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The Medieval Nile:
Route, navigation and landscape in Islamic Egypt

by

John Peter Cooper

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To my parents, John James and Marie Cooper,
with love and gratitude.

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ABSTRACT

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A highly dynamic fluvial environment acted upon by a complex human society capable of landscape-changing hydro-engineering works, the Nile of Egypt has undergone significant and constant change during the period of human inhabitation of its basin. This thesis looks at navigation on the Nile network in the period from Islamic conquest of Egypt in the mid-seventh century AD to the 15th century AD.

The mostly Arabic historical and geographical texts of that period describe a waterway network that differs markedly from that described by the authors of antiquity, and from that seen today. This thesis investigates these texts, in concert with geological, archaeological and cartographic data, and charts the routes of the major medieval waterways of Egypt within the modern landscape in Cartesian spatial terms. The chronology of major changes in the network – the comings and goings of artificial and natural waterways – is also established.

Having proposed routes and chronologies for the major medieval Nile waterways, the thesis then investigates the sailing conditions encountered on the river network, including the hydrological cycles and meteorological conditions effecting navigation, the obstacles and hazards encountered *en route*, and the times taken to make long-distance journeys. It also looks at the interface between Nile navigation and that of the adjacent Mediterranean and Red Seas.

Finally, the thesis considers the location of the major ports of the Nile Delta and the Red Sea, and considers the factors – navigational and otherwise – determining the choice of harbour site. It concludes that, far from being exclusively the product of a process of navigational optimalisation, the siting of these ports was the outcome of a far more complex set of prerogatives, among which navigational ease was one factor to be considered among many.

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The thesis is also accompanied by a DVD disk containing an ArcGIS file entitled Cooper2008Nile.mxd which locates spatially the waterways discussed in the thesis and presented in map from in Appendix 2.

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For those due thanks whom I have overlooked: shame on me.

Notes

Citation of primary sources

For reasons of clarity and economy of space, primary historical sources are cited as follows: the short name of the author is followed by the italicised first main word of the title, followed by the volume number, if any, and the page number, where relevant. For example, a citation from page 205 of volume three of *al-Murūj al-Dhahab* by al-Mas'ūdī will appear as "al-Mas'ūdī (*Murūj*, 3.205)". The full list of primary sources, together with the biographical dates of the author, is listed in the References section (Section 7.1).

Transliteration of the Arabic alphabet

The following conventions are followed:

Letters						Short vowels	
ا	Ā	س	s	ل	l	ـَ	A
ب	B	ش	sh	م	m	ـِ	I
ت	T	ص	ṣ	ن	n	ـُ	U
ث	Th	ض	ḍ	ه	h	**Diphthongs**	
ج	J	ط	ṭ	و	w or ū	يَ	Ay
ح	ḥ	ظ	ḍh	ي	y	يِ	Ī
خ	Kh	ع	‘	ى	ā	وَ	Aw
د	D	غ	gh	ء	’	**Shiddah**	
ذ	Dh	ف	f	ة	ah *or* at	ـّ	Double Consonant
ر	R	ق	q				
ز	Z	ك	k				

Manuscripts

Manuscript citations follow the folio number with r for *recto*, and v for *verso*.

Translations

All translations from Arabic, French and Italian primary sources are the author's own, unless indicated otherwise in the text.

Dates

All years are given in the Gregorian calendar unless otherwise indicated. Before-Christ years are indicated by the 'BC' suffix, Anno Domini years by none. Where Hijrah dates are used, for example in quotations, they are suffixed 'AH', and their Gregorian correlate is given. In addition, the following abbreviations are used:

c. circa

b. born

d. died

f. writing around

Place Names

All Arabic place-names are given in their transliterated Arabic form, except such cities Cairo, Alexandria and Suez, for which the English names are so established as to render pretentious any use of their Arabic form.

"The Nile of Egypt is the lord of rivers. God has subordinated to it every river, from east to west. For when God wishes to make the Nile of Egypt flood[1], He commands every other river to lower, and they lower their waters. God cleaves the earth into springs, and they make the river flow as God wills – may He be glorified and praised. And when its flood is finished, He inspires every water to return to its own."

Tradition ascribed to ʿAbd Allāh bin ʿAmr (in Ibn ʿAbd al-Ḥakam, *Futūḥ*: 149)

[1] Literally, *flow*.

1. Introduction

This thesis considers the navigational network of medieval Egypt, comprising the Nile, its major distributaries, lakes, excavated canals, and onward connections to the Mediterranean and Red Seas. It has three central objectives: first, to identify and locate the main waterways existing in Egypt during the period from the Islamic conquest of 641-3 through to the 15th century and establish their chronology of existence; second, to consider the navigational conditions experienced by people negotiating those waterways; and finally, to investigate the extent to which the locations of the main river- and sea-ports of medieval Egypt, and the routes they served, were influenced by fluvial and navigational factors on the one hand, and to which, on the other, social, political and geopolitical, factors were at play.

Following on from a brief overview in Section 2 of the historical context of Egypt from the eve of Islam to the Mamluk period – that is, from the seventh to the 15th centuries – Section 3 comprises an attempt to inventorise, locate, and give chronological date to the major waterways of Egypt in the period. The investigation depends for its data on pre-Islamic historical sources and on the works of the medieval Arabic geographers as the basis for building a time-series of geo-referenced maps of the main waterways of the Nile. It further draws on geological and geo-archaeological studies of the Nile Delta, for example in establishing the location of the Canopic and Pelusiac branches of Antiquity and the timing of their declines, which are absent by the time the first detailed Islamic-era geographies emerge in the tenth century. These geological studies also provide insight into the overall formation of the landscape, such as the expansion of the coastal lagoons of the Delta. Finally, the section draws upon historical and modern cartography, as well as satellite imagery drawn from Google Earth™ in order to further understand the chronology and location of the waterways under consideration. This section is to be read in conjunction with the historical maps in Appendix 1, and with the Cartesian maps of Appendix 2 that constitute the outcome of this interpretative process. The latter process draws upon ArcGIS, the Geographical Information Systems (GIS) software, to plot the medieval waterways in question on the WGS84 geographical grid system, and thus project in locatable form the interpretations of route, and change in route, developed during the section. The maps of Appendix 2 are arranged so as to present my interpretations of the works of individual ancient and medieval authors – specifically Ptolemy Claudius, Ibn Ḥawqal and al-Idrīsī, and then to offer a time-lapse series depicting change in the configuration of waterways in Nile Delta – the most complex and changeable region of the

river network – during the period under study. The ArcGIS file underlying these maps is provided on an accompanying DVD.

The representation of past landscapes through the Cartesian medium of GIS technology has been criticised by some scholars (Thomas 2004), on the grounds that it constitutes past landscapes in an essentially modern manner, and so from a perspective that contemporary inhabitants of those past landscapes could never have conceived or perceived them. It must be stressed that the objective of this stage of the thesis is not, on its own, to postulate a view of landscape that in any way reflects or suggests past appreciations of the fluvial environment experienced, known, and lived in by navigating individuals in the past. It is, however, a step in that direction: unless we can sketch the network of waterways available to navigators, the routes these waterways followed, and the places they joined together (and indeed the locales they circumvented), it is impossible to develop an understanding either of the lived experience of the individual navigator or indeed the environmental and socio-political forces at work in the riverscape that constrained, enabled and directed waterborne movement through it. Thus, this section of Cartesian map-making lays the foundations for the preoccupations of the subsequent sections of the thesis, which turns its attention to the skills and social processes behind medieval Egyptian navigation. As Sturt (2006: 131) has argued, Cartesian approaches are not inherently in conflict with past lived space, but rather "are a significant part of how we understand the [archaeological] record."

Indeed, the activity of creating modern maps from medieval sources requires no apology. The Arabic geographical texts in particular offer an unprecedented level of detail in their descriptions of the main Nile waterways. The resolution is such that one can in many cases construct a Cartesian mapping that holds out the very real prospect of predicting the location of Islamic archaeological sites in the Delta landscape. Ironically, it is those medieval authors that do *not* offer an exclusively Cartesian cartography who are the most useful in this regard. Sources such as al-Khawarīzmī (*Ṣūrat*) and Suhrāb (*'Ajā'ib*) – and before them Ptolemy Claudius – offer cartography based largely on faulty or inaccurate longitude-and-latitude locations which render them poor sources in the exercise of waterway reconstruction. In contrast, it will be seen that sources such as Ibn Ḥawqal (*Ṣūrat*) and al-Idrīsī (*Nuzhat*) supply essentially topological accounts of the Nile waterways – that is, they define routes in terms of the sequence of settlements occurring on their banks, very much in the manner that modern maps of underground metro systems depict their cartography simply as sequences of the stations constituting individual train lines. Since the great majority of the toponyms these authors cite are still known, joining the dots between them gives a fair indication of the route those waterways took through the

modern landscape. Sometimes these sequences are seen still to track waterways today, thus identifying those waterways as the modern manifestations of medieval, and sometimes earlier, watercourses. That in turn invites further, archaeological, enquiry into those routes. For example, the modern and somewhat diminutive Baḥr Saghīr (Appendix 2, Figure 2) emerges as a medieval waterway – the Tinnīs branch – of primary importance, its sinuous pre-modern course still traceable in today's Delta landscape, and worthy of archaeological investigation, not least in the contextualisation of the lake-island city of Tinnīs that it served (see section 5.3).

This thesis is not the first to draw upon the medieval Arabic literary canon in a bid to reconstruct the medieval Nile riverscape. It is preceded by such scholars as Guest (1912) and Toussoun (1925), who likewise sought to extrapolate maps from many of the same medieval accounts. While acknowledging the debt it owes to these pioneers, this thesis also departs from their interpretations of the texts in certain respects, and makes fuller use of Ibn Ḥawqal in the eastern Delta to greater effect. It also has the advantage of GIS and remote-sensing technology in locating precisely for present and future readers the routes proposed: the maps bequeathed by Toussoun and Guest have far too low a resolution to enable any form of landscape reconstruction, and many of the place names these scholars list have required laborious relocation on modern maps. Moreover, this thesis offers a time-lapse sequence of Delta maps, adding a temporal dimension that was not attempted by earlier authors.

Section 4 of this thesis shifts to a quite different perspective on the Nile riverscape. Despite centuries of scholarly interest in the antiquities of Egypt, and a recognition since Herodotus (and, no doubt, before) of the centrality of the Nile to human life in that land, an extended portrayal of the *experience* of navigation on the Nile has not, to this author's knowledge, been attempted in modern times, nor has navigation been placed in its landscape context. Except where papyrological study has shone occasional and invaluable light on the experience of individual navigators (Goitein 1967: 1.295-301; Sjipesteijn 2004), nautical aspects of the Nile have largely been investigated and viewed in terms of ancient boats, their types and technologies (for example, Aksamit 1981; Bell 1933; Block 2003; Bowen 1960; Creasman 2005; Edgerton 1923; Haldane 1993; Hassan 1946; Lipke 1984; Vinson 1994; Ward 2004; Ward 2000).

That the experience of sailing on the Nile has scarcely been considered is a breathtaking realisation demanding some reflection. How can it be that the longest river in the world, where it passes through what is arguably one of the richest and most extensively studied

archaeological zone in the world – certainly the most captivating in the popular imagination – has scarcely been considered from a navigational perspective?

There are a number of reasons for this omission, I suggest. The first must lie in the archaeological tradition in Egypt, and the preoccupations that have informed it. For much of its history, Egyptology has focused on objects, and often from an art-historical perspective, quite separate from their practical context. Archaeological enquiry, moreover, has centred on prestige and tourist sites, such as temples and pyramids, rather than landscapes, bringing with it interest in settlement-specific social organisation, and in trade and exchange networks – though not necessarily with an accompanying appreciation that such organisation and networks implied navigational knowledge, technical competence and social structures to bind them together.

