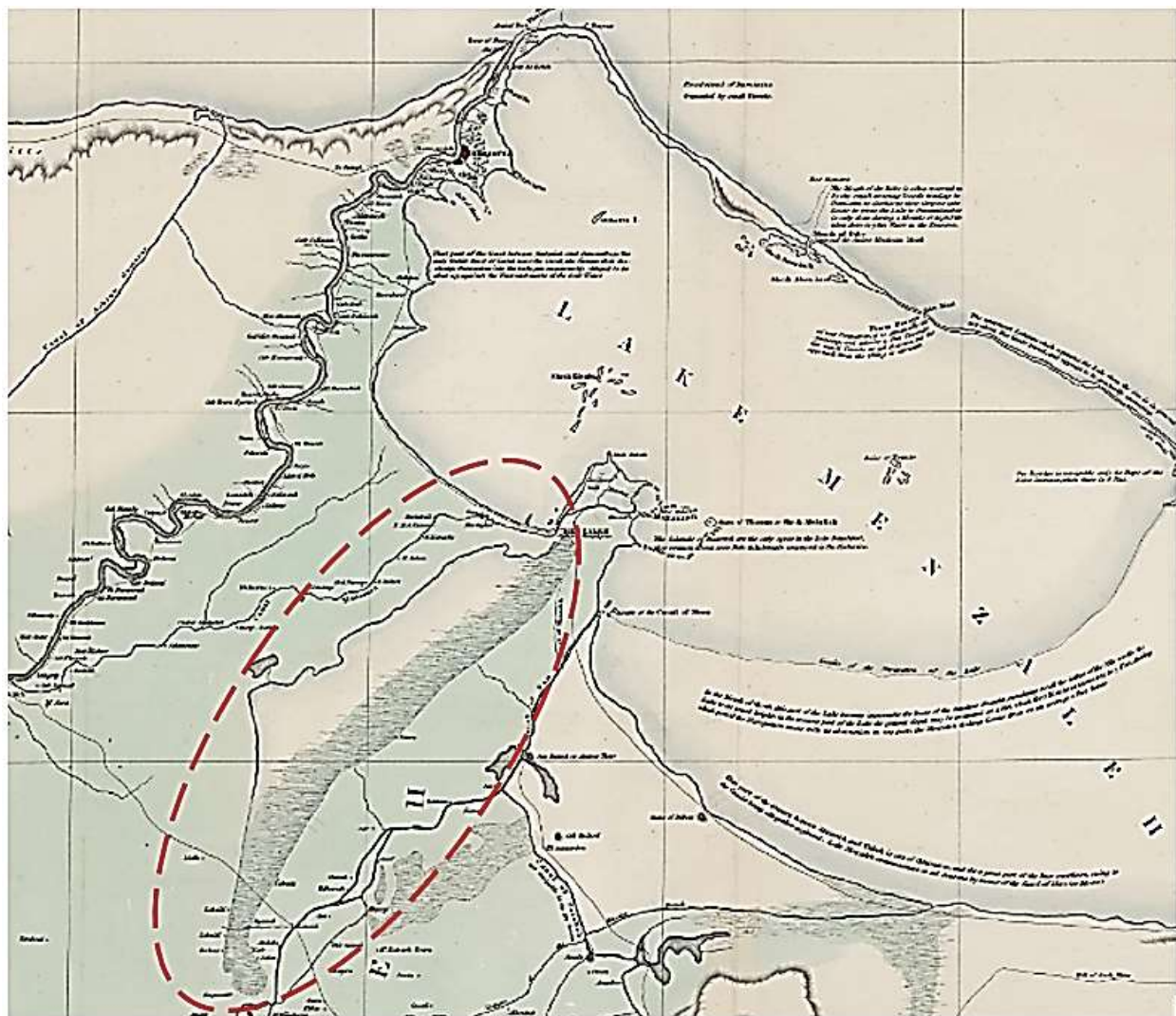
<sup>42</sup> In comparison, the Fayyum had less than 200 saqiyas at this time.

<sup>43</sup> This would particularly apply to the shift in water use at the area labelled the “Damanhūr Crossroads.” Here the shift in instructions presumes that Ibn Mammātī's rendition of the Qanūn al-Riyy was older than that of al-Makhzūmī's, which is entirely possible and shown to be quite likely from the logic of the water trajectories. In this case, the altered trajectory shifted water demand away from the heavily taxed Alexandria canal and its feeder to the Baḥr Damanhūr and back to the Baḥr Ramsīs, an older canal (the relic of the Canopic branch of the Nile). The Baḥr Ramsīs appears to have been extended so that in al-Makhzūmī's scheme, the areas to the east of Damanhūr could be supplied by its water, rather than the floodwater of the Baḥr Damanhūr. An entirely new basin area and altered water exchange were generated by this process, which had taken place much before the rest of this story.

