The Canary in the Coal Mine: The Transformation of Rural Egypt in Modern Times — A note on how we can use geographic information in the study of landform transformation in rural Egypt —

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Preface

The objective of the essay

The modern time since the beginning of the 19th century has been a period of drastic transformation in rural Egypt caused by the transition of the irrigation system from basin (natural) irrigation to perennial (artificial) irrigation. The banks that surrounded the basins in the flood season of the Nile were destroyed, and the cultivated lands became units of cultivated land of small size, which were also called basins, and were imposed the same rate of land tax.

Moreover, hamlets began to be constructed in the cultivated lands because the lands were no longer flooded by the Nile. Many of the small hamlets were especially built in the peripheral lands that were reclaimed after the introduction of perennial irrigation system.

Thus, many "new villages" were born. The traditional "old villages" were called *qarya*, while "new villages" were called *'izba*. The construction of these "new villages" took the form of hamlets around the "mother villages." The number of these villages increased rapidly in the second half of the 19th century.

The transformation of rural Egypt, caused by the transition of the irrigation system, was so fundamental that we could not easily imagine and reconstruct the landscape of rural Egypt before the transition of the irrigation system. The objective of this essay is to try to do this difficult task, based on geographical information.

Today, much attention is paid to the reference of geographic information in the study on Egyptian history, and not a few achievements have been accumulated. This essay is written encouraged by this academic trend.

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The originality of this essay is that we focus on the transition of the irrigation system to confirm the process of the landform transformation in rural Egypt in modern times. It happens to mean the researching for the framework to bridge the "pre-modern" and "modern" histories in the border of the reign of Muhammad Ali (ruled 1805-48) because the landform was dramatically changed from before to after the transition of the irrigation system that was initiated by Muhammad Ali.

Data and information

Another originality of the essay is the reference to the geographic information that could not be effectively used in the study on the socioeconomic history of Egypt. The socioeconomic history of modern Egypt has two turning points from the viewpoint of source materials of geographic information.

The first turning point is Napoleon's expedition to Egypt in 1798, which produced the *Description de l'Égypte*. The second is the British military occupation of Egypt in 1882, which initiated the systematic collection of geographic information as well as statistical data under British administration.

As a result, geographic information for research on rural Egypt in modern times is relatively abundant. The first production of modern scientific maps of Egypt was the time when French scholars produced the map of Egypt on Napoleon's Expedition to Egypt, which we will call Napoleon's map from now.

After the British occupation of Egypt, the production of maps of Egypt, using scientific ordnance survey techniques, began as part of the agricultural land survey project conducted between 1892 and 1907. Subsequently, maps containing specific information on, for example, irrigation and transportation came to be produced.

The geographical information, with which this essay is concerned, is various kinds of maps, including the maps of remote sensing. The main maps are the following three. 1) Napoleon's map in *Description de l'Égypte* at the beginning of the 19th century and other maps produced in the reign of Muhammad Ali, 2) the maps in the 1930s, which were produced by the British administration[3], 3) the contemporary maps and the satellite maps of elevation.

I. The transition of the irrigation system and change of landform in rural Egypt

The transition of the irrigation system

Egypt is a hydrologic society, which is characterized by systematic management of water,

3 The Survey Department produced 1:25,000 scale maps for the whole of Egypt from 1934 to 1938. They came to be the base maps in land survey projects in modern Egypt. A lot of revised versions of them have been published since then. All maps including their revised versions are collectively named "maps of the 1930s" in this paper.

and it is well known that the drastic social transformation in modern Egypt proceeded against the background of the transition of the irrigation system from the basin (natural) one to perennial (artificial) one.

The irrigation system in Egypt before the 19th century is called "basin irrigation." A basin is a large field and a unit of cultivation surrounded by banks. Egyptian agriculture was indebted to the Nile and its dependable seasonal flooding, which occurred regularly once a year. The river's predictability and the fertile soil allowed the Egyptians to have great agricultural wealth.

Under the traditional basin irrigation system, the location of villages was determined by a simple condition, that is, they were located on higher ground (mounds, *kum* in Arabic) where the water did not reach when the Nile flooded, which occurred regularly, once a year. As a result of this constraint, Egyptian villages have existed in the same places over long periods of time. In addition, the villages agglomerated and increased in size over time. As naturally formed agglomerations, the Egyptian villages came to function as administrative units.

However, from the 19th century, the irrigation system was changed to a perennial system. For this purpose, many barrages or dams were constructed to manage the water level of the Nile, and the networks of big, medium, and small canals to lead water into the fields through the year. The transition to a perennial system of irrigation in the 19th century resulted in a significant change in the layout of the Egyptian countryside.

As mentioned before, the banks that had previously surrounded the cultivated lands (basins) to protect them from floodwater were destroyed and these lands were subsequently converted into small units of land for cultivation, and where hamlets began to be constructed on the cultivated lands because these were no longer flooded by the Nile. The hamlets appeared especially on the lands that were reclaimed after the 19th century in the peripheral regions.

The change of landform in rural Egypt, which was caused by the transition of the irrigation system, was fundamental and irreversible. However, the perennial irrigation was not expanded at the same time in all of the Nile Valley, but with a time lag, which reflected the geological circumstances and the traditional affairs of irrigation. Table 1-1 shows the cultivated area by irrigation circle in 1927. The irrigation circle is the administrative unit for the management of irrigation since 1883.

We can deduce the following two points from Table 1-1. First, the Egyptian authorities recognized at the beginning of the 20th century that the transition of the irrigation system to the perennial irrigation was already complete, and basin irrigation did not exist in Lower Egypt. Second, the process of the transition of the irrigation system from basin irrigation to perennial irrigation was not unilinear from Lower Egypt to Upper Egypt, unlike what had been thought so far, but a plural one with a time lag, depending on the landform and the traditional way of irrigation in the region.

Regions and topics for study

In this essay, we pay special attention to the change of landform in three "peripheral" regions as follows, considering the regional diversity reflected in Table 1-1 on a time lag of the penetration of the perennial irrigation. 1) Idku Lake region in Buhaira Governorate, 2) Desert region in Minya, and 3) Riverside region in Suhag Governorate.

Why are the "peripheral" regions selected for study? Because they were impressively transformed by the transition of the irrigation system. It is certain that the phenomena of structural and historical changes in society more clearly appear in peripheral spaces than in central spaces.[4] We can check the features of the three regions as peripheral regions in Table 1-2.

Table 1-2 shows the results of cluster analysis of current regional differences in terms of income, employment, and educational level (unit: town or village), based on the Population Census of 1996 and the Household Income & Expenditure Survey in the period 1999-2000.

In addition, the phenomena of structural and historical changes in a society can be more clearly observed in "small" spaces than in "large" spaces. Fortunately, we have information on "small" spaces at the level of villages in the three regions: 1) Sidi Oqba Village for the Idku Lake region in Buhaira Governorate, 2) Beni Samrag Village in the Desert region for Minya, and 3) Awlad Sheikh Village for the Riverside region in Suhag Governorate.