Boats themselves have appeared frequently in the Egyptian archaeological record, yet the pattern of their appearance within that record has led to a focus on the artefact itself, at the expense of the context of Nile navigation. Boats and ships, actual and represented, appear regularly in the iconography of tomb and temple friezes and papyri, as boat models, and as real vessels found in funerary contexts: but in all of these the interest has been on the boat as a vehicle for religious belief, reflecting a wider preoccupation in the Egyptological tradition (see, for example, Černý 1952: 114, 120; Clark 1959: 140-4, 191; David 1982: 25, 25, 51, 63, 109; Flinders Petrie 1924: 23, 29, 115, 158; Meeks & Faverd Meeks 1996: 179; Taylor 2001: 28, 42, 178, 189, 198). Where boats have not occurred in the archaeological record – so far – is in the Nile itself. Thus, the notion of the Nile boat is often divorced from the navigational context of boats on the river. Moreover, the stylised depictions in ancient Egyptian art (such as the reliefs depicting Hatshepsut's ships sailing to Punt at Dayr al-Baḥrī (Hourani 1951: plate 2) or the Book of Amduat papyrus (Taylor 2001: 28)), their occurrence in ritual contexts, such as the Dashur boats (Creasman 2005) and the Solar boat of Cheops (Lipke 1984), and the association of these vessels with the social elite who commissioned these artefacts perhaps convey an air of unquestioned human control over the vessel and the water on which it moves. It is difficult to look at these depictions and imagine the contrary winds, groundings, storms, and the intellectual and physical grit that navigators of the Nile required, and which is evoked in Section 4 of this thesis.

Even the emergence of the discipline of maritime archaeology has failed to bring about an appreciation of Nile navigation. Maritime archaeology has often been regarded, from within and without, as a discrete sub-discipline pursuing a traditional focus on technology – particularly of ships and shipwrecks – and using a very particular methodology that the

underwater environment thrusts upon it (Adams 2006; Farr 2006: 88; Gibbins & Adams 2001: 279). Indeed, the 'binary orbit' of nautical technology and underwater methodology have at once driven and constrained the trajectory of the discipline, maintaining shipwrecks, and by extension ship construction, as the focus of intellectual activity of many in the discipline. It is perhaps this drive that Adams has in mind when he describes maritime archaeology as "... a field that has often struggled to gain intellectual maturity" (Adams 2006: 1). From this perspective, the particular focus of archaeological attention on Nile boat technologies and typologies is not quite so peculiar: it is reflective of a wider preoccupation among many within the discipline (see, for example, McGrail 2001). Indeed it may also be that this focus on scuba and shipwrecks has also diverted attention to the sea and away from rivers. In any case, it is worth reflecting that insights into the lived experience of Nile navigators have so far come not from the intellectual heartlands of maritime (or any other) archaeology, but from papyrology, in the case of Goitein and Sjipesteijn, and, in the case of this thesis, largely from traveller accounts, supplemented by meteorological and hydrological data. Indeed, if this thesis succeeds in presenting a new perspective on Nile navigation, it will have done so because of its multidisciplinary approach that reaches beyond archaeology.

A diminished awareness of the navigational complexity of the Nile is perhaps also a result of the transformative effect of the Aswan High Dam, built in 1964. Since then, the Egyptian Nile has been, hydrologically speaking, a highly controlled waterway, displaying little of its previously radical seasonal variability. Hence it is easy to be lulled into the sense that the river has always been a navigational easy touch: today's encounter with the Nile suggests little to the contrary.

Finally, it is tempting to spot Romanticist and Orientalist tropes in many – but not all – comments suggesting a minimal skill set for successful Nile navigation. When Semple (1932: 159) declares that "Nile navigation was easy", or Lane (2000: 30) that upstream navigation was a simple case of riding the northerly winds, and downstream travel merely a matter of furling the sail and drifting back down, it is difficult not to see in these Anglo-Saxon writers the reduction of lived experience to the externally observed picturesque of British Romanticism (Johnson 2007: 18-33), and the portrayal of the quaint indolence of subject peoples as justification for the colonial project (Said 1978: 201 ff.; 1993: 202). It is the hope of this author that, if nothing else, this thesis lays to rest the notion that navigation on the Nile was wanting in skill, lacking in knowledge of the lived environment, or requiring little in the deployment of physical energy. It instead argues in favour of Farr's appreciation of navigation as *socially* produced action, requiring the communication,

reproduction and exercise of knowledge (Farr 2006). That Egyptian navigators created the landscape through the agency of their labours (Johnson 2007: 147) is perhaps not quite so immediately obvious as in the case of the peasantry, whose labours quite tangibly transformed the flanking riverbanks into fields, irrigation systems and villages. But they did so nevertheless: it was through the often arduous, and certainly skilled, agency and practice of individual navigators that the political, economic and social fabric of Egypt was created and held together through the movement of produce, goods, people and authority. Indeed, the very agricultural landscape that the peasants worked was in turn contingent on the transportation of their produce to the urban consumption centres of Egypt and beyond. The same can be said for the materials constituting the built environment of Egypt's urban centres. "If you seek his memorial - look around you", says the dedicatory plaque to Christopher Wren in St Paul's Cathedral, London, for which he was architect[2]. While the centuries' labours of Nile navigators cannot easily be detected on the water, they are manifest in the urban fabric and archaeological record of the entire land of Egypt.

The above are the principal reasons, I propose, why Nile navigation has been largely overlooked by scholars of the Egyptian past, whether approaching from a maritime or terrestrial archaeological approach, or indeed from any other scholarly perspective. These reasons are open to debate and addition, but the fact remains that, for whatever reason, Nile navigation has been extensively under-investigated and under-appreciated.

The final major section of this thesis, Section 5, turns its attention to a selection of the major river and sea ports that served the waterways discussed in the previous sections, and the implications of the locations, functions and chronologies of these ports for our understanding of the factors determining the configuration of major navigated routes of the Egyptian riverscape. An initial inspiration for this entire thesis was the emerging notion of the 'maritime cultural landscape' (Hunter 1994; Parker 2001; Westerdahl 1992, 1998, 2002). As Adams (2006: 4) has noted, the idea has "gained currency far beyond its original constituency." It originated with Westerdahl (1992: 5; 1994: 226) as a simple spatial description of the set of material cultural remains to be found in the coastal zone, an area of growing concern to heritage managers (Westerdahl 1992: 5; 1994: 266). Westerdahl (2002), and other scholars such as Parker (1992), Hunter (1994) and Crumlin-Pederson (1996) subsequently invested the term with socio-cultural and cognitive dimensions. Responding to what they regarded as a failure among archaeologists to appreciate the maritime outlook of people living along the shoreline, they emphasised the interpretive

[2] "Lector, si monumentum requiris, circumspice"

value of viewing land, sea and the spatial relationships between maritime topography from a water-based perspective, as if through the eyes of a seafarer.

The problem of unpacking the constituent terms of the phrase "maritime cultural landscape" has been recognised elsewhere (Adams 2006: 4), and is not to be dwelled upon here in great detail. Suffice it so say that scholars have recognised the problems of definition (Hunter 1994: 261; Parker 2001: 23), while in the meantime resorting to an ultimately circular holding definition that implies some sort of quantifiability in the degree to which 'culture' can be construed as 'maritime': they suggest that 'cultures' are more or less 'maritime' according to the extent (somehow measured) of their maritime activities, dependencies, pastimes and beliefs – implicitly as a proportion of some cultural 'whole'. What is interesting for the matter at hand is that the problem of defining a *closed* world of definitively *maritime* activity is already apparent in the notion of a 'maritime culture'. Just as such a closed system is untenable in terms of 'maritime culture' so too it is for a 'maritime cultural landscape': neither can be understood or explained in isolation from the wider human social world.

What is particularly interesting to this thesis is not the difficulty of defining maritime culture *per se*, but rather the problem of appreciating a landscape – even the maritime-navigational aspects of that landscape – solely within parameters that have been set out by theorists of the maritime cultural landscape. Insofar as the notion of the maritime cultural landscape has developed further, it has adopted perspectives drawing on transport geography and navigated space. Moving beyond Westerdahl's original inventorisation of heritage remains, scholars subsequently conceived of the maritime landscape in broadly functionalist and structuralist terms (Parker 2001; Westerdahl 1994, 1998). This approach appreciates relict maritime facilities and infrastructure (such as moles and harbours) within the wider environment, relating them to natural features and phenomena that further elucidate maritime activity (such as sand bars and shallows, sheltering headlands and bays, estuaries and tidal reaches) which variously interact with the technology of the boat to define and delimit zones of maritime activity and the transition points between them, and which serve also to determine the locations of maritime 'enclaves' – centres of maritime-oriented cultural activity – within this navigational-transportational space (Parker 2001; Westerdahl 1994, 1998).

A further strand of the development of the theory of the maritime cultural landscape has urged the utilisation of this wider appreciation of environment "... to learn to perceive the landscape and the settlements as they were seen with the eyes of the sailor or fisherman in the past, approaching land from the sea or from navigable rivers." (Crumlin-Pedersen

1996). Here a more phenomenological, person-centred approach to the maritime landscape has been invoked – one which is most closely reflected in Section 4 of this thesis, on Nile navigation.

There has been some passing acknowledgement among maritime archaeological theorists that the maritime cultural landscape they are expounding and exploring is contingent on factors that are in some sense beyond that which is navigationally determined or experienced. Hunter (1994: 262) notes that 'maritime cultures' are "no more than extensions or reflections of the broader culture to which they belong and are integral rather than isolated economic or social elements." Moreover, Parker (2001: 37) recognises that: "The control of access by rulers is a feature of the landscape which applies especially to waterborne communications" – although what he explores is simply the control of elements of infrastructure within a given port, rather than the idea that power structures can be expressed in the wider configuration of the wider 'maritime' landscape, as will be investigated here. However these are themes that have not been taken up generally by maritime archaeological theory. Theoretical approaches to maritime activity within the landscape have instead largely adhered to structuralist and functionalist explanations – that maritime landscapes are *navigationally* construed spaces.

The original impetus for this thesis arose not from curiosity about navigational conditions on the Nile, but rather those on the Red Sea, and not about the situation in the Islamic period, but rather the Roman. During the course of my studies for the Maritime Archaeology Master's degree at the University of Southampton in 2004-5, I was introduced to recent scholarship on the Roman ports of Myos Hormos and Berenike (Blue 2007; Blue and Peacock 2006; Sidebotham 1989, 1986; Sidebotham and Wendrich 1998; Sidebotham and Wendrich 1996, 2000; Sidebotham 1999). The recent focus of archaeological activity at these sites has helped give rise to the argument that their respective locations – relatively far south on the Egyptian Red Sea coast – were decided by a desire to avoid the relatively difficult sailing conditions found in the Red Sea further north (for example, Facey 2004). In these explanations, an essentially functionalist approach to the maritime landscape – one that does not look beyond navigational considerations – is apparent. My doubts about the singular decisiveness of this particular argument were first raised during research for my Master's degree dissertation, which surveyed the evidence for the ancient canal linking the Nile of Lower Egypt to the Red Sea at Suez (Cooper 2005). Surely such a massive public work implied that sailing in the northern reaches of the Red Sea was in fact entirely possible using the sailing technology of Antiquity? That in turn led to a further question: if sailing conditions in the northern

Red Sea were difficult-but-surmountable, how did they compare, in terms of time and effort, to the alternative north-south waterborne route – the Nile valley? Hence the exploration of Nile sailing conditions on Section 4 of this thesis.

The changing configuration of the Nile Delta waterways explored in Section 3 is an extension of this initial curiosity about Nile sailing conditions, since the shifting course of the Nile, and especially its distributaries in the Delta, must have had an influence on the location of the major ports of Egypt, which – presumably – acquired and lost prominence in response to such changes. Thus, as will be discussed in this thesis, the decline of the Pelusiac branches in the early centuries of Islam deprived the port of al-Faramā (ancient Pelusium) of its rôle as a Nile-mouth port, giving new importance to the port of Tinnīs, in today's Lake Manzalah, which retained its river connection.