Village Name	Revenue in 1315 CE
1. Balaqtūr	12,000
2. Baslaqūn	16,000
3. Qāfila	6,000
4. Lūqīn	6,000
5. Maḥlaat Kīl	5,000
6. Maḥallat Namīr	6,000
7. Buṭūris	9,000
8. Tarūja	72,000
9. Qabr al-Wā' ilī	7,000
10. Qabr Rawq	5,850
11. Arsāg (BirkatQarṭīṭa)	10,000
12. Qabr al-Wā' ilī	7,000
13. Galamūn	1,300
14. Tilimsā Kubra/Şughra	2,400
15. Kūm al-Akhḍar	1,000
Total of 15 Villages	166,550
Total ʿibra of al-Buḥayra	741,294
% of total	22.50%

Another point in the matter of summer crops is further suggested by the geography of this area. I think that there was a notion of turning liability into asset here, something that the early Mamluks were able to achieve in western Buḥayra and probably elsewhere too (Sharqiyya most particularly). The contour maps of this province betrayed a grave weakness that was ultimately Buḥayra's undoing: the steps leading down to a very low elevation on the western end of the province, 2m below sea level in the Maryūt south-east basin. Low elevations were indeed very often a terrible curse from the perspective of winter cropping and the maintenance of the ordinary flood basin: if the continual labor-draining task of maintaining the infrastructure was ever relaxed, as happened after the Black Death, bad results were quick to follow. The same 15km circle drawn from an epicenter within the basin that highlights the rosy picture of 1315 betrays the fate that was to befall these village in the century following: by the time of the 1477

CE survey update, roughly half of these villages registered losses that ranged from 50% to 90% of their 1315 revenue values. To understand the scale of loss relative to the province as a whole, the 1477 survey update as a rule only recorded cases of substantial revenue losses, leaving a blank if the revenue were more or less the same. Given that general function, the usual rate for recording villages was about one in four, with this area around the south-east Maryūt basin, severe revenue losses occurred at about twice the usual rate. The fate of this area of the Delta would in the end be similar to that faced by the outer perimeters of Gharbiyya, Daqahliyya, and Sharqiyya. A sidelong glance at a map from the early 1800s can sum up this impression rather succinctly: the depression that came to be called Birkat al-Daqahliyya was an enormous body of water that had once been good agricultural land. The neglect of infrastructure in this case can be read by the size of this “lake” of shallow water over a poorly drained area.



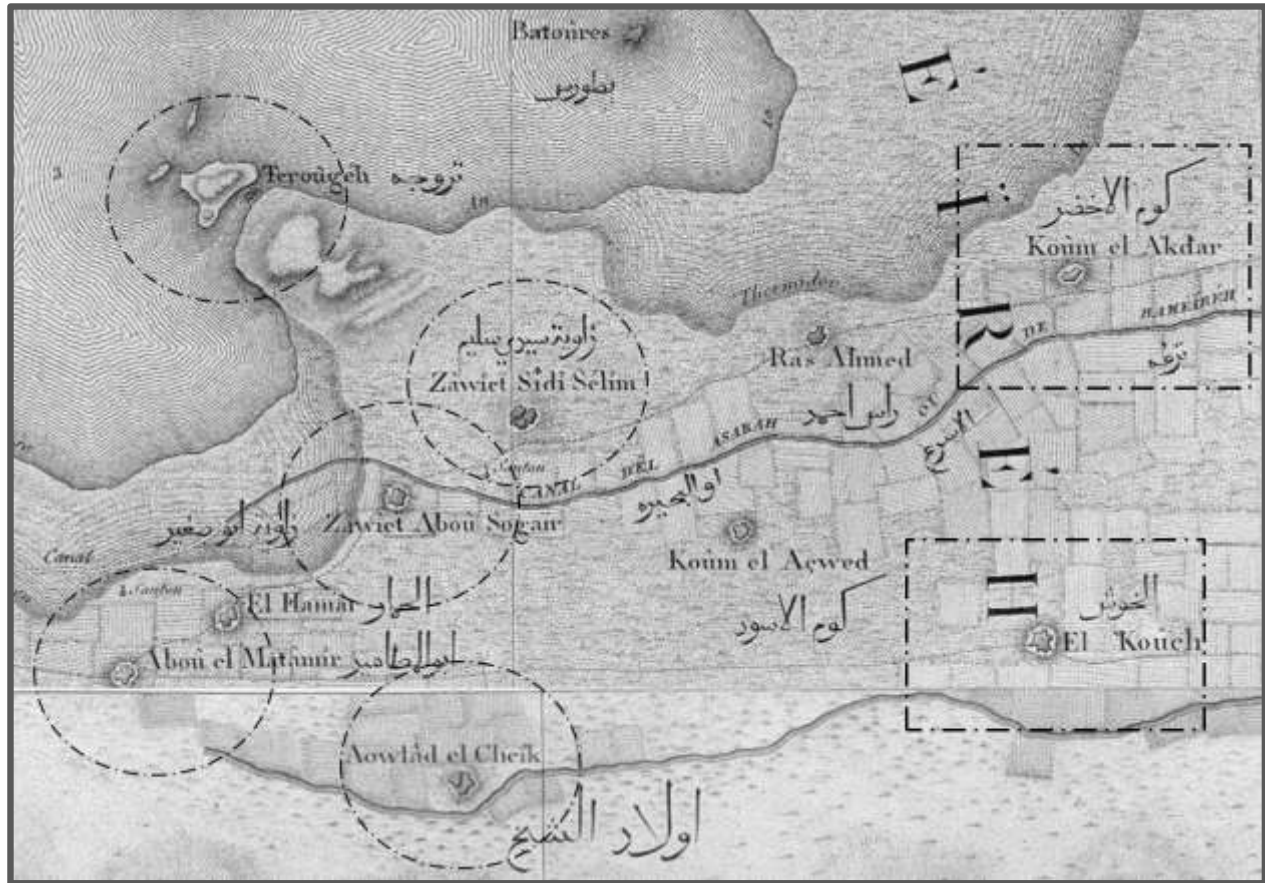
1807 Map of the Delta  
(Showing area of poor drainage)