The three villages are among 19 villages in rural Egypt that we have studied since 2004 in cooperation with the Central Agency for Public Mobilization and Statistics (CAPMAS). They are typical villages that represent or reflect the characteristics of the regions, not only from the aspects of the geology and the irrigation system but also from the aspects of socioeconomic affairs. Table 1-3 is on the peculiarities to 19 villages. We can check the historical and institutional features of the three peripheral regions mentioned above by referring to Table 1-3.

The three regions had the common experience of the fundamental transformation of landform in the process of the transition of the irrigation system. However, the transformation appeared in different ways, being conditioned by their geologies. As mentioned before, the landscape of rural Egypt has changed dramatically in modern times. Recent changes can be observed using satellite images, but these are obtainable only from the 1960s. Prior to the 1960s, it is much more difficult (although not impossible) to elucidate the features of the area's landscape and ecology.

Given the circumstances regarding the source materials, historical maps are useful for examining the features of the landscape, and for following their transformations before the 1960s. The main work here is to superpose some maps, such as historical, contemporary, and satellite maps, with each other, and to display the plural images as one map.

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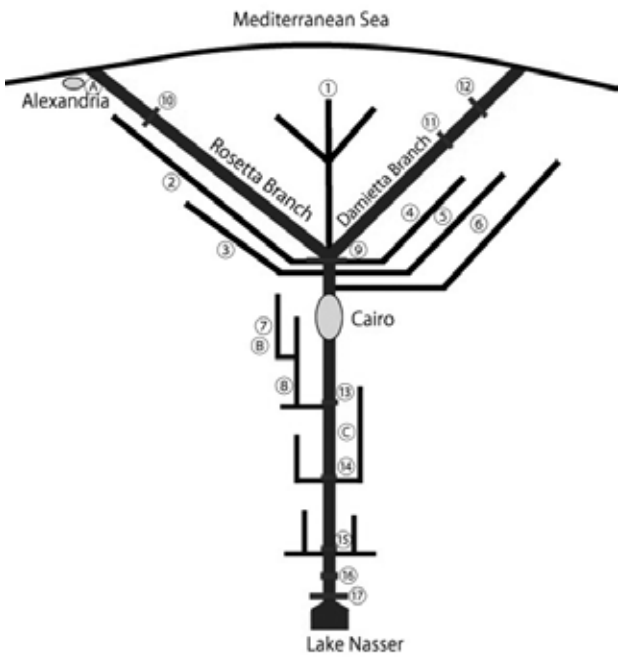
4 On the rural transformation in the "central" region, see the paper named "An Essay on 'Dead River.' Case Study of Applying Geographic Information for the Historical Study of Modern Egypt" (in Japanese), *Annals of Japan Association for Middle East Studies* (*AJAMES)*, no. 35-1, 2019.

Table 1-1 Cultivated area by Irrigation Circle in 1927

Circles	Provinces	Headquarters	Cultivated Area (Feddans)				
			Gross Area	Perennial	Rate of Perennial	Basin	Rate of Basin
Lower Egypt							
First	Qalyubiya and Sharqiya	Cairo	1,079,000	823,500	76%	nil	
Second	Menufiya and part of Gharbiya	Tanta	1,683,000	932,000	55%	nil	
Third	Beheira	Alexandria	1,011,000	572,200	57%	nil	
Zifta	Saqahliya and part of Gharbiya	Mansura	880,000	767,500	87%	nil	
Upper Egypt							
Giza	Giza and part of Beni Suef	Cairo	212,986	164,610	77%	48,376	23%
Fayyum	Fayyum	Fayyum	341,500	340,000	almost100%	1,500	almost0%
Fourth	Part of Beni Suef and Minya	Beni Suef	665,688	521,007	78%	144,681	22%
Asyut Barrage	Part of Asyut	Asyut	430,535	113,623	26%	316,812	74%
Girga	Part of Asyut and Girga	Sohag	319,620	7,310	2%	312,310	98%
Fifth	Qena and Aswan	Qena	524,429	217,739	42%	306,690	59%

Note 1) The difference between the total area and the area of perennial irrigation in Lower Egypt shows the area irrigated by the small canals, which were called the "nile" canals, for delivering water to the cultivated lands in the season of the Nile flood. 2) The rates of the basin and the perennial irrigation are added by the author.
Source: [Tottenham 1927:10].



Legend

Canal
① Menuf Canal
② Buhaira Canal
③ Nasser Canal
④ Tawfiq Canal
⑤ Sharq Canal
⑥ Ismail Canal
⑦ Bahr Yusef Canal
⑧ Ibrahim Canal

Barrage, Dam
⑨ Delta Barrage
⑩ Edfina Barrage
⑪ Zifta Barrage
⑫ Farskur Barrage
⑬ Asyut Barrage
⑭ Nag Hammad Barrage
⑮ Esna Barrage
⑯ Aswan Dam
⑰ Aswan High Dam

Regions for study
A Lake region in Lower Egypt
B Desert region in Middle Egypt
C Riverside region in Upper Egypt

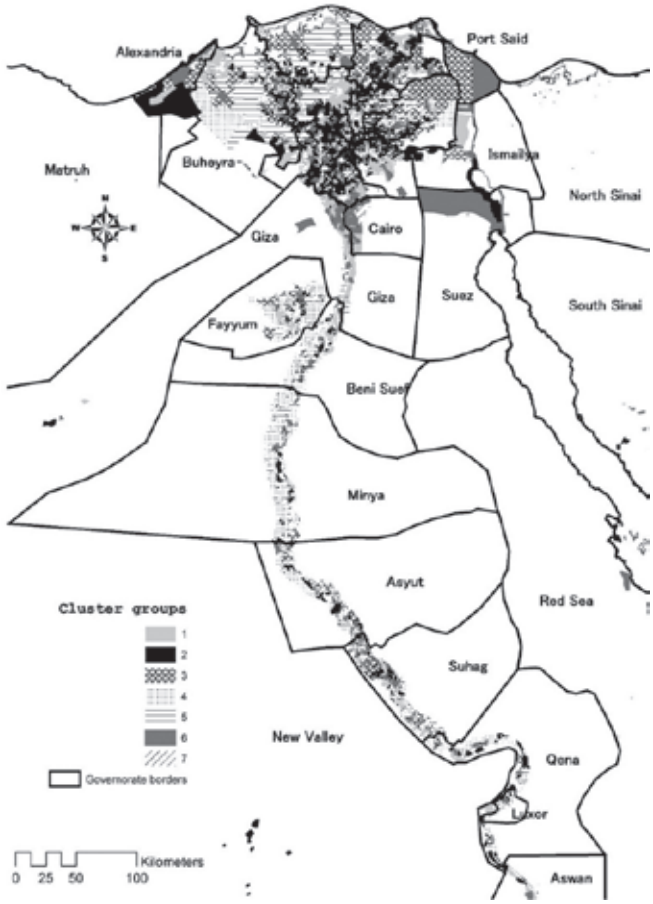
Map 1-1 Irrigation system in modern Egypt

Source: Delatour [1953: Table no. 11].