So far, the discussions appears to be of a landscape (or riverscape) determined by physical environment and navigational conditions, in line with the functionalist approaches to the maritime cultural landscape discussed above. However, it will be demonstrated in this thesis that such conditions were in fact far from being the only factors in determining the choice of route and the placement of ports. For example, Section 5 of the thesis shows that Tinnīs was abandoned as a major port in the 12th century, even though its river connections were unchanged. Likewise, the connections between the main river ports of Upper Egypt – Aswan and Qūṣ – and their corresponding Red Sea ports – 'Aydhāb and Quṣayr – changed over time despite the continuity of environmental conditions. In these cases and others, the constellation of route and port had *a strongly geopolitical dimension*: navigational routes, and the major ports that served them, were established and maintained according to the priorities and prerogatives of Egypt's ruling élite: they were not the exclusive domain of the navigators who sailed and used them. This realisation, arrived at during Section 5 of this thesis, has implications for functionalist approaches to the maritime cultural landscape, and indeed for the very *tenability* of the notion of a 'maritime cultural landscape' that can be successfully isolated and understood apart from the wider inhabited landscape of which it is part. While Section 4 is inspired by those theorists of the maritime cultural landscape (Crumlin-Pederson 1996; Hunter 1994; Westerdahl 1992, 1994, 2002; Parker 1992) who argue for an almost phenomenological appreciation of the landscape from a navigator's perspective, the evidence of Section 5 demonstrates that an understanding of route and port location does not necessarily arise from such a perspective. For that, an understanding of the riverscape as a component within a wider, politically informed and constituted landscape, as advocated by Adam T Smith (2003), is also required. The embedding of the navigational aspects of the Nile riverscape within the

wider lived landscape goes further still to blur the boundaries between the apparently maritime, and the apparently terrestrial. Clearly, the riverine nature of the land/waterscape under discussion in this thesis means that the two are not easily separated. But what is true for the Nile is true for other waterborne activity. Can the maritime cultural landscape of the Atlantic slave trade be understood in isolation from contemporary European imperialism and West African politics? Can the maritime cultural landscape of the Tyne coal trade be understood without reference to the industrial revolution?

The thesis takes as its case study the Arab-Islamic era largely because the period – and the Arabic language – are this author's specialism. In fact, many of the conclusions drawn, especially about navigational conditions and the influence of hydrological and meteorological season on Nile navigation, could be applied in principle to any era of human navigation on the river prior to the completion of the Aswan High Dam in 1964. Indeed, the investigation in Section 4 into navigational conditions on the Nile draws upon traveller accounts that are mostly later than the period under investigation, as well as on hydrological and meteorological data from the 19th-20th centuries. The patterns these data indicate are extrapolated back into the medieval period.

By the same token, the conclusion drawn in this thesis that geopolitical factors were heavily implicated in influencing the changing choice of route between the Nile and the Mediterranean and Red Seas in the medieval period might equally be borne in mind when considering similar connections in, for example, the Roman or Ptolemaic eras. If exclusively functionalist explanations for the choice and establishment of trans-Egyptian route fall short of explaining the changing configuration of these ports and routes over time in the medieval period, then might this not also be the case in earlier times? This thesis argues that, even where consistent conditions held – for example, hydrological and meteorological conditions of the Nile and Red Sea, pack-animal journey times across the desert – strikingly different configurations of trans-Egyptian waterway route existed. It follows, therefore, that explanations for changes in port location and route cannot be found solely in notions of – and assumptions surrounding – the optimisation of navigational and land-transportational ease. This is not to say that environmental conditions did not change on any level over time – the configuration of Nile distributaries certainly did, and impacted navigational practice in doing so. Rather, this thesis argues that those who decided and established trans-Egyptian navigational routes did so with an eye to geopolitical priorities as well as navigational predicaments. By extension, it argues that explorations of the maritime cultural landscape must go far beyond the traditional bounds of maritime

archaeology if they are to provide satisfactory explanations for the archaeological manifestations of past maritime activity.

2. Historical context

It is not the objective of this thesis to provide a narrative history of Islam and Egypt from the time of Muḥammad to the rise of the Mamluk dynasty. Such narrative accounts exist in abundance elsewhere (Hitti 1970; for example, Butler 1978; Kennedy 1986, 2007; Hourani 1991). However, since the research seeks in part to highlight connections between change in the Nile riverscape and the geopolitical situation of Egypt, a degree of familiarity with the significant events and polities of the era is necessary.

Egypt on the eve of the Islamic conquest was in a state of political upheaval. Domestically, a quasi-nationalist resentment amongst indigenous Egyptians towards the Byzantine empire, the occupying power, was finding its expression in theological competition between local Coptic Christianity and the Melkite orthodoxy (Butler 1978: 42-53; Frend 1982, 1984). Moreover, the wider Byzantine empire was weakened by civil war and confrontation with Persia. Coptic support for the rebel Heraclius had been vital to the success of his 609-10 usurpation of the Emperor Phocas (for example, Butler 1978: 8-32). That civil war had been the cue for the Persian Emperor Chosroes II to invade the Byzantine east, and Egypt was overrun by in 617, and remained under Persian control for a further decade. When Byzantine forces regained it in 627, Coptic hopes that Heraclius would be more tolerant of their theology than Phocas had been were dashed. His vice-regent Cyrus launched a brutal persecution that continued until the Roman rule ended in 642 (Butler 1978: 193).

Byzantine rule meant that Egypt was politically and economically oriented towards Constantinople. Alexandria's status as secular and ecclesiastical Egyptian capital, and its position as the principle trade emporium of the province reflected the country's Mediterranean orientation (Butler 1978: 359-399; Bagnall 1993: 77, 156, 290).

While Byzantium and Persia were locked in territorial conflict, the Prophet Muḥammad began his ministry in the Ḥijāz. By the time of his death in 632, most Arabia's fragmented tribal polities had been unified under the banner of Islam. The unity almost did not survive the Prophet's passing: Arabian tribes were familiar with the practice of making alliances with persons and groups, but not with the notion of religious kinship. Matters were exacerbated by the prophet's failure to nominate a successor – an omission with far-reaching implications for the subsequent geopolitical history of Islam.

A small group of Muḥammad's close associates chose his uncle Abū Bakr to lead the community as Caliph, or successor (Hourani 1991: 22). His first task was to put an end to the tribal secessions, to which task he appointed the loyal general Khālid bin Walīd

(Shaaban 1971: 20-24). Khālid went far beyond his remit, however, initiating the conquest of the rest of Arabia and, crucially, raids into Persian territory. The latter incursions became a vital source of booty income to replace the trans-Arabian trade that had stagnated during the turmoil of the early Islamic conquests.

Recognising the value of the strategy, Abū Bakr reward the suppressors of the secessions with booty raids against Byzantine Palestine. These were led by 'Amr Ibn al-'Ās, the ultimate conqueror of Egypt, and Yazīd, a member of the Banī Umayyah, the Makkan tribe that was ultimately to form the Umayyad dynasty. Both of these men were familiar with the region through their trading activities (Shaaban 1971: 23-5). Thus began a process of raiding and expansion that was ultimately to destroy the Persian empire and the end of Byzantine rule in North Africa and the Levant.

Abū Bakr's rule as Caliph was brief. His successes were followed by a period of rapid territorial expansion under the second Caliph 'Umar ibn al-Khaṭṭāb. By now, the process of raid and conquest was acquiring a momentum of its own, driven on by religious fervour and the dividends of conquest: the conquering armies were entitled to four-fifths of the booty, with only one-fifth reverting to the treasury in Madīnah.

The invasion of Egypt

'Amr's invasion of Egypt appears to have been a response to an increasingly crowded situation in Syria, which had been conquered in 639. The 3,500 men with whom he set off to conquer the country were from relatively minor Arabian tribes who had found themselves increasingly sidelined in Syria. Egypt, largely empty of Arab peoples, therefore represents a drive among 'Amr's troops to find a province of their own (Kennedy 2007: 139; Shaaban 1971: 36).

Egypt was easily conquered. Coptic resentment towards Constantinople ensured limited resistance. Forty years after the conquest, the Coptic bishop John of Nikiou regarded the Byzantine expulsion as divine judgement on "the wickedness of Heraclius and the persecution of the orthodox [i.e. Coptic]" (John of Nikiou, *Chronicle*, 464). His contemporary, Theophilus of Alexandria, welcomed the coming of the Muslims (Fleisch 1935-6: 374-5). The Roman fort of Babylon, today's Old Cairo, fell to the Muslims in April 641. Alexandria surrendered a year later. In the south, 'Amr made a pact with the Nubians, fixing Egypt's southern border (Spaulding 1995).

Following the conquest, Alexandria lost its status as Egyptian capital. A tradition reported by Ibn 'Abd al-Ḥakam (*Futūḥ*, 91) has it that 'Umar – known for his suspicion of

travel by water – told 'Amr: "I do not wish the Muslims to reside in a place in which water comes between me and them, winter or summer."

'Umar's policy was not as superstitious as it ostensibly appears: Alexandria was vulnerable to Byzantine naval attack at a time when the Arabs had not yet developed a naval force. Indeed it was briefly retaken by the Byzantines in 645 (Shaaban 1971: 37). 'Umar's strategy throughout the empire was in any case to keep his Arab garrisons apart from the native populations in a bid to maintain the momentum of conquest (Hourani 1991: 24). A new capital was thus established at al-Fusṭāṭ, alongside Roman Babylon. Its location was dictated by the same considerations that had previously placed Babylon there: it stood at the pivotal point through which all Egypt's long-distance waterbourne traffic had to pass (Shaaban 1971: 31). Moreover, it was directly on the land route to the Islamic capital.

While the overlordship of Egypt had shifted from Byzantine to Muslim, little in the domestic governance of Egypt changed. The civil administration was left in native hands, and non-Muslims were largely unmolested provided that they paid the *jizyah*, or poll tax for non-Muslims (Spuler 1960: 25; Kirk 1964: 16; Shaaban 1971: 39; Hourani 1991: 23).

'Umar was murdered in 644 , leaving an empire in which the Arab tribesmen and provincial governors were acting largely independently, with the Caliph little more than an intermediary. That was to change following the election of his successor, 'Uthmān ibn 'Affān (Lewis 1974: 8). A member of the Bani 'Umāyyah tribe, his accession represents a resurgence of the same Makkan aristocracy that had initially suppressed the Prophet in his early days. 'Uthmān appointed close family members as provincial governors in Syria, Iraq and Egypt – removing 'Amr as governor there (Shaaban 1971: 66). His nepotism caused consternation in Madīnah, who sensed – correctly – that power would drain north to Syria and Iraq (Hourani 1991: 24): 'Uthmān's actions ultimately laid the foundations for the Umayyad dynasty, based in Damascus.

A key development under 'Uthmān was the development of a Muslim navy in the Mediterranean. While 'Umar had been wary of naval confrontation (Mahmud 1960: 98), the new regime sought to build a force capable of curbing Byzantine dominance of the Mediterranean. By 648, Mu'āwiyah, 'Uthmān's kinsman and governor of Syria, was able to send a fleet against Cyprus, on which he imposed a tribute. Sicily was raided in 652. Two years later Cyprus was raided again, and a Muslim occupation force installed (Lewis 1974: 57).

The entry of Arab-led navies into the Mediterranean basin marked the end of the centuries-old Roman *mare nostrum*, and the opening of a trans-Mediterranean front between the Christian and Muslim lands. From Egypt, Byzantium had imported spices from the Indian Ocean and Egyptian agricultural produce, textiles and papyrus. The Islamic conquest was to fundamentally change the political situation, turning the Mediterranean into a theatre of ideological conflict. Pirenne's thesis (1939: 284-5) that the conquest precipitated a major decline in the trade of the eastern Mediterranean has since been disputed (Hodges and Whitehouse 1983): a more radical decline was the eastward shift in the seat of the Caliphate from Damscus to Baghdād, which prompted a significant downturn in the economic life of Egyptian ports such as Alexandria (Haas 1997: 346).