Courtesy of David Rumsey Maps

But while this factor in the long-run proved poisonous for the periphery of the Delta, I think here the rich agrarian interests and money-hungry military elite found a suitable and profitable home for summer cropping: low elevations could pay dividends, given the right conditions. While they problematically drew down the drainage of much of this province (Flaux et al. were measuring the register of this fact in the soil layers of the Maryūt basin), the descent to the lowest levels in the province could also be advantageous: low elevations meant more dependable access to summer water, easier access via deep canals and more efficient lift characteristics for the twin-effect of weir pushing the canals' water up and the saqiya lifting it on to the fields themselves. A sense of this tactic can be gotten by looking forward several centuries, to the time when Muhammad Ali's economic development schemes focused with particular intensity on places like western Buḥayra. The disastrously deep summer canals he built led into the new areas he was trying to reclaim in western Buḥayra; summer crops played an important role in the nineteenth century.

The last point to be made in support of this article's hypothesis concerns the process of splitting and growing, or a certain kind of rural district (*nāḥiya*) "mitosis," because the core village would spawn hamlets and satellite villages (*kafr/kufūr*) that could gradually grow to become *nāḥiyas* in their own right. In evolutionary fashion, the death of a village was just as frequent as the birth of a new one and from studying the land surveys, it is clear that this process of rural district growth and decay was an exceedingly slow one, and it proceeded slowly over the centuries.

Furthermore, it was very seldom that a single rural district spawned anything more than one new district (most were in a steady-state and never generated a new district). So for a rural district to generate a new district from one of its satellites (*kafr*) was relatively rare; for a rural district to spawn two new districts was exceedingly rare and happened in the Buḥayra province in less than a handful of cases. But for the area of the south-east Maryūt basin, and most particularly for the rural district of Tarūja, it happened over and over again, so much so that Tarūja, by itself, produced no less than six new rural districts. This rate of growth contains some mysteries, and the subject is explored further in the appendix following this text, but the salient point vis-à-vis this hypothesis is that – at the very minimum – the revenue values of this area were genuinely indicative of this area's economic productivity. The map below from the Napoleonic expedition shows the conglomeration of villages that emerged from the single district of Tarūja. Sadly for Buḥayra, these villages were decayed or deserted by this time, but their very presence registers what could be achieved by medieval Egypt's irrigation system.



The Tarūja Area of the South-East Maryūt Basin in the early 1800s  
(Courtesy of David Rumsey Maps)

New rural districts generated from the district of Tarūja:

1. Abū Maṭāmīr
2. Abū Shūqāf (not shown on the map)
3. Awlād al-Shaykh and al-Najayla
4. Zāwiyat Ṣaqr
5. Zāwiyat Sīdī Sālim

Conclusion

Whether in the end this proves the hypothesis we started with is unfortunately hard to say. Despite all these indicators there is a lot we still don't know about the area. Doubts about the actual density of this agricultural activity are created by things like the references to Bedouin pastoralism in this area. Settled Bedouin life, Bedouins who had genuinely taking up farming and irrigation activity is a possible explanation for the contrast between Bedouin presence and agricultural growth. Scholar are increasingly recognizing the apparent juxtaposition of Bedouin as pastoralist – perhaps inimical to the settled economy, as clearly they were in the fifteenth

century – and Bedouin as himself settled into an agricultural context.<sup>44</sup> There also does not appear to be a noticeable wealth of archaeological findings in the south-east basin itself, which might be explained by their using it for cropping, but settling on the tells around the basin. Nevertheless, there are strong indications here that the medieval Maryūṭ has some very important things to say historically, and should not be marginalized because of enthusiasm for antiquity. The hypothesis posed here is perhaps more of a proposal in the end – for further work on the area in the context of Islamic Egypt.

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<sup>44</sup> Rapoport's fresh insights are useful here, and go together with the details of the Fayyum and the quantitative database that includes so much (settled) Bedouin economic activity. See also, Rapoport, "Invisible Peasants, Marauding Nomads, Taxation, Tribalism, and Rebellion in Mamluk Egypt." *Mamluk Studies Review*, 8 (2004): 1-22.