Table 1-2 Regional categorization according to the cluster analysis in 1996

Cluster	Geographical location	Characteristics
1	Suburbs of large cities (Cairo, Alexandria, Port Said) Suburbs of Mahalla Kubra city Provincial cities in the central and southern parts of Lower Egypt (governorates of Menufiya, Sharqiya, Gharbiya, Qalyubiya) Villages in the southern parts of Upper Egypt	Predominance of industrial workers
2	Villages in the suburbs of provincial cities, especially in the central and southern parts of Lower Egypt (Daqahliya, Menufiya, Sharqiya, Qalyubiya) Villages in the southern parts of Upper Egypt, and oases in the Frontier governorates	Markedly low ranked government employment
3	Villages in the northern parts of Lower Egypt (Daqahliya, Buheyra, Sharqiya) Villages in Fayum governorate and other southern parts of Upper Egypt (Asyut, Suhag governorates)	Predominance of agricultural self-employment
4	Villages in the southern parts of Upper Egypt (Minya governorate and northern parts of Asyut governorate)	Predominance of waged agricultural labour and low income
5	Villages in the northern parts of Lower Egypt (governorates of Buheyra, Kafr Sheykh, Daqahliya) Villages in Minya governorate	Predominance of large-scale agricultural enterprises
6	Large cities, and most of the provincial cities	Mixture of government employment, commercial and industrial activities
7	Some districts (*qism*) in Cairo	High incomes and dominated by service industries

Note: For detail, see [Kato and Iwasaki 2008: 14].
Source: CAPMAS, 1996 Population Census dataset, Household Income & Expenditure Survey 1999/2000 dataset.



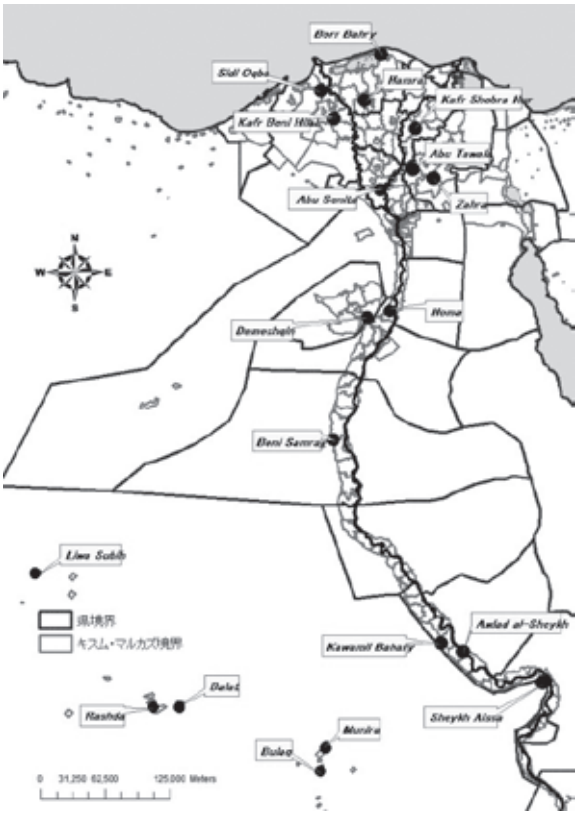
Map 1-2 Result of the cluster analysis in 1996

Table 1-3 Peculiarities to 19 villages

Region	Village	Governorate	Population (2006)	Period of village formation	Village type	Land reform	Presence of umda	Presence of police station	Presence of 'arab	Location
Central Lower Egypt	Abu Semita	Menuflya	4,468	Old	qarya	×	○	×	×	6km from Bagur
	Kafr Shubrahur	Daqahliya	515	New	izba	○	○	×	×	8km from Simbilawin
Peripheral Lower Egypt	Zahra	Sharqiya	5,082	New	qarya & izba	○	○?	×	×	15km from Zagazig & Bilbeis
	Abu Tawala	Sharqiya	5,458	Old	qarya	×	○	×	×	8km from Minya al-Qamh
	Kafr Beni Hilal	Buheyra	5,933	New	qarya & izba	○	○	×	○	5km from Damanhur
	Sidi Oqba	Buheyra	20,429	Old	qarya & izba	○	○	○(1975)	×	9km from Mahmudiya
	Hamra	Kafr Sheykh	9,252	Old	qarya & izba	○	○	○(1968)	×	7km from Kafr Sheykh
	Borr Bahry	Kafr Sheykh	8,214	New (1998)	qarya	×	×	○(2002)	×	10km from Biltim
Middle Egypt	Homa	Beni Suef	6,148	Old	qarya & izba	○	×	○(1952)	×	4km from Wasta
	Damashqin	Fayyum	6,501	Old	qarya	○?	○	×	×	14km from Fayyum
Southern Upper Egypt	Beni Samrag	Minya	9,810	Old	qarya & izba	○?	○	×	○	20km from Minya
	Kawamel Bahry	Suhag	4,461	New	qarya	○?	○	×	○	12km from Suhag
	Awlad Sheykh	Suhag	5,242	New	qarya	×	○	×	×	20km from Dar al-Salam
	Sheykh Isa	Qena	5,651	New	qarya	○?	○	×	○	8km from Qena
Oasis	Bulaq	New Valley	1,825	Old	qarya	×	○	×	×	25km from Kharga
	Munira	New Valley	1,915	New (1966)	qarya	×	×	○(2003)	×	22km from Kharga
	Bulat	New Valley	4,273	Old	qarya	×	○	×	×	27km from Mut
	Rashda	New Valley	4,364	New	qarya	×	○	×	×	10km from Mut
	Liwa Sabih	New Valley	2,710	New (1985)	qarya	×	×	×	×	

Note: The basic indicators in the table are selected for the following reasons.
1) "Period of village formation" and "Village type" indicate whether the village is an old and traditional one (*qarya*) that existed before the 19th century or a new and modern one (*izba*) formed in the 19th century ([Ramzi 1968]).
2) "Land reform" indicates whether land reform was executed in the village in the 1960s.
3) "Presence of umda (village chief)" and "Presence of police station" indicate the centralization of village politics.
4) "Presence of 'arab'" is the indicator to measure the influence of Arab culture in the village.
5) "Location" is the indicator to show the distance of the village from the central local city.

Source: [Kato and Iwasaki 2011:148].



Map 1-3 Location of 19 survey villages

II. Change of landform in three "peripheral regions," based on the geographical information

2-1 Lake region in Lower Egypt

The region concerned

Idku Buhaira region, which is relevant here, is located near two cities, Rosetta and Alexandria[5]. In terms of today's administrative divisions, the region mainly belongs to the Rosetta and Mahmudiya Districts (*markaz*) in the Buhaira Governorate, which are the hinterlands of Alexandria, enclosed by the Nile, the Mediterranean, and the Western (Libyan) Desert.

The hinterlands of Alexandria are lagoon regions, where the two lakes that give the regions the name Buhaira (small sea), Maryut Lake and Idku Lake, are located. The study place is called the Idku Buhaira region because it is located between the Nile and Idku Lake along the shore of the Mediterranean in the east part of the hinterlands of Alexandria.

The Buhaira Governorate, which is in the Third Irrigation Circle in modern times (see Table 1-1), is divided into two parts, east and west in the border of the Rosetta Branch of the Nile. The east part was developed early and is well known for the fertile agricultural land, but the west part was late for development. The Idku Lake region is located in the west part.

Today, Idku Buhaira region, in the outer (or peripheral) Delta that includes Buhaira and Kafr Shaykh Governorates, has a typical Egyptian rural view of fertile agricultural land. According to Table 1-2, the region concerned is categorized in cluster 5, which is characterized in the "predominance of large-scale agricultural enterprises," in contrast to the central Delta characterized by "markedly low-rank government employment."