The Arab strategy of developing a Mediterranean naval force was a costly one. In Egypt, the governor Ibn Abī Sarīḥ began to squeeze the population for taxation, prompting growing resentment against the Madīnah government, and an atmosphere of revolt. Meanwhile, the Arab troops in al-Fusṭāṭ became increasingly frustrated with the bar on their settling in Egypt at a time when their booty opportunities were diminishing. Ultimately, resentment towards 'Uthmān overflowed. In 655, he was besieged in his house in Madīnah by tribesmen from Egypt and Iraq. After 50 days of fruitless negotiation, the Egyptians entered and killed him (Shaaban 1971: 73).

Civil war

'Uthmān's elected successor was 'Alī ibn Abī Ṭālib, son-in-law of Muḥammad through his daughter Fāṭimah. 'Uthmān's Umayyad provincial governors objected to 'Alī, however. In Syria, Mu'āwiyah demanded that 'Uthmān's killers be brought to justice before he would swear allegiance. 'Alī, hoping to curtail the power of the Umayyad governors, refused. In the civil war that followed, 'Alī was killed at Kūfah in 661.

Supporters of 'Alī, many of them non-Arabs in the conquered lands, regarded Umayyad rule as the illegitimate ascendancy of Arab aristocracy at the expense of the pious. The party of 'Alī, or *shī'at 'Alī* – hence the term *shī'a* given to their followers – wished to see the caliphate pass to his sons Ḥasan and Ḥusayn. Ḥasan did not press his claim, and died naturally. Ḥusayn, however, raised his banner in Iraq in 680, only to be killed at Karbalah by Umayyad troops. His killing gave defining momentum to the Shia branch of Islam, which garnered support from the poor and marginalised.

The Umayyads

The victorious Mu'āwiyah ruled for 20 years, instigating a 90-year period of Umayyad rule. With its new capital in Damascus, the Islamic empire spread to its greatest extent. By

the centenary of the Prophet's death, it reached from Northern India to Transoxiana to Spain. In Egypt, Mu'āwiyah reinstated 'Amr ibn al-'Ās as governor. From there 'Amr directed the ongoing conquest of North Africa (Shaaban 1971: 80)

Once Caliph, Mu'āwiyah resumed development of the Muslim navy. Indeed the Umayyad period coincides almost exactly with a period of Islamic naval expansion in the Mediterranean, starting with sporadic raids of island communities, but evolving into a strategic struggle for dominion over the Mediterranean. It was brought to an end by a decisive Byzantine victory off Cyprus in 747 – just three years before the end of Umayyad rule.

From the outset, Mu'āwiyah felt that the empire was vulnerable from the sea. In 663 he settled Persians in the coastal cities of the Levant and raised defences. Alexandria's walls, pulled down by 'Amr after the Byzantine reoccupation of 645, were rebuilt (Lewis 1974: 60). In 669, Mu'āwiyah went on the offensive. His navy raided Sicily that year from Qayrwān. In the east, the Muslims occupied Rhodes in 672 and Crete in 674, and in 717-8 besieged Constantinople. The latter adventure had catastrophic consequences, however. A Byzantine assault using Greek fire devastated the Muslim fleet. A resurgent Byzanine Navy was able to halt the Muslim march across North Africa. In 683, the Byzantines seized Qayrwān. The setback was only temporary, however. By 700, Byzantine Africa was no more, although Byzantine naval raids continued to menace the Egyptian Delta coast (Trombley 2004: 200).

The early Umayyad rulers faced revolt in Madinah, where people resented the shift of power to Damascus that had followed Mu'āwiyah's victory, tribal fighting between northern and southern Arabian tribes, and a Kharijite rebellion that over-ran Iraq, southern Persia and much of Arabia. The key figure in turning the situation around was the Caliph 'Abd al-Malik (685-705). Apart from putting down the Kharijites, he also sought to unify the empire by instigating a postal system, replacing Byzantine and Persian coinage with Islamic coins, and instituting Arabic as the state language. The non-Arab civil administrators were not removed, but by this time the barrier between conquerors and natives was beginning to break down. Non-Muslims were being attracted to Islam because of the social prestige attached to it, and the opportunity to avoid paying the *jizyah*. In Syria and Lower Egypt, however, many of the inhabitants were still Christian in the ninth century A.D, and in Egypt in particular Arabic was slow to take hold (Kirk 1964: 22-3).

Having taken the whole of the southern and eastern Mediterranean littoral, Muslim ambitions for dominance of the sea itself were thwarted in 747 with the destruction of the Muslim navy off Cyprus. A relatively small Byzantine fleet came upon an Arab fleet of

1,000 vessels, which it destroyed with the aid of Greek fire. Muslim sea-power in the Mediterranean was not to recover until the Fatimid period.

Umayyad government in Egypt was principally structured to farm taxation from the subject economy, and to provide a military base for the terrestrial and naval conquest. There was little attempt to convert the population, and it was only after the rise of the Abbasid dynasty that Islam became the religion of the majority (Hawting 2000: 9, 39-40). Umayyad domination of the Islamic world came to an end in 750, soon after the loss of the navy. Despite their territorial achievements, the Umayyads had failed to secure popular support. They lived in accord with their aristocratic origins, operating as an elite caste that estranged in particular their non-Arab subjects (Kirk 1964: 27). Those who tried to convert to Islam as a means of gaining status as fully fledged citizens found they were instead obliged to attach themselves as dependent client *mawālī* to established Arab tribes.

The Abbasids

Change came in the form of the Abbasids. In contrast to the Umayyads, they claimed legitimacy by virtue of descent from the Prophet's family, in particular his uncle, Abbas. Starting in Khurasan, in the north-east of the old Persian empire, the Abbasids launched a campaign against the Umayyads that drew on non-Arab resentment of what they saw as the materialistic and impious Umayyads. Their rallying concept was that all Muslims, Arab or not, were equal in the eyes of God (Kennedy 1981: 35-45; Randa 1990: 3). Such an outlook also attracted Shiite support, and within three years of launching their revolt in 747, the Abbasids had supplanted Umayyad rule everywhere but Spain (Hourani 1991: 31-2).

The Abbasid ascendancy ended Arab supremacy of the Islamic world. The second Abbasid caliph, al-Manṣūr (754-75), founded a new Islamic capital of Baghdād in Mesopotamia, shifting the centre of political gravity, and trade, eastward. His objective was to make Baghdād not just the political, but also the economic centre of the empire (Kennedy 2004: 133). Many of the rulers of the new dynasty were Persians, or Persian-influenced, and the court began to take on the opulent trappings of a Sassanid court. Egypt, in consequence, became a political backwater, and Alexandria and the coastal ports of Egypt suffered a decline along with the maritime economy of the rest of the eastern Mediterranean (Kennedy 1981: 24-5).

The growth in the size of the Abbasid state in this period required a commensurate growth in taxation. Under the Abbasids, a departmental administration system modelled on its Persian forebears was adopted and a canonical system of taxation emerged, based on the

earlier Islamic principles of *kharāj* (land tax) and *jizyah* (poll tax for non-Muslims) (Hourani 1991: 35).

The growth in the state was not driven by taxation alone, however. Baghdād became the centre of a global maritime trade. By 850 Muslim ships had reached China, where they traded silk and porcelain. India was the source of spices, precious stones and fine cloth: coral, ivory and textiles were sent in return. Trading activity in east Africa, albeit smaller, reached Madagascar. The main trade entrepots in the Indian Ocean were Baṣrah in Iraq and Sirāf on the Southern Iranian coast. Egypt's agricultural produce and luxury textiles made it a major contributor to the Caliph's coffers, but it was by no means a centre of maritime commercial activity.

In the Mediterranean, there was even some revival of trade between the Levant ports, with their land and river connections on to Baghdād, and the Christian northern shores, especially Venice. The middlemen in this trade were often Jewish, their religion making them more palatable to both sides (Kirk 1964: 28; Hourani 1991: 44). However the bulk of trade ran along the southern and eastern shores, linking Islamic Spain and the Maghreb with Egypt and Syria. The commerce was in Spanish silk, gold from west Africa, metals and olive oil. There was also trade with Russia and Scandinavia through the Black Sea in furs, arrows, birch bark, fish glue, amber, slaves and cattle (Bagot Glubb 1963: 324). Contact with east Asia brought new crops to the Mediterranean basin: rice, sugar-cane, cotton, watermelons, aubergines, oranges and lemons. The new crops and new agricultural techniques increased production, further spurring trade and exchange. As a result the monetary economy developed and coinage expanded.

This trade also enabled a revival in industries that had been crippled by the wars of conquest. In Egypt, these included fine textiles – centred around Lake Tinnīs – wool weaving, and glass making. A declining papyrus industry was replaced with rice and sugar cultivation. Meanwhile, a government wheat monopoly prevailed, requiring large state granaries (Spuler 1960: 68-9).

The Mediterranean remained a sporadic war zone, however. The Caliph al-Ma'mūn sent a naval expedition from Egypt to conquer Crete in 825, and the autonomous Aghabids conquered Sicily for the first time in 827-831.

However, amid the cultural and commercial advances of the early Abbasid period, the seeds of fragmentation had already been sown. The Abbasid's had come to power on a manifesto of ending Arab dominance. They soon came to fear the opposite: the growth of ethnic power groups in the provinces that would challenge control from Baghdad. To

counter that possibility, they took to using Turkish slave-soldiers, who provided not only an autonomous military force, but also were involved in provincial civil administration (Randa 1990: 3-4). The first of these were serving in Egypt by 808, and the practice was systematised under the Caliph al-Mu'tasim (833-842). This policy soon acquired a momentum of its own, however, and the Caliphs became increasingly dependent on their mercenaries.

The power of the Turkish mercenary class was to reach its zenith in the Mamluk period (1250-1517), the end of the period of this study. However, the first of these Turkish peoples to take power in Egypt was four hundred years earlier, in the form of Aḥmad ibn Ṭulūn.

The Tulunids and Ikhshidids

Abbasid fiscal policy fermented resentment. The practice of tax farming – whereby the government borrowed from a private lender who was then able to extract the tax on the government's behalf – fuelled growing resentment across the empire (Spuler 1960: 51). The Umayyads had held on in Spain: now separate dynasties broke away in northwest Africa – the Idrisids in Morocco from the late eighth century, and the Aghlabids in Tunisia (800-909 A.D). In Khurasan, birthplace of the Abbasid rebellion, the Samanids (819-1005) took control. Even in southern Iraq, close to the heart of the empire, the Zanj rebellion flared in 869 (Dixon 1971: 147). Moreover, the Byzantine navy continued to represent a threat. In 852, a Byzantine fleet attacked Dumyāṭ: several thousand troops were put ashore, and large quantities of goods and women were carried off.

In Egypt, the breakaway from the Abbasid centre was led by Ibn Ṭulūn, who declared himself ruler of Egypt, Palestine and Syria in 868, establishing a new Egyptian capital just to the northeast of al-Fusṭāṭ, called al-Qaṭā'ī (Brockelmann 1939: 138). By 876, Ibn Ṭulūn controlled the North Africa coast as far as Barqah (Randa 1990: 155). His putsch was backed by the local elite, who had rebelled as early as 831 against Abbasid taxation. By that time, the process of Islamicisation in Egypt had reached a critical point: many landowners, merchants and officials had converted to Islam, and had intermarried with the Arab conquerors to the extent that the two groups were becoming indistinguishable. Together they formed a powerful local interest group that backed the Tulunid secession (Randa 1990: 20-21).

The Tulunid period, though lasting less than forty years, saw some far-reaching developments in the Egyptian geopolitical landscape. Whereas Egypt had previously been a province of empires with their capitals at al-Madīnah, Damascus and Baghdād, it was now, for the first time in the Islamic era, an independent entity, ruled not by an overseas

elite, but by one based near the apex of the Nile Delta. Moreover, the Zanj revolt had shut off Baghdād from the trade routes to India, which had become hugely important under Abbasid rule. Previous sidelined, Egypt once again found itself an important entrepot for east-west trade. According to Randa (1990: 137):

"...at least some of this trade went to the Red Sea ports, and some of that went to Egyptian ports. A larger portion of goods in transit to the Byzantine Empire and other European destinations found its way to Egyptian ports. Spices in particular had been drawn through Iraq rather than the more direct route through Egypt because of the huge market created by the 'Abbasid capitals [of Baghdad and Samarra]".