However, the current features of Idku Buhaira region were formed around the turn of the 20th century. Many parts of the outer areas along the Mediterranean Sea and on the borders of deserts were marshy or arid, and they were unsuitable for habitation until the 19th century mainly because of salt damage. Idku Buhaira region was most newly developed in the Delta. It is reflected by its characteristics of the "predominance of large-scale agricultural enterprises" in Table 1-2.

Sidi Oqba Village reflects such development history of the region concerned. In the 1882 and 1897 censuses, Sidi Oqba Village seemed to be part of Barriyat Masna Village, then part of Izba Khalid Mari' Village from 1917. It implies that people settled in the area, where Sidi Oqba is situated now, before the end of the 19th century.[6]

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5 We have discussed this subject in two papers in [Kato and Iwasaki 2015] and [Kato and Iwasaki 2017].

6 In 1908, the village Masna was composed of 30 izba. Thus, Sidi Oqba would have been a small agglomeration of average 80 persons. It seems that one of the important groups that settled there were Bedouins. According to the 1907 census, Bedouins counted 1518 out of 3762 persons in Masna Village. It seems also that the peasants – from the nearby areas or sometimes from other localities within the Delta – were also an important group (Kato and Iwasaki [2015]).

The region belonging now to Rosetta District was reclaimed by the Buhaira Company in 1908 (Map 2-9). The Buhaira Company was contracted to develop the region around Sidi Oqba Village for land development. The most essential work of the Company was the arrangement of irrigation, especially a drainage system to exclude salt damage.

Sidi Oqba Village is a typical new settlement in the region, which is composed of 52 hamlets (*izba*). Izbat Sidi Oqba after which the village is called now "Sidi Oqba," is the biggest hamlet in Sidi Oqba. Sidi Oqba became an independent village in 1947, although the name Sidi Oqba appears in the old literature. The cemetery and holy mausoleum are located in the suburbs of the settlement of the village.

Geographical analysis

The region has experienced a complicated history in modern times. So, given another opportunity to follow its history in detail, we shall focus here on the examination of landform transformation in the region, based on the geographic information. The main work here is, as mentioned above, to superpose some maps, and to display the plural images as one map. Map 2-1 (base map is the contemporary Google map), 2-2 (base map is Napoleon's map), 2-3 (base map is the satellite map of elevation) are the maps where the important geographic information is superposed.

The red line is the border between the wasteland and Lake Idku, and cultivated land in Napoleon's map at the beginning of the 19th century (Napoleon's expedition to Egypt in 1798). The literature on modern Egypt described the region as unsuitable for habitation until the end of the 19th century, when it began to develop. In fact, wide areas of the region are covered with a kind of wasteland in Napoleon's map.

However, we can clearly distinguish two areas on the border of the red line in Napoleon's map: the east area between the red line and the Nile, and the west area between the red line and Lake Idku. The east area is relatively high and the west area is relatively low, as shown in the geological Map 2-3.

In the east area on the border of the red line, some rivers or canals seemed to flow westwards from the Nile. The purple line is the rivers in the plan map of the Buhaira Company for land development in 1908, which are called *baḥr* meaning "river" in Arabic (Map 2-9). Map 2-2 shows the geological traces of these rivers or canals.

Map 2-6 more clearly shows the existence of these rivers or canals. This map was produced by the Egyptian Society for the Studies on History as part of a project mapping the public irrigation works by Muhammad Ali ([Shafi'i 1950]) (called from now "Muhammad Ali's map"). It was largely based on information provided by Linant de Bellefonds (1799-1883)[7], but it also supposedly referred to some historical maps, including Napoleon's map.

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7 Linant de Bellefonds was a French explorer of Egypt, the chief engineer of Egypt's public works (1831-1869), and the chief engineer of the Suez Canal.

It contains a great deal of precious information on the landscape of the area in the first half of the 19th century. We can confirm the traces of the rivers or canals in the east area on this map. One of them, which probably had been a big river or canal, was a river named "abandoned canal" in Napoleon's map. It flowed westwards from Kafr al-Minya al-Said on the shore of the Nile to Minya Said, which was situated in the place of the present Sidi Oqba.

Minya Said, which is the present Sidi Oqba, was located a little in from the Nile and on a mound, and flourished as a port on the shore of Lake Idku in the Middle Ages ([Kumakura 2017]). It was probably named "abandoned canal" in Napoleon's map because the earth and sand had been accumulated in the flood season with time.

The land in the east area between the red line and the Nile was cultivated, but only by shallow rivers or canals in the old days. However, in the reign of Muhammad Ali, deep canals were dug for perennial irrigation, which were not newly dug, but were the old shallow rivers or canals deeply dug.

In the west area on the border of the red line, the wasteland was expanding. The area was classified into two categories. The first is the area near the red line border and is characterized by the planting of fruit trees such as fig, olive, and date (pink line). The second is the inland area reaching to Lake Idku and is the marshes or other rough lands (*būr*). *T*his land was the latest developed in the Delta region.

In 1880, the Egyptian government decided to establish large elevating-machines for irrigation. This was not an isolated experiment, but a system planned to extend over a greater part of the Delta for the transition from basin irrigation to perennial irrigation. The irrigation system adopted there was unique, to the effect that it was a system combining the traditional "basin" system on one hand, and the modern canal system and the introduction of large elevating-machines on the other.

The bases of the new perennial irrigation were the mounts, which are the archaeological hill sites of ancient times, from which the drainage canals run downward into Idku Lake. The most important work was, as mentioned before, the construction of drainage canals to remove the salts on the land ([Kato 2012]). The blue lines in Maps 2-1, 2-2, and 2-3 are canals (light blue for irrigation and dark blue for drainage) in the irrigation map of 1946 (Map 2-4).

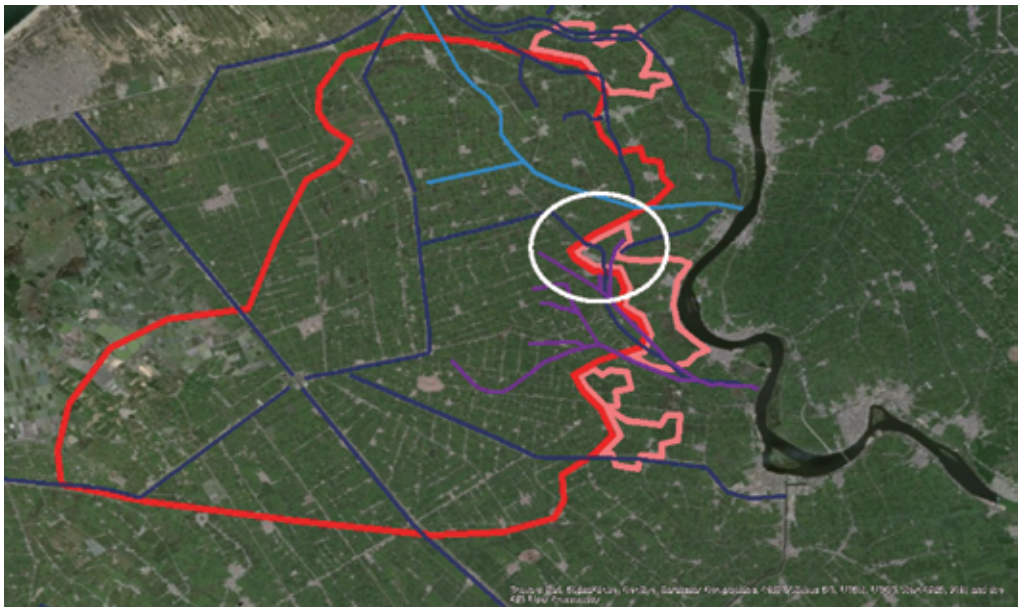
Photo 2-1 Landscape of Izbat Sidi Oqba

Photo 2-2 Farm Land in Izbat Sidi Oqba (August 2010)