The Zanj rebellion therefore not only reduced the ability of the caliphate to rein in Ibn Ṭulūn by distracting it militarily, it also gave him the economic wherewithall sustain his independence.

Trade was a high priority under the Tulunids. The new capital was organised to stimulate trade through Egypt, with different trades given their own markets (Randa 1990: 149). The Tulunids also vied with the Abbasids for control of the frontier zone with Byzantium, partly for the prestige of leading the confrontation with the enemy, but also to further control trade across the frontier (Randa 1990: 159).

The abiding threat to the Tulunid state was a reassertion of Abbasid control. As the Byzantine raid on Dumyāṭ in 853 showed, Egypt's maritime defenses were weak From 876 , he began to build a naval force. Ibn Ṭulūn fortified al-Rawḍah island, in the Nile at modern Cairo, and made it a naval base to protect his ships from surprise attack by sea. He also fortified Dumyāṭ and other points on the coast. And he established shipyards at Giza, as well as building warships (Randa 1990: 172-4). He also had the Alexandria canal cleaned and repaired, building new cisterns there and in Tinnīs (Butler 1978: 460).

Tulunid rule ended in 905, when the country was taken by naval and land forces loyal to the Caliph, and Egypt returned to provincial status (Brockelmann 1939: 140). From 935 the Abbasids ruled through the Turkish Ikhshidids, until 969 when failure of the Nile flood and famine prompted rebellion and the assassination of Kafūr, the final Ikhshidid ruler (Spuler 1960: 71; Lewis 1974: 46; Lev 1991: 14).

The Fatimids

A major shift in power followed that placed Egypt at the centre of one of the major empires of Islamic history. With the death of Kāfūr, the Shiite Fatimid dynasty, which claimed legitimacy by descent from the Prophet's daughter Fāṭimah, moved on Egypt from its base in north Africa, founding Cairo as its imperial capital in 969. Fatimid control

subsequently extended to western Arabia and the Levant, their culturally and economically glittering rule lasting for two centuries. Their economic power was based on the fertility of the Nile valley, the flourishing of industry and artisanship in Egypt's cities, and trade in the eastern Mediterranean basin and across the Red Sea (Hourani 1991: 41). Moreover, following the establishment of Cairo as the Fatimid capital, east-west maritime trade shifted from the Arabian Gulf to the Red Sea, putting first al-Qulzum, and later 'Aydhāb and the Nile valley, on a major highway of international trade serving the new capital (Bagot Glubb 1963: 323; Chaudhuri 1985: 37).

Trade across the Mediterranean had diminished during the 'Abbasid period. In the tenth century this began to change, especially following the reconquest of Sicily in 950 by the Aghlabids of Tunisia. However the period also saw an increase in Byzantine naval activity, perhaps encouraged by the increasing disunity of the Muslim Middle East.

Fatimid rule was fundamentally weakened internally by famine and political strife during the 11th century. Externally, it faced the arrival on the scene of two new forces, the Seljuk Turks, former mercenaries of the Abbasids, who had dealt the Byzantine army a major defeat in 1071, and the Crusaders, who were initially the western Christian response to the Seljuk expansion. Egypt had already begun to feel the force of western Christendom, having suffered a number of piratical raids by Sicilian Normans against its coastal towns in the mid-eleventh century (Ehrenkreutz 1955: 102). Now it also attracted the attention of the Crusaders, who attacked the Delta city of al-Faramā in 1118 and 1150. The Crusader seizure of Aylah in 1116 closed the pilgrimage route to Arabia, giving new importance to the Red Sea port of 'Aydhāb. By the time the king of Jerusalem Almaric I made an attempt on Cairo in 1168-9, the Fatimid dynasty was close to collapse.

The Ayyubids

The increasing dependence on the Fatimid Caliphate on mercenaries in the Turkish mould led the Caliph al-'Adīd appointing Ṣalāh al-Dīn al-Ayyūbī (Saladin) as *wazīr* (vizier). By 1171, Ṣalāh al-Dīn felt strong enough to abolish the Fatimid Caliphate, and return Egypt to the Sunni fold (Cahen 1960). While his predecessors had laid claim to the title of Caliph – successor to the Prophet – Ṣalāh al-Dīn and his successors laid no claim to the caliphate, but instead styled themselves as Ṣulṭān – holder of power.

With the death of the Seljuk ruler Nūr al-Dīn in 1174, Ṣalāh al-Dīn extended his rule to Syria also. Despite the ideological differences with his Fatimid predecessors, Ṣalāh al-Dīn restored Egypt to something like the heyday of Fatimid rule. Territorially, their domains were similar, and despite the increasing conflict with the Crusaders, Ṣalāh al-Dīn succeeded in renewing and building commercial connections with Pisans, Genoese and

Venetians, who following the Third Crusade flocked once again to Alexandria (Cahen 1960: 798). Red Sea trade continued, first through 'Aydhāb, and later through al-Quṣayr (Quseir al-Qadim).

The period was dominated by episodic confrontation with the Crusaders, however. Egypt, now seen as the political centre of the Islamic Middle East, became the target of the Fifth Crusade, with both Dumyāṭ and Tinnīs falling in the siege of 1218-19. The Crusade of King Louis in 1249, which proved to be the final act of the Ayyubid dynasty, once again saw the fall of Dumyāṭ. The Ayyubids did not survive to see the outcome of the siege. The final Sultan, al-Kāmil, died before it was over.

The Mamluks

Rule of Egypt passed briefly from al-Kāmil to his wife, Shajar al-Durr. On her murder, the first Mamluk ruler of Egypt, Aybak, assumed effective power. The Mamluk dynasty ruled Egypt until the Ottoman Turkish conquest of 1517. Essentially, it was "a self-perpetuating military élite" (Hourani 1991: 213), in which largely Turkic slave-soldiers were brought in by the existing Mamluk oligarchy and trained in turn as its new members on a quasi-meritocratic basis (Irwin 1986: Introduction). It was under the fourth Mamluk ruler al-Malik al-Ḍhāhir Baybars (1260-77) and his son that the major Levantine Crusader states and the invading Mongols were vanquished, and the eastern Ḥijāz conquered, establishing Mamluk-Egyptian military hegemony over much of the Red Sea, and heralding new era of Middle Eastern stability and economic prosperity that fostered the development of new trading links across and around the Mediterranean. Under the third reign of al-Nāṣir Muḥammad (1293-4, 1299-1309, 1310-41), a major cadastral survey of Egypt and assessment of its irrigation works took place, as a result of which al-Nāṣir's owership of land rose from 16% of the total to 42%, greatly increasing his power and income at the expense of other Mamluk amirs. He also commissioned major irrigational works, including a new excavation of the canal serving Alexandria, irrigation of the lands around Giza, and a new canal to the west of Cairo that allowed the reclamation of marshland on the east bank of the Nile, and the establishment of Būlāq, rather than al-Fusṭāṭ, as the port of Cairo. These developments facilitated a substantial growth of trade with the Italian city-states (Irwin 1986: 105-21). As a result, Mamluk Egypt became a major and prosperous power centre throughout out the 14th and 15th centuries.

This narrative summary of the major geopolitical and economic developments influencing Egypt in the early centuries of Islam relevant to the Nile riverscape, and which will be referred in this thesis. Summary maps of Egypt's geopolitical situation are presented in Figure 2.1.

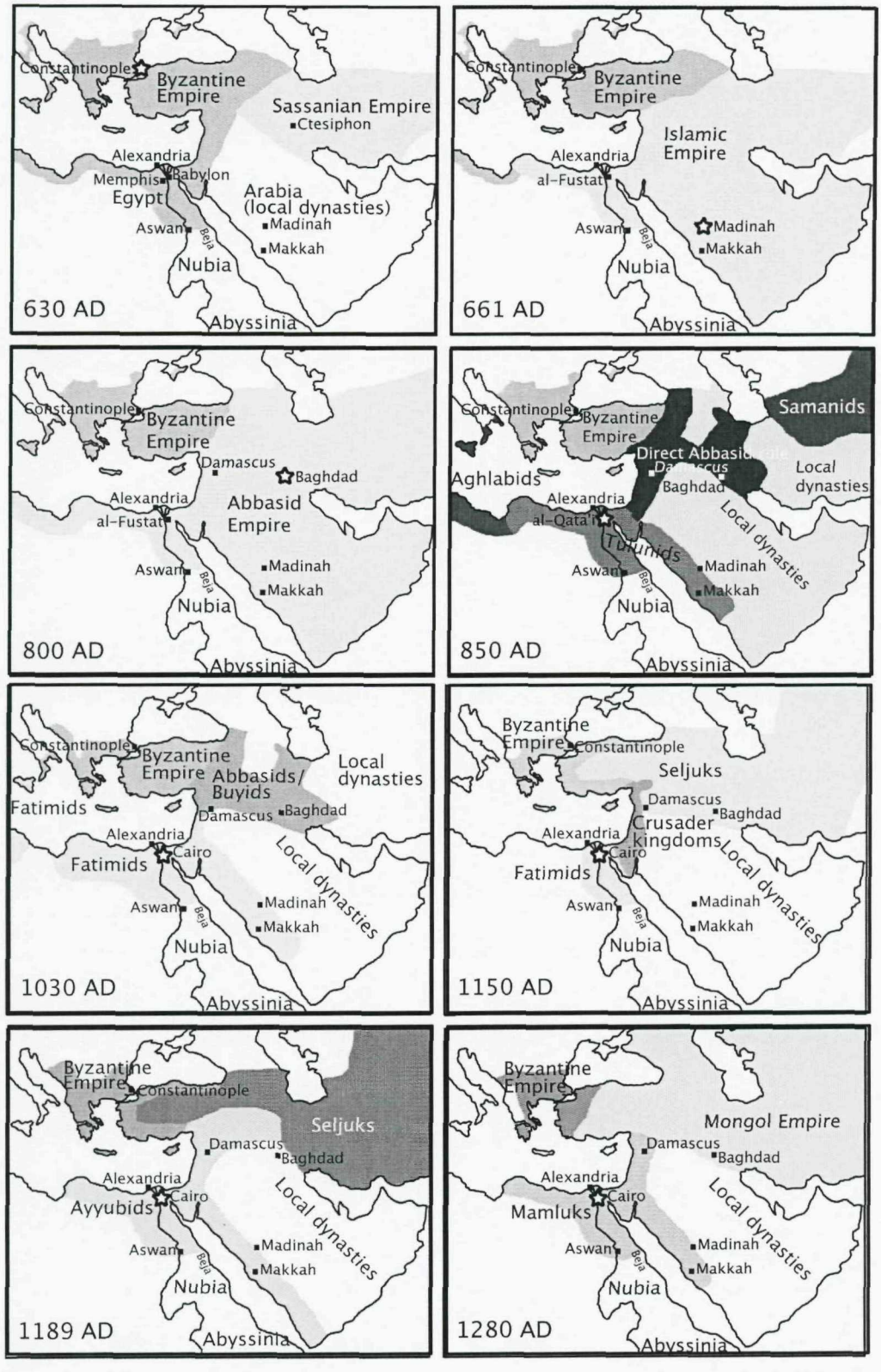

Figure 2.1: Egypt's geopolitical situation from the eve of the Islamic conquest to the Mamuk era.

3 The Waterways of the Nile

This section seeks to identify the major waterways of the medieval Egyptian Nile – including natural branches, canals, and lakes – and to locate them in the contemporary landscape. It also seeks to establish a chronology for the existence of these waterways, given the highly dynamic nature of the Nile fluvial system – particularly in the Delta region – and the creation and abandonment of major canals in response to changing natural and political-economic circumstances. The analysis draws upon historical sources, as well as cartographic, geomorphological and archaeological data. The section is to be read in conjunction with the historical maps included in Appendix 1, and with the maps of Appendix 2, which seek to locate in the modern landscape the waterways discussed. Appendix 2 also presents of a series of time-lapse maps reflecting the changing shape of the riverscape in the early centuries of Islam, based on the interpretation presented in this section. Maps summarising the modern place names and waterways discussed in the text are presented in Appendix 2, Figures 1-3, and should be read in conjunction with it.

3.1 Introduction

> "There is great difficulty in ſettling the antient branches of the Nile, after its diviſion into ſeven parts, when it runs through that part of Egypt which was called Delta, by reaſon that many of them have been fill'd up for want of being clean'd; and the maps that have been made of thoſe parts are not intirely (*sic.*) to be depended upon." (Pococke, *Description*: 1.15-6)

It is almost a tautology to observe that the Nile river system constituted the major medium of long and medium-distance movement and bulk transport in Egypt before the modern era. In enabling the agriculture by which Egyptians could live in an otherwise desert landscape, the river itself was the principle determinant of patterns of human settlement. Few Egyptians lived far from a watercourse. It was by default, therefore, that the Nile also constituted the optimal medium for the transport of people and goods. Even setting aside the ease and economy of water transport relative to land transport by pack animal, the river system had the singular advantage of dictating many of the destinations of human travel: where it went, the people were – whether in the agriculturally productive countryside or in the urban consumption centres. Its utility was therefore inherent.

To understand the navigated riverscape of medieval Egypt, one must, therefore, understand the physical network of waterways it comprised, and the chronology of significant changes to it. The waterway network was subject to highly dynamic geological

processes – tectonic, sedimentological and eustatic – which created and erased waterways over time, particularly in the Delta. Overlaying and interacting with these processes was human activity. Human-excavated canals extended the navigational and agricultural reach of the Nile's natural channels. Alexandria and, for a time, al-Qulzum on the Red Sea were connected to the river network by canal. On a broader scale, and more commonly for reasons of irrigation and drainage, this human activity increasingly influenced the fluvial dynamics of the Nile basin, particularly in the Delta, where increasing canalisation contributed to the ultimate diminution of the number of major Delta distributaries to just two – the modern Dumyāṭ (Damietta) and Rashīd (Rosetta) branches – by the early second millennium (Butzer 1976; Said 1993: 1.576; Summerhayes et al. 1978).

The early centuries of Islam witnessed some significant changes to the shape of Egypt's waterway network. Of the natural Delta branches, the Canopic and Pelusiac branches disappeared entirely, giving new importance to those leading to Tinnīs, Dumyāṭ and Rashīd. Geological investigation of the Delta has yielded valuable information on the nature and timing of these changes. When supplemented with archaeological and historical data from the period, a relatively high-resolution chronology for the main waterways of the Nile begins to emerge.

3.2 The pre-Islamic Nile

It is not until the tenth century that an Islamic-era author – Ibn Ḥawqal – provides a description of the Nile that is sufficiently detailed for it to be interpreted onto the contemporary landscape of Egypt with any precision. The earlier texts of al-Khawārizmī and *Suhrāb* (*see his heading under Section 3.3 below*) are sparse and problematic. To understand the layout of the waterways of Islamic Egypt during the first three centuries of Islam, it is therefore necessary to look to pre-Islamic historical sources. The exercise is particularly important in charting the emergence of the Dumyāṭ and Rashīd branches, which came to dominate the Nile Delta, but also to understand the chronology of some of the lesser distributaries of these major branches.

Three problems present themselves in examining the pre-Islamic sources. The first is the lack of route data in the texts that can be charted on the modern landscape. While some later Islamic authors chart Nile channels by naming the towns along their banks – singularly useful in reconstructing river courses –pre-Islamic texts offer very little data linking the Nile distributaries they name to known loci. Even the most detailed, Ptolemy Claudius, is problematic. He locates Delta bifurcations and river mouths by his relatively inaccurate latitude and longitude measures (Ball 1942: 119; Stevenson 1932: xiii-xiv; Toussoun 1925: 2.181). The Delta towns he locates are described as falling between,

rather than on, distributaries, leaving great scope for interpreting his intended river courses.

The second problem is an apparent tendency among the ancient authors to homogenise their interpretations of the Nile to reflect earlier authors (Du Bois-Aymé 1813: 277). As a result, the works of Pseudo-Scylax, Diodorus, Strabo, Pomponius Mela and Pliny in particular give a highly synoptic account of the classical Nile (Appendix 1, Figures. 2-6). For example, Pliny's description of the Nile (*Naturalis Historia*: V.viii-xii) clearly owes much to Diodorus Siculus, and even though he says the Nile has twelve mouths plus four 'false' ones, he ventures to name only the seven 'main' ones outlined by earlier authors. Meanwhile Strabo, who like Pliny admits to there being more Nile mouths than the seven he names (*Geographica*: XVII.1.17-18), seeks to associate his Tanitic mouth with the 'Saitic' mouth of Herodotus, even though the eponymous city of Saïs is in the western Delta, while Tanis is in the east (see Appendix 1, Figures. 1, 4). Finally, although Ptolemy Claudius subsequently presents a nomenclature of branches that is radically different from that of his predecessors, he nevertheless gives names to the mouths of his branches that reflect those earlier usages (see Appendix 1, Figure. 7).

The final problem is the lack of any substantial description of the river layout surviving from late antiquity. Apart from a cursory listing of the main Nile mouths by George of Cyprus at the start of the seventh century (*Description*: 172) (see Appendix 1, Figure. 10), no comprehensive pre-Islamic Nile geography survives from after Ptolemy Claudius.

Attempts to project this sparse pre-Islamic historical dataset onto the contemporary Delta landscape have been made by a number of 19th- 20th-century scholars, most notably Du Bois Aymé (1813), Toussoun (1925), and Ball (1942). Ball, for his part, owns that "even when all the information that can be gathered from them is duly weighed and considered ... there is still room for differences of opinion". Despite his warning, however, the extrapolations made by these authors – those of Toussoun in particular – have acquired canonical status. Toussoun's interpretations of the Delta descriptions of Herodotus and Strabo – as well as of some Islamic-era authors – continue to be followed (Said 1981: 82-83 (apart from his interpretation of the Saitic branch); Stanley et al. 2004b). Moreover, maps asserting correlations between the Nile *mouths* named by the ancient texts and the entire course of present-day branches continue to be made on the basis of the conjectures of these scholars. Thus, for example, the Bolbitic and Phatmitic *mouths* of, among others, Strabo (*Geographica* XVII.1.17-18) and Pliny (*Historia*: V.xi), are routinely associated with the modern Rashīd and Dumyāṭ *branches* respectively (Arbouille and Stanley 1991: 58; Ball 1942: 27-28; Du Bois-Aymé 1813: 278; Said 1981: 82; Stanley et al. 2004b: 924; Toussoun 1925: 1.158, 184). However, it should be born in mind that, while these

associations may indeed represent best-fit hypotheses, they are based on little more than the place-order of these mouths in the list of Nile mouths provided by these authors. Since this thesis seeks to establish the layout of the main Delta waterways since the dawn of Islam, a re-examination of the pre-Islamic historical dataset is required.

The data

Figures 1-7 and 10 in Appendix 1 show schematic representations of the Delta-related data presented in eight pre-Islamic works – Herodotus (484-425 BC; *Historia*: chiefly II.17), Pseudo-Scylax (after 350 BC; *Periplus*: 1.25v), Diodorus Siculus (f. 59 BC; *Bibliotheca*: chiefly I.33), Strabo (c.63 BC-c.24 AD; *Geographica*: chiefly XVII.1.16-22), Pomponius Mela (f. 40-1 AD; *Chorographia*: 49, 52) Pliny (c.23-79 AD; *Historia*: particularly V.xi), Ptolemy Claudius (90-c.168 AD; *Geographia*: 100-4) and George of Cyprus (f.c. 606 AD; *Description*: 172). The schematics use a graphic idiom inspired by Beck's London Underground map (Garland 1994) as a means of capturing what information the ancient authors do and, equally importantly, do not provide. Just as Beck's map separates the information required to navigate the London Underground system from the actual geography of the city above, so too these diagrams seek to isolate the actual data that the historical sources provide from subsequent scholarly interpretations of these data. Even so, the placement of the vast majority of the *towns* on these diagrams relative to the Nile is based on modern scholarship locating these sites, rather than data provided by the ancient author in question: thus, the primary dataset is poorer even than these diagrams suggest. Table 3.1, meanwhile, compares and summarises the branch nomenclature used by the various pre-Islamic authors.

From Herodotus to Pliny

The authors writing before Ptolemy Claudius present a broadly consensual view of a seven-mouthed Nile delta, albeit with the admission by Pliny and Strabo already noted, that other smaller mouths also existed. The consensus among these authors is that the mouths were named the Canopic, Bolbitine/Bolbitic, Sebennytic, Phatnitic/Pathmetic, Mendesian, Tanitic and Pelusiac branches (see Table 3.1). The listed sequence is only *implicitly* west-to-east. There is some variance. For example, Herodotus does not place his Bolbitic and Bucolic mouths in sequence, and indeed does not locate them at all. Modern scholars infer, only from mention of the Bolbitic branch by other authors, that it came second (Ball 1942: 24; Said 1981: 82, 84; Stanley et al. 2004b: 924; Toussoun 1925: 1.158). Likewise, since Herodotus does not name a Phatnitic branch, modern scholars, arbitrarily, associate his Bucolic mouth with it, since other authors name the former, but not the latter (Arbouille and Stanley 1991: 58; Ball 1942: 27-28; Du Bois-Aymé 1813:

278; Said 1981: 82, 84; Stanley et al. 2004a; Toussoun 1925: 1.184). In fact, the association of the Bolbitic mouth with the modern Rashīd branch, and the Phatnitic with the Dumyāṭ, is based entirely on their relative position in the sequences of mouths listed by these authors. However, a precise association of the Phatnitic mouth with the modern Dumyāṭ branch is improbable: El Gamili *et al* (2001) have identified a paleochannel running to the west of and roughly parallel to the modern Dumyāṭ branch in the Samannūd area which they associate with the ancient Bucolic branch. This hints at a more complex situation than a simple association between ancient mouth-names and modern branches would allow.

Herodotus 484-425 BC	**Scylax** >350BC	**Diodorus Siculus** 59 BC	**Strabo** c.63 BC – c.24	**Pomponius Mela** 40-41	**Pliny** c.23-79	**Ptolemy Claudius** 90 -c.168		**George of Cyprus** c. 606
Mouths	*Mouths*	*Mouths*	*Mouths*	*Mouths*	*Mouths*	*Mouths*	*Associated Rivers*	*Mouths*
-	-	-	-	-	-	-	-	Alexandria
Canopic	Canopic	Canopic/ Heracleotic	Canopic	Canopic	Canopic/ Necrotic/ Heracleotic	Canopic/ Heracleotic	Agathodaemon	Colynthin
Bolbitine*	Bolbitine	Bolbitine	Bolbitine	Bolbitic	Bolbitine	Bolbitine	Taly	Agnu
Sebennytic	Sebennytic	Sebennytic	Sebennytic	Sebennytic	Sebennytic	Sebennytic	Thermutiac	Of Paralos
-	-	-	-	-	-	Pineptimi 'false'	Athribitic	Chasmatos
-	-	-	-	-	-	-	-	Tamiathê
-	-	-	-	-	-	Diolcus 'false'	None	-
Bucolic*	-	-	-	-	-	-	-	-
-	Phatnitic	Phatnitic	Phatnitic	Pathmetic	Pathmitic	Pathmitic	Busiricriver	-
Mendesian	Mendesian	Mendesian	Mendesian	Mendesian	Mendesian	Mendesian	-	-
Saitic	Tanitic	Tanitic	Tanitic/ Saïtic	-	Tanitic	Tanitic	-	-
-	-	-	-	Cataptystic	-	-	-	-
-	-	-	-	-	-	-	-	Tenesê
Pelusiac	Pelusiac	Pelusiac	Pelusiac	Pelusiac	Pelusiac	Pelusiac	Bubastic	-

*Herodotus does not place this branch in west-east order.