Photo 2-3 Cemetery and holy mausoleum in Sidi Oqba Village (August 2010)

Photo 2-4 Irrigation Canal in Sidi Oqba Village (August 2010)

Photo 2-5 Drainage Canal in Sidi Oqba Village (August 2010)

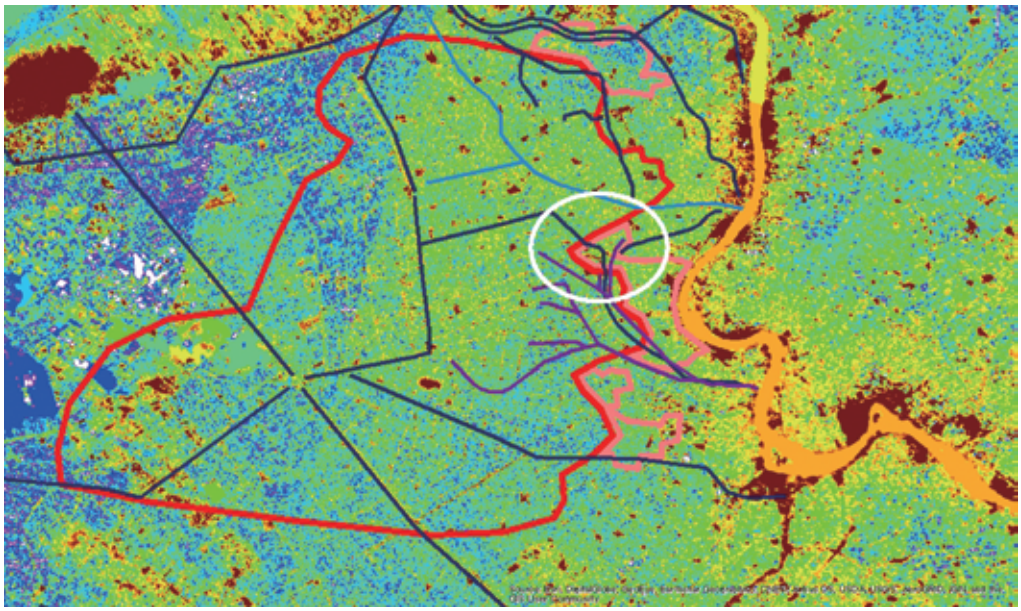


Map 2-1 Landform transformation in the Idku Lake region (Base map: Google map)

Source: Esri, Digital Globe

Map 2-2 Landform transformation in the Idku Lake region (Base map: Napoleon's map)

Source David Rumsey Map Collection



Map 2-3 Landform transformation in the Idku Lake region (Base map: Satellite map of elevation)

Source: SRTM data and topography shadow-map

Legend

Red line: Area of rough land (būr). Pink line: Area planted by fruits. White circle: Location of Sidi Oqba Village. Purple line: Creek in 1908. Light blue line: Irrigation canal in 1946. Dark blue line: Drainage canal in 1946.

Map 2-4 Irrigation map in 1946

Map 2-5 Map of the region around Sidi Oqba Village in 1801

Map 2-6 Muhammad Ali's map

Map 2-7 Map of the region around Sidi Oqba Village in 1882

Map 2-8 Map of the region around Sidi Oqba Village 1895

Map2-9 Plan map of Buhaira Company for land development in 1908

2-2 Desert region in Middle Egypt

The region concerned

The Desert region, with which we are concerned here, belongs to Samalud District (*markaz*) in Minya Governorate. Minya Governorate, which is located in middle Egypt, was the Fourth Irrigation Circle, where the perennial irrigation system was late in being introduced. The rate of perennial irrigation there was 78% in 1927, as shown in Table 1-1.

The region is situated between Bahr Yusuf and the Western (Libyan) Desert (see Map 3-1). It is well known that the region was bordering the desert, and was under the influence of the Arab culture ([Kato 2001]). Bedouin people in the Western Desert called the Nile Valley *rīf* (countryside), and the river (*baḥr* in Arabic), by which they called not the Nile, but Bahr Yusuf.

In fact, it was famous for the settled area of Bedouin tribes, some of whose chiefs became big landowners. There are many small hamlets (*izba*) settled by Bedouin tribes. According to Table 1-2, Minya Governorate is categorized in cluster 4, which is characterized by the "predominance of waged agricultural labor and low income." There, poverty seems to be associated with the historical landowner system there.

Beni Samrag Village reflects such features of the region. It is an old village, which means that the name of Beni Samrag is found in the old literature, but is collected hamlets (*mujamma'*) composed of more than 10 hamlets, where the nomads settled in the 19th century and located in the fringe between the Western Desert and agricultural area irrigated by Bahr Yusuf. As shown in Table 1-3, it is characterized by the presence of Arabs.

Geographical analysis

The topic for analysis here is concerned with a lake in the desert, which was found in maps of the 1930s (Map 3-1). The area enclosed by the black line is the lake concerned. However, the lake is not found in Napoleon's map (Map 3-5) and the contemporary map. The satellite map of elevation (Map 3-2) shows the location of the disappeared lake. We cannot confirm whether the lake did not really exist at the beginning of the 19th century, or French surveyors of maps did not pay attention to such a small lake in the desert. The lake is not found also in Muhammad Ali's map.

Then, when the lake was formed? Probably it was the period from the middle of the 19th century to the beginning of the 20th century because its existence is confirmed in the maps of the 1930s. Map 3-3 and Map 3-4 are the maps where the important geographic information on this lake is superposed. The area enclosed by black, yellow, and red lines shows the area of the lake in the maps of the 1930s (Map 3-1), 1934 (Map 3-7), and 1960 (Map 3-9) respectively. Apparently, the area of the lake was gradually decreasing in time.

The irrigation of the region concerned depended on Bahar Yusef under the basin irrigation system. Bahar Yusef is a natural-made canal. It received water from the Nile, which was situated at a high altitude on the east side of the valley. Thanks to the high elevation topography, where

there are many mounds (*kums*) as shown in Map 3-2, it made possible cultivation in low lands during inundation before the introduction of the perennial irrigation system.

Photo 3-5 shows the wall of Qasr Umar, one of the izbas belonging to Beni Samlag Village ([Kato 2008]), to which the water of Bahar Yusef reached at the time of the Nile flood under the basin irrigation system. It means that the place where Qasr Umar is situated was a kind of border that the water from Bahar Yusef reached at the time of the Nile flood. This was demonstrated by the fact that Qasr Umar is located on a relatively high place, and a canal exists in front of Qasr Umar (Photo 3-4). In fact, the basin maps in the 1930s (Map 3-6, 3-8) show the existence of a lake outside the basin system, although the lake cannot be found on the maps.

The land beyond the border was desert. It also has elevation, and there are high mounds and low lands. The water did not reach it, but according to the interview with an informant[8], the underground water accumulated in the low lands between the mounds, because the desert has a slope becoming lower from the east to the west, and formed the lake. This can be confirmed in the satellite maps of Maps 3-2 and 3-4. There existed some small lakes in the low lands apart from the lake concerned.

The lake, which is called *birka* in Arabic and *khafj* in the Bedouin language, was composed of the northern lake and the southern lake. The northern lake is named *birka al-ḥajar*. It means the lake of stone and signifies a lake full of stones (Photo 3-6). The southern lake is named *birka al-burīka*. It means the blessed lake. The area of the lake is about 1.1 square km, the northern lake is 0.73 square km and the southern lake is 0.33 square km, being calculated on the basis of the area of the lake in Map 3-1. In the old days, it was possible to catch fish in the lake.

There was a small hamlet on the shore of each of the northern and southern lakes, named Izba Abdelunis and Izba Muhammad Sultan, respectively. Izba Abdelunis was an izba where the tribe of Qabail settled, and Izba Muhammad Sultan was an izba where the tribe of Hadirat settled. Both the tribe of Qabail and the tribe of Hadirat are tribes from the Western (Libyan) Desert in origin and almost all of the inhabitants of the two izbas came from Izbat Abdusalam Abdullah, which belongs to Beni Samalut Village, about 90 years ago. It means that the inhabitants of the two izbas first settled in Izbat Abdusalam Abdullah from the Western Desert, and settled again in the two izbas, probably in pursuit of water.

About 90 years ago, when the tribe of Qabail and the tribe of Hadirat settled in the two izbas, it was apparent that plenty of water existed in the lake. However, at present (March of 2019), the lake was dried up. The process of the drying up of the lake was as follows. The inhabitants began to cultivate the land of the southern lake area for about 8 years, using the underground water. As a result, the level of water in the northern lake was decreasing lower and lower for about 7 years because the southern place is high and the northern place is low in elevation. Finally, the northern lake dried up one year ago.

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8 The informant is an inhabitant of Izba Abdelunis, an izba on the shore of the disappeared northern lake.

Photo 3-1 Map of hamlets (izba) of Beni Samrag Village in the Health Center

Photo 3-2 Map of small settlement under the Health Center in Beni Samrag Village

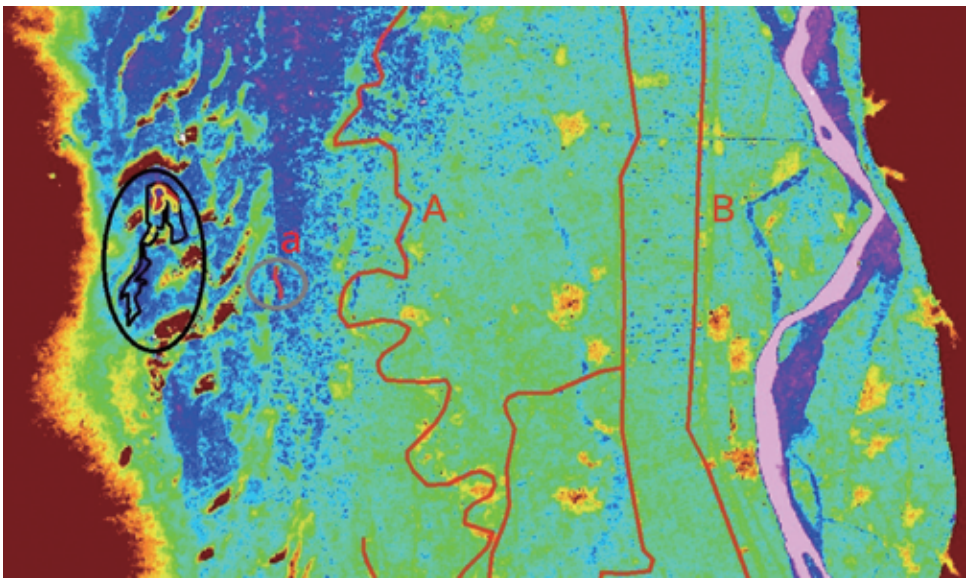
Photo 3-3 Qasr Umar (September 1991)

Photo 3-4 Canal in front of Qasr Umar (September 1991)

Photo 3-5 The wall of Qasr Umar, to which the water of Bahar Yusef reached at the time of the Nile flood (March 2019)

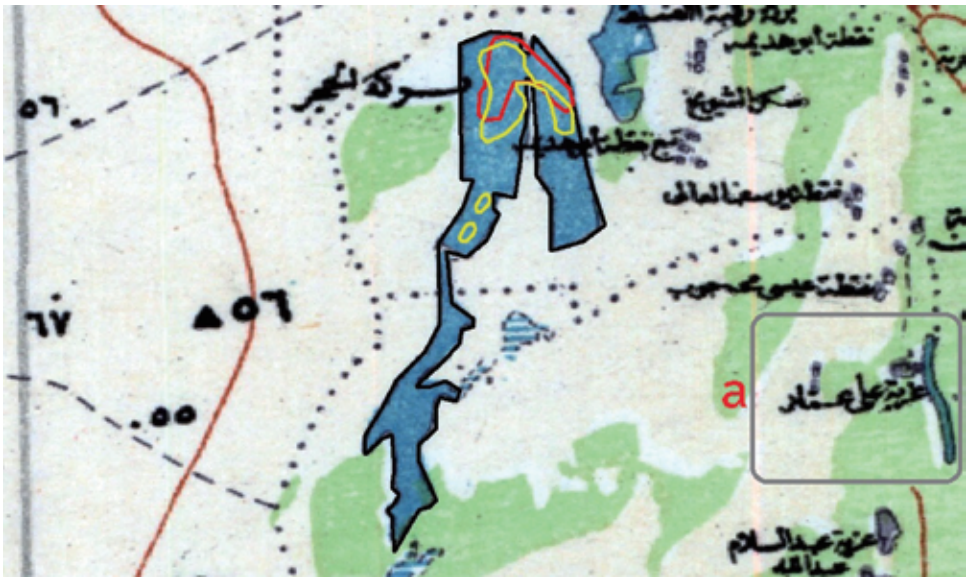
Photo 3-6 The northern lake, named *birka al-ḥajar* (March 2019)

Map 3-1 Landform transformation in the Desert region in Middle Egypt
(Base map: Map of the 1930s)