Table 3.1: The nomenclature of Nile branches provided by eight pre-Islamic authors.

There is also some difference in the ancient authors' accounts of the sixth mouth, which most call the Tanitic. Since Strabo (*Geographica*: XVII.1.20) says that the Tanitic mouth is also known as the Saitic, the Saitic mouth of Herodotus is frequently identified as the same entity (For example, Ball 1942: 29-30; Stanley et al. 2004b: 924; Toussoun 1925: 1.190). This may or may not be correct. Herodotus says that his Saitic branch was a distributary of the Sebennytic, but he does not say whether it branched east or west. In fact, the eponymous town of Saïs is in the western Delta, while Tanis is in its east (Appendix 2, Figs 4-5). Herodotus might equally be describing a westward-branching distributary that was defunct by the time of later authors. Recent geological studies of the west-central delta have indeed identified candidate paleo-channels for a west-branching Saitic branch

(Arbouille and Stanley 1991; Said 1981: 82; Wunderlich 1988). Strabo may have been trying here to reconcile the difference between Herodotus and later authors by associating the two. If that association is false, then it appears that Herodotus was not aware of the branch later called Tanitic, and that his Saitic branch was likewise unknown to later authors. Pomponius Mela (*Chorographia*: 52) is unique in calling the sixth Nile mouth the Catapystic. Meanwhile, since it lies between the Mendesian and Pelusiac branches, Ball (1942: 71) associates it with the Tanitic.

The authors so far discussed provide overwhelmingly relativistic descriptions of the Nile Delta, as they saw it, between the fifth century BC and the first. The absolute data they provide –identifiable toponyms in reference to which their Nile channels are described – are extremely limited. Apart from their (only implicit) west-east order, it is reasonable to assume that the names given to the mouths imply that the associated branches passed close to their eponymous towns – Canopus, Saïs, Sebennytus, Mendes, Tanis, and Pelusium. Beyond that, Herodotus offers that Naucratis was on the Canopic branch (*Historia*: II.178-80), Buto on the Sebennytic (II.155), and Patumus on the Pelusiac (II.158). Strabo, meanwhile, places Schedia on the Canopic branch (XVII.1.16,22). These, are, however, the sum indications of the actual routes of the Nile waterways of antiquity. The ancient authors do *name* other Delta towns, many of which names have by now been associated with archaeological sites (See, for example, Ball 1942: 104-116). Howevever, they rarely place these towns with reference to the Nile branches. Moreover the etymologies of the Bolbitic, Bucolic, and Phatmitic names give little further clue to their routes. In sum, the geography of the Nile distributaries of the period before the first century can be sketched out only in the loosest terms.

Ptolemy Claudius

A substantial improvement in the resolution of Nile descriptions comes about with Ptolemy Claudius in the second century. However, far from embellishing the descriptions of earlier authors, he presents a radically different configuration of Nile branches with unfamiliar branch names for the Nile Delta (see Appendix 1, Figure 7). It is perhaps with a desire to reconcile his account with those of his predecessors, that he allocates named mouths to his (differently named) Nile branches, the names of which are mostly familiar from earlier authors. The cartographic interpretations of Ptolemy by Toussoun (1925: pl. IX) and Ball (1942: 120) are reconstructed, to the extent that this is possible given their small-scale maps and descriptions, in Appendix 2, Figs. 4-5.

The fringing branches of Ptolemy's Delta – the Agathodaemon and Bubastic rivers to the west and east respectively – are probably associable with the Canopic and Pelusiac

branches of the Ptolemy's predecessors. That interpretation is supported by their Delta-littoral locations, the naming of their mouths, and the towns that fall on an around them.

Moving east from the Agathodaemon River, one comes in Ptolemy's account to the Taly River. Because Ptolemy says its mouth is the 'Bolbitic', and because his next mouth to the east is the Sebennytic, it is customary to correlate the Taly River, entirely or in part, with the Bolbitic branch of earlier authors, and hence to regard it as the modern Rashīd branch (Ball 1942: 126; Stanley et al. 2004b: 924; Toussoun 1925: 1.190; van Wesmael 1988: 224). However, Ptolemy offers a problematic datum for that view. According to him, the former separates from the Agathodaemon (his Canopic) branch at 61°00'E, 30°50'N – also the location he gives for Hermopolis Parva, modern Damanhūr (*Geographia*: 102; Appendix 1, Figure 7, Appendix 2, Figures 4-5). However, a branch that separates from the Canopic branch at Damanhūr is substantially different from the modern Rashīd branch, which instead takes its leave from what was once the Canopic bed some 45km further upstream, at Zāwiyat al-Baḥr (Ball 1942: 27; Toussoun 1925: 1.162)(see Appendix 2, Figure 1). It may be that Ptolemy's astronomical location of the bifurcation of the Taly and Canopic Rivers is wrong, due to his or a copyists error. However, the fact that he gives the same co-ordinates for both it and Hermopolis Parva suggests he intended to place the two together. No earlier author identifies or locates a bifurcation of the Bolbitic branch from the Canopic, making this the only datum concerning a waterway that so many modern scholars have identified as being the modern Rashīd branch already in place in antiquity. Yet that datum suggests the Rashīd branch was not yet in place.

Next, Ptolemy describes two central Delta distributaries that are almost entirely unfamiliar from earlier works: the Thermutiac and Athribitic Rivers. From Ptolemy's account, the former, though he says it debouches through the 'Sebennytic mouth' is unlikely have flowed past the city of Sebennytus. The towns he places to its east and west suggest that its course lay some way to the west of that city (see Appendix 1, Figure 7; Appendix 2, Figures 4-5). The implication of the branch's name is that it took leave of its parent branch, the Agathodaemon River, at Terenuthis, modern Kūm Abū Billū (Appendix 2, Figure 1). Herodotus and Pseudo-Scylax, in contrast have the Sebennytic branch rising at the apex of the Delta. No other author before Ptolemy locates its connection. At the same time, the towns that Ptolemy places to the west of the Thermutiac branch – Saïs, Casaba and Butus – demonstrate that, equally, neither does it correlate to the medieval/modern Rashīd branch, since these towns are to the east of the latter. Thus, while the course of the modern Rashīd branch can be recognised in Ibn Ḥawqal's tenth century cartography, the branch's earlier origins are, as far as the historical texts go, obscure. It

correlates neither to Ptolemy's Taly nor his Theremutiac River (Appendix 2, Figures 4-5).

Something like the alluvial cone of the Rashīd mouth is suggested in the c. fourth century Peutinger Map, which depicts a promontory on the eastern edge of what must be Abū Qīr Bay (Appendix 1, Figure 8) that also echoes Strabo's Agnu Ceras promontory (*Geographia* XVII.I.18), but the branch's course through the Delta cannot be confirmed as the Rashīd branch.

Ptolemy's Athribitic River further diverges from the Delta descriptions of his predecessors. Ptolemy has this waterway separating from his Bubastic River (the Pelusiac branch) of the Nile close to the Delta apex, and passing through Athribis (near modern Banha) before entering the sea through the unfamiliar "Pineptimi false mouth". The river has the towns of Tava, Xois and Pachnamunis to its west, and Busiris, Sebennytus, Leontopolis, Onuphis and Thmuis to its east (see Appendix 1, Figure 7; Appendix 2, Figures 4-5).

Since the Athribitic River rises close to the Delta apex and passes through Athribis, its course through the upper Delta has been interpreted as occupying some of the bed of the modern Dumyāṭ branch (Ball 1942: 126; Toussoun 1925: 157), albeit with its bifurcation occurring from the Pelusiac branch rather than the modern Rashīd branch, as the Dumyāṭ branch does today[1]. However, Ptolemy's placing of Busiris and Sebennytus, now on the west bank of the Dumyāṭ branch, to the *east* of the Athrbitic River suggests that, at some point after Athribus, the Athribitic River adopts a more westerly course than the medieval/modern Dumyāṭ branch (Appendix 2, Figure 4, 5).

Ptolemy's fifth branch to enter the sea is the Busiritic River, which he says separates from the Bubastic River and enters the sea through the Phatnetic mouth, the latter name begging an association with the eponymous mouth of his predecessors. Ptolemy places Parabaethus, Tanis and Panephysis to its east, and Sebennytus, Leontopolis, Onuphis, and Thmuis to its west. When the trajectory implied by these towns' locations is traced on the map, the branch is seen to cross a section of the eastern Delta traditionally associated with the Mendesian and Tanitic branches of earlier authors (see Appendix 2, Figures 4, 5). Ptolemy places 'mouths' bearing these latter two names between his Phatmitic and Pelusiac mouths, but he associates no waterways with them: these may be inlets into the lagoon that later became Lake Tinnīs/Manzalah.

[1] The Rashīd branch occupies the ancient Canopic bed at that point, and for its upper course as far as Zāwiyat al-Baḥr.

Because of its general location in the eastern Delta, the Busiritic River has been depicted as simply Ptolemy's nomenclature for the older Tanitic branch (Coutellier and Stanley 1987: 269). However, the towns that Ptolemy places to the east and west of the Busiritic branch suggest a trajectory that does not pass close to Tanis (see Appendix 1, Figure 7). Moreover, Strabo has the Tanitic branch rising from the Phatnetic branch (Appendix 1, Figure 4) – not the Pelusiac, as Ptolemy's Busiritic branch does.

The routes Ptolemy describes for his Athribitic and Busiritic branches have implications for the chronology of the Dumyāṭ branch, which latter is discernable from no historical texts earlier than Ibn Ḥawqal. It has become customary to interpret the modern Dumyāṭ branch as correlating, between the Delta apex and Samannūd, to the Sebennytic branch of Herodotus, and the Phatnetic of Strabo. Downstream of Samannūd, the customary correlation is to the Phatnetic branch of Ptolemy's predecessors (Ball 1942: 26; Du Bois-Aymé 1813: 279; Said 1981: 82; Stanley et al. 2004b: 924; Toussoun 1925: 1.189). The implication is that the branch has existed, more-or-less along its modern route, since at least the time of Herodotus, albeit bearing different names.

The data from the ancient authors discussed above and outlined in Appendix 1, Figures 1-10, show that they give no such confirmation. Moreover, even Ptolemy, writing later and in greater detail that his forbears, *still* gives no suggestion of a branch following the modern Dumyāṭ bed. Ptolemy's Athribitic River separates from the Pelusiac branch, not the Rashid/Canopic branch as the modern Dumyāṭ bed does. It is conceivable, as Toussoun (1925: 1.157) and Ball (1942: 58, 126) have proposed, that soon after its rise, the Athribitic River joined and followed the modern Dumyāṭ bed as far as Athribus/Binhā, but that is conjecture. In any case, its course thereafter runs too far to the west to occupy the Dumyāṭ bed. Ptolemy's Busiritic River also separates from the Pelusiac branch and this time flows too far to the east, at least as far as Onouphis, to be identified with the modern Dumyāṭ branch. It may be, as Toussoun (1925: 1.159) and Ball (1942: 127) propose, that after Onouphis the Busiritic River followed the modern Dumyāṭ bed to the sea. But again, this is conjecture.

Finally, Ptolemy names a further channel, the Buticus River, which he has passing laterally across the Delta, connecting all his sea-bound branches (Appendix 1, Figure 7; Appendix 2, Figures 4-5). Apart from locating this branch as being close and parallel to the coast, he give not further detail. A similar lateral waterway is described by Ibn Ḥawqal, and is discussed below.