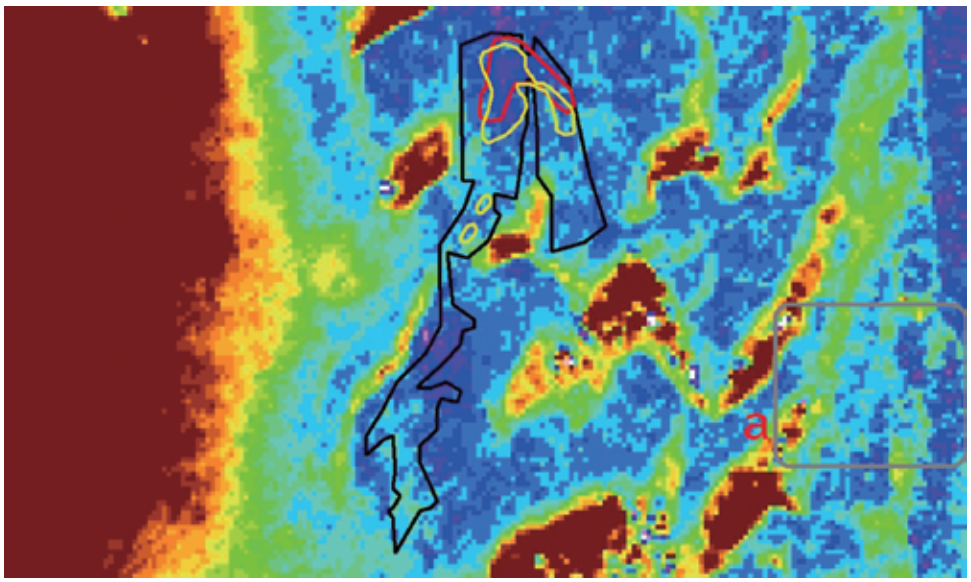


Map 3-2 Landform transformation in the Desert region in Middle Egypt
(Base map: Map of the 1930s)

Source: SRTM data and topography shadow-map



Map 3-3 Disappeared lake in the Desert region in Middle Egypt (Base map: Map of the 1930s)



Map 3-4 Disappeared lake in the Desert region in Middle Egypt (Base map: Satellite map)

Source: SRTM data and topography shadow-map

Legend

Black circle: Location of the lake concerned. A: Bahr Yusef. B: Ibrahim Canal. a: Qasr Umar.
b: Izbat Abdlusalam Abdlullah. c: Beni Samlag.

Map 3-5 Napoleon's map

Map 3-6 Fourth Irrigation Map in 1933

Map 3-7 Disappeared lake in the map of 1934

Map 3-8 Basin map in the region around Beni Samrag village in the 1930s

Map 3-9 Disappeared lake in the map of 1960

2-3 Riverside region in Upper Egypt

The region concerned

Riverside region, which is discussed here, belongs to Dar al-Salam District (*markaz*) in Suhag Governorate. Suhag Governorate is located on the south of Upper Egypt and was in the Girga Irrigation Circle, where the perennial irrigation system was the last to be introduced in Egypt.

The rate of perennial irrigation there was 2% in 1927, as shown in Table 1-1. The process of the expansion of perennial irrigation ended only after the construction of Aswan High Dam in the 1970s. A short history of perennial irrigation is as follows.

Chronicle of Egyptian irrigation in modern times

1805 Beginning of Muhammed Ali's rule (-1848)
1816 The digging of large "summer canals"
1818-1821 Construction of Mahmudiya Canal
1847 Foundation of the Delta Barrage (Al Qanatir Al Khayriya)
1873 Foundation of the Ibrahim Canal
1882 British occupation of Egypt
1890 Repair of the Delta Barrage
1898 Foundation of the Survey Department
1901 Foundation of the Asyut Barrage
1902 Construction of the Aswan Dam
1922 Independence of Egypt
1911 Drainage schemes were commenced
1912 Completion of the first elevation of the Aswan Dam
1933 Second elevation of the Aswan Dam
1938 Maintaining the agricultural drainage network in Lower Egypt after the completion of the network that was started in 1930.
1952 Revolution of July in Egypt
1960-1976 Construction and filling of Aswan High Dam

Suhag Governorate is known as one of the poorest governorates in Egypt. According to Table 1-2, it is mainly categorized in cluster 3, which is characterized by the "predominance of agricultural self-employment," and cluster 1, which is characterized by the "predominance of industrial workers." The people there seem to live dependent on small-scale agriculture or nonagricultural employment opportunities in local factories and, through migration, on the distant large cities or overseas.

Awlad Sheikh Village reflects such development history of the region. It is a new village existing between the western mountainous desert and the canal flowing along the Nile. The

village exists being stuck fast to the western mountainous desert. It is the poorest village among 19 survey villages in Table 1-3 ([Kato and Iwasaki 2011]).

Geographical analysis

Under the basin irrigation system, the direction and width of the Nile changed depending on the surface level of the Nile at the time of its flood. Muhammad Ali's map (Map 4-5) shows that the eastern border is the mountainous desert, and the western border is the line of the chain of villages located on high places. The Nile did not flow expanding westwards beyond the line of the chain of villages. The villages seemed to literally be islands in a sea at the time of the flood of the Nile.

The region, in which Awlad Sheikh is located now, was under water at the time of the flooding of the Nile because it was stuck fast to the mountainous desert (Photo 4-3, 4-4), and had a possibility of sinking under the water. The basin map in the 1930s (Map 4-6) implies that the region around Awlad Sheikh Village was not subject to the basin irrigation system, probably because of its geological characteristics.

However, perennial irrigation began to extend to the region. The important turning point was the construction of Aswan Dam in 1902. Aswan Dam was constructed to control the surface of the Nile at the time of its flooding. However, as shown in the chronicle of Egyptian irrigation in modern times, Aswan Dam had to be elevated twice, in 1912 and 1933, because the effect of its construction for the management of the Nile was less than had been expected.

Map 4-1 (base map is contemporary Google map), 4-2 (base map is satellite map of elevation), 4-3 (base map is Napoleon's map), and 4-4 (base map is the map of the 1930s) visualize this story of the region. They are the maps on which the information on the width of the Nile in the times of the beginning of the 19th century (red line), the 1930s (green line), and the present (white line) are superposed.

They show that the surface of the Nile could gradually be controlled along with the construction and elevation of Aswan Dam, and the arrangement of the network of irrigation canals in Upper Egypt, since the construction of Aswan Dam in 1902. It means the expansion of perennial irrigation in the region. As a result, new land was born clinched to the mountainous desert (the area enclosed with a yellow line in Map 4-1, 4-4, 4-7 and 4-8), and people began to settle in the place where Awlad Sheikh Village is located now, and to cultivate newly born land (Photo 4-5).

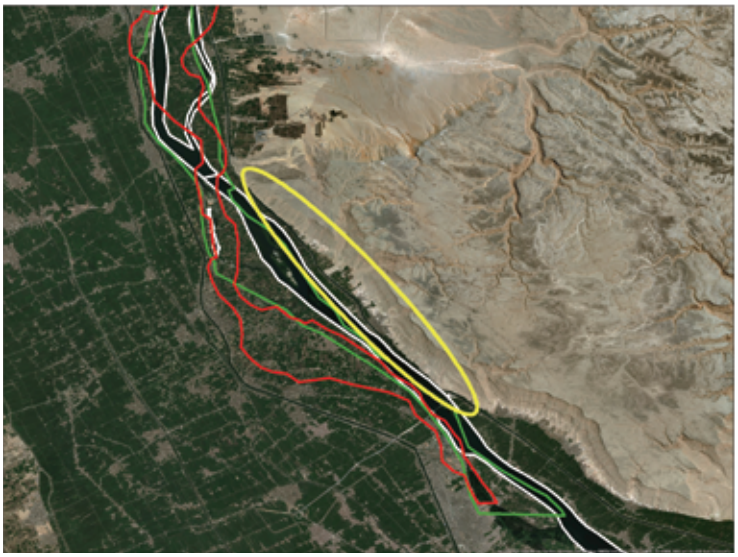
Photo 4-1 Aswan Dam 1903 [Garstin 1903]

Photo 4-2 Aswan Hight Dam (September 2001)

Photo 4-3 View of Awlad Sheikh Village (September 2005)

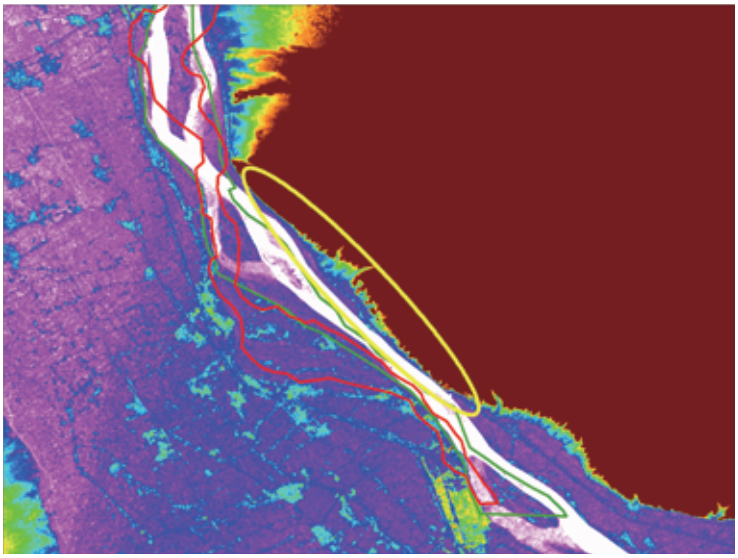
Photo 4-4 Mountainous desert behind Awlad Sheikh Village (September 2010)

Photo 4-5 Small agricultural land between the Nile and the canal (September 2010)



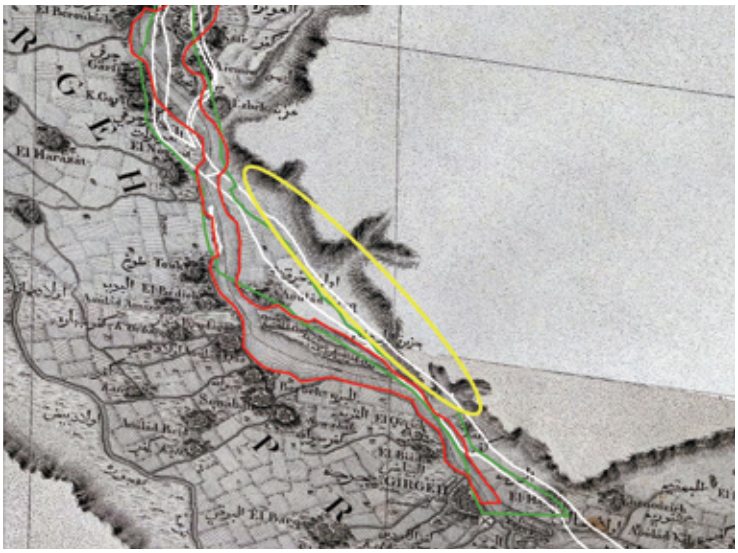
Map 4-1 Landform transformation in the Riverside region in Upper Egypt (Base map: Contemporary map)

Source Esri, Digital Globe



Map 4-2 Landform transformation in the Riverside region in Upper Egypt (Base map: Contemporary map)

Source SRTM data and topography shadow-map



Map 4-3 Landform transformation in the Riverside region in Upper Egypt (Base map: Napoleon's map)

Source David Rumsey Map Collection

Map 4-4 Landform transformation in Riverside region in Suhag Governorate (Base map: map of 1930s)

Legend

Red line: At the beginning of 19th century. Green line: In 1930s. White line: At present.
Yellow circle: Location of Awlad Sheikh Village.

Map 4-5 Muhammad Ali's map

Map 4-6 Basin map in the region around Awlad Sheikh Village in the 1930s

Map 4-7 Map of the region around Awlad Sheikh Village in 1945

Map 4-8 Map of the region around Awlad Sheikh Village in 1960

Some conclusions: The canary in the coal mine

Here, we will consider again why the three peripheral regions were selected to confirm the transformation of rural Egypt in this essay. My answer is, as mentioned above, because the phenomena of structural transformation first appears not in the central region, but in the peripheral and microspheres, for the change is reflected earlier in the periphery than in the center. It is difficult to observe the fundamental transformation in the center, but relatively easy to do so in the periphery at the early stage of the transformation.

In other terms, the peripheral regions are the spaces that play the "canary in the coal mine." The "canary in the coal mine" implies some phenomena that warn of the coming of great danger or trouble. In the context of this essay, "the great danger or trouble" to come is the fundamental and irreversible change of rural Egypt, which is caused by the transition of the irrigation system from the basin (natural) irrigation to the perennial (artificial) irrigation.

On the estimation of this change, disputes have continued since the end of the 19th century between the "modernists" and the "ecologists." However, regardless of its estimation, there is no doubt that the traditional ecology was completely destroyed by this change. It is true that the phenomena appeared in different ways, being conditioned by their geologies. However, what is common is that all of them showed signs of the fundamental and irreversible change of rural Egypt to come.

The three villages that we take up here for case studies are not typical Egyptian villages in a sense. They are not located in the central region, but in the peripheral region, and their villagers are "newcomers" in modern times. This is exactly why I am interested in the three villages and regions concerned.

In the Idku Lake region in Buhaira Governorate, the transition of the irrigation system resulted in the destruction of ecology so far. In the Desert region in Minya Governorate, the transition of the irrigation system and the expansion of cultivation made a lake in the desert disappear, and made it a "lake of illusion." In the Riverside region in Suhag Governorate, the introduction of the perennial irrigation system produced new land for settlement of people and cultivation.

I concluded the previous paper on the environment and development in the Idku Buhaira area in modern times with the following sentences.

In other words, a drastic and irreversible transformation of the society in the Idku area occurred in modern times, particularly from the end of the 19th century, as a result of rapid land development. In the process of this land development and modernization, the previous ecological system and the livelihoods peculiar to it were destroyed. … However, in our opinion, the ecological complexity and the varied lifestyle, based on the combination of agriculture, hunting (fish and birds), manufacturing, and commerce in the Idku Buhayra area, could be

observed in other areas of rural Egypt to varying degrees. Thus, in summary, the historical experience of the Idku Buhayra area is not an exceptional case, but a common case in the history of the modernization of Egypt. ([Kato and Iwasaki 2017])

These sentences are on the Idku Lake region in Buhaira Governorate. However, I believe that they are also applicable to the Desert region in Minya Governorate and the Riverside region in Suhag Governorate, with which this essay is concerned. In addition, a geographical transformation of the same kind could be observed in other regions in rural Egypt in the process of the transition of the irrigation system from basin irrigation to perennial irrigation in modern times.

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