George of Cyprus

It is only in the dying decades of pre-Islamic Egypt that Tamiathe (Dumyāṭ) is finally associated with a Delta distributary, being one of the seven Delta mouths named by George of Cyprus at the start of the seventh century. George provides a simple list, implicity ordered west-east, of the names of seven Nile mouths (see Appendix 1, Figure 10). He gives no geographical description of them or of the distributaries that emptied through them. Murray (1942: 176) makes the following associations:

George's mouth name	Branch with which associated
Alexandria	Schedia canal
Colynthin	Canopic
Agnu	Rashīd
Parollos	Burullus
Chasmatos	Pineptimi false mouth
Tamiathe	Dumyāṭ
Tenesê	Tinnīs

If Murray's association of Colynthin with Canopic is correct, (again, the basis is only its west-east placing) then George is the final author to note a contemporary Canopic mouth. What is also striking is the emergence, for the first time, of the notion of an 'Alexandria branch', a term that was to become a staple of later Islamic-era authors (for example, Ibn 'Abd al-Ḥakam, *Futūḥ*; 6; Ibn Ḥawqal, *Ṣūrat*: 134; al-Muqaddasī, *Aḥsan*: 20). The data from these later authors, discussed below, suggest that this branch was simply a re-conceptualisation of the aquatic route between the Delta apex and Alexandria comprising the erstwhile Canopic riverbed as far as Schedia, and thereafter the Schedia canal to Alexandria (Bergmann and Heinzelmann 2003, 2004; Toussoun 1925: 1.198). In short, branch and canal became conflated in people's perceptions into the same waterway, the *Khalīj al-Iskandariyyah*, or Alexandria channel.

Murray's association of the Agnu mouth with the Rashīd branch reflects Strabo's account that places the "Agnu Ceras" promontory close to the Bolbitic mouth (*Geographica*: XVII.1.18), but is otherwise based simply on its west-east sequencing.

In the central Delta, George names two Nile mouths, the Parallos and Chasmatos, lying between the Agnu (Rashīd) and Tamiathe (Dumyāṭ) mouths. In the former, the precursor to the Arabic toponym Burullus, the large lake on the coastal Delta plain, can be seen. These mouths may be the vestiges of Ptolemy's Thermutiac and Athribitic Rivers, with their Sebennytic and Pineptimi mouths. They equally be inlets into Lake Burullus. In any case, no later authors describe major Nile branches entering the sea between the Rashīd and

Dumyāṭ branches.

In the eastern Delta, the mouths George names accord with the Delta as conceived by later Islamic authors. For the first time, there is a Tamiathe mouth, referring to the eponymous Dumyāṭ. To its east is a Tenese branch, named after Tinnīs, the island city in modern Lake Manzalah that became a prominent port in the medieval period (see Section 5). Significantly, George makes no mention of the Pelusiac branch, although its vestiges probably survived into the Islamic period (see below), and appear to be shown on the fourth century Peutinger Map, where the easternmost branch is seen going to Peluisum (See Appendix 1, Figure 8). Its mouth is also mentioned in the fifth century work of Martianus Capella (*De Nuptiis*: 2.2.284r). Thereafter, however, it disappears from the historical record.

Discussion of the pre-Islamic data

The above is a summary of the pre-Islamic historical data informing any attempt to reconstruct the waterways of the Nile Delta before and on the eve of the Arab conquest. The shortcomings of this data are by now apparent. For all authors before Ptolemy Claudius, the data is extremely vague and lacking in loci that can be referenced unambiguously in the contemporary landscape. In the case of Ptolemy, the data is of higher resolution, but the trajectories of the main branches can still only be traced in broad terms.

Notwithstanding the shortcomings of the historical data, scholarly attempts to reconstruct the geography of the main pre-Islamic Nile waterways on the basis of this data have been attempted. Already mentioned are those of Du Bois Aymé, Toussoun, and Ball. In the case of the latter two scholars, the reconstructions have also drawn upon contour data and visible evidence of raised levies, which they take as relict evidence of ancient watercourses, and therefore as candidates for the branches named by the ancient authors (Ball 1942: 23; Toussoun 1925: 1.152-153).

It should be by now apparent from the above discussion, however, that the pre-Islamic historical sources provide limited data on which such reconstructions can be built, and that a series of assumptions and conjectures must be made in transferring their sparse data onto the contemporary landscape. These include:

- That the historical sources are, in their received form, accurate in their representations of the contemporary Nile they represent.
- That scholarly associations between modern sites and settlements named in the historical sources are correct, given that they form the basis for identifications

between historical and present-day waterways.

- That the ancient waterways and the present-day channels to which they are interpreted as correlating follow a sufficiently similar course for the two to be meaningfully identified with each other – in the sense that predictions might be made about past navigational activity on the route, and archaeological sites be predicted along it.

Of these, the first is circular, the second is a reasonable working assumption, and the third is a required outcome if the exercise of waterway/landscape reconstruction is to be useful to the archaeologist. This third requirement is compromised, or at least caveated, by three developments since the publication of Toussoun's and Ball's works. These are:

- That the modern waterways identified by them as correlating to the waterways described by Ptolemy and other ancient authors have changed substantially even since these scholars described them in the early-to-mid 20th century. To a greater or lesser extent, they have been straighted, and their meanders reduced.
- That the very small scale of the maps published by Toussoun and Ball are inadequate to the task of plotting even their own reconstructions accurately in the modern Delta landscape with any degree of archaeologically meaningful accuracy, except where these reconstructed routes follow named waterways identifiable from larger contemporary maps (such as the 1:100,000 Survey of Egypt maps of 1917).
- That sub-surface geophysical investigations of sectors of the Delta in recent decades have revealed a more complex picture of paleochannel distribution than can be captured simply by associating contemporary waterways with those named by ancient authors, as Ball and Toussoun have done. See for example, work on the lower Canopic channels (Stanley and Jorstad 2006b; Stanley et al. 2004b; Warne and Stanley 1993), paleochannels in the Samannūd area (El Gamili et al. 2001), defunct Delta lobes in the eastern Delta region (Coutellier and Stanley 1987), and the lower Pelusiac branch (Sneh and Weissbrod 1973).

The first, and to an extent the second, of these problems can be rectified by making reference to contemporary maps depicting the Delta as Toussoun and Ball knew it, in particular the 1917 Survey of Egypt maps. The second is insurmountable, except by new and painstaking ground-truthing – and that in a Delta very much changed since the early 20th century. The third is a caution underlining the limitations of seeking to reconstruct the ancient riverscape from surface morphology alone.

Geomorphological evidence

Toussoun and Ball's cartographic interpretations of Ptolemy, shown in Appendix 2, Figures 4 and 5 respectively, stand as two hypotheses of the layout of the main waterways of the Nile in the second century. A consideration of the geomorphological evidence allows some refinement, and some confirmation, of aspects of their interpretations.

Geomorphological investigations in the northwest Delta area have refined our understanding of the lower reaches of the Canopic branch north of the modern Maḥmūdiyyah Canal (Stanley et al. 2004a; Stanley et al. 2001; Stanley and Jorstad 2006b). The paleo-channels identified by those studies as forming the late Canopic branch are used in this thesis in preference to the routes proposed by Toussoun and Ball (See Appendix 2, Figure 2, for location of the Maḥmūdiyyah Canal, and Figures 12-19 for the reconstructed route of the Canopic branch). Meanwhile, investigation of the area east of the Suez Canal by Sneh and Weissbrod (1973) identified defunct Nile paleo-channels that they associate with the ancient Pelusiac branch. These are incorporated into the final representation of the branch in this thesis (Appendix 2, Figures 12-19).

Geological investigation by Coutellier and Stanley (1987) into the delta fans produced by distributaries of the Nile in the northeastern Delta lend weight to view that the Dumyāṭ mouth – though not necessarily the route of the entire modern branch – was in place by around 500, i.e. before the Islamic conquest. Arbouille and Stanley (1991: 59), meanwhile, are of the opinion that the Rashīd branch was 'already important' by the tenth century, and that it 'probably' correlates to the Bolbitine canal of Herodotus. However, this stands in contradiction to Ptolemy's description of the course of the western distributaries.

According to Coutellier and Stanley (1987: 269), the emergence of the Dumyāṭ branch as the dominant branch of the eastern Delta by about 1000 was a corollary of the demise of the Mendesian, Tanitic and Busiritic branches. Since neither the Mendesian nor the Tanitic branches were in place by the time of Ptolemy – who has his Busiritic branch crossing this area of the Delta along a quite different trajectory – this adds further implicit weight to the notion that the Dumyāṭ mouth – again, not necessarily the entire modern Dumyāṭ riverbed –was in place by the middle of the first millennium.

These findings are incorporated into the depiction of the main Nile waterways on the eve of the Islamic conquest in Appendix 2, Figure 12.

3.3 The Islamic-era Nile

When in the tenth century Ibn Ḥawqal (*Ṣūrat*: 132-145) provides the first detailed account of the waterways of the Nile in the Islamic era, the picture is of a Nile Delta radically transformed from that of Ptolemy Claudius (Appendix 1, Figures 14-5, Appendix2, Figures 6-8). The Canopic and Pelusiac branches are no longer represented – although, the former persists between the Delta apex and al-Karyūn (adjacent to ancient Schedia) in what early medieval authors conceive of as the Alexandria canal, which thereafter follows the ancient Schedia canal to Alexandria. Between Schedia and the sea, however, the Canopic branch is not depicted. Moreover, the broadly modern courses of the Rashīd and Dumyāṭ branches are for the first time discernable along their entire lengths, although they are not yet named or conceived as such. Each has lesser distributaries or parallel channels which are discussed in detail below.

Ibn Ḥawqal is not the first Islamic-era author to seek to represent the Nile. He is preceeded by al-Khawārizmī (*Ṣūrat*: 106-09) in the ninth century, and Suhrāb (*'Ajā'ib*) also known as Ibn Sirapion, in the mid-tenth (Appendix 1, Figures 11-13). However, both texts, while offering insights, fall short of a traceable account of the Nile's waterways.

To some extent, the shortcomings of textual data apply to all the medieval sources. Suhrāb (*'Ajā'ib*: 48) admits selectivity in saying that 'many [other] rivers' branch from each of the channels he has described, and Ibn Ḥawqal's description of the settlements on the Rashīd branch ends downstream of Balhīb because "it would take a long time to mention them all" (*Ṣūrat*: 143). However, much of the data can be validated by comparing to modern waterways the sequences of towns the texts locate on branches. It is clear from Ibn Ḥawqal and al-Idrīsī, for example, that the modern-day Dumyāṭ branch closely correlates in its course to its medieval antecedent – a feature noted by both Toussoun (1925: 1.170-1) and Guest (1912) in their reconstructions of aspects of the medieval Delta.

al-Khawārizmī (d. 850)

The mathematical geography of al-Khawārizmī (*Ṣūrat*: 106-9) was a ninth century attempt to update Ptolemy's *Geographia* created in Abbasid Baghdad. It is, however, far less detailed than its predecessor. A representation of a manuscript copy of his Nile map is shown in Appendix 1, Figure 11, while a schematic representation using the London Underground idiom appears in Appendix 1, Figure 12.

Al-Khawārizmī's work is of limited usefulness in understanding the layout of the ninth-century Nile. He has the western and easternmost Delta branches entering the sea at Alexandria and Dumyāṭ respectively, but he gives no means of identifying or charting his

seven intervening distributaries. The other Delta cities he identifies are listed only in his tables of latitude and longitude: he does not locate them relative to Nile branches. Where he does, the result is contradiction: the astronomical tables puts Dumyāṭ at longitude 53°15', yet he says that the distributary entering the sea 'at Dumyāṭ' does so at 54°30'.

If there is additional information to be inferred, it is from al-Khawārizmī's description of the branch going to Alexandria. Since there was no natural Nile distributary going all the way to Alexandria even in antiquity, it is probable that that this channel is an early representation of the Alexandria canal described later by Ibn Ḥawqal and al-Idrīsī. The bifurcation of this branch just 10' east of Alexandria (Appendix 1, Figure 12) is also interesting: while inadequate on its own to establish the survival of the Canopic branch running to the sea until the ninth century, it nevertheless reflects modern scholarship indicating that the branch survived until after that time (*see Canopic Branch, p.61*). A bifurcation further upstream on al-Khawārizmī's Alexandria-bound branch perhaps suggests the Rashīd branch.

Suhrāb (Ibn Sirapion, before 945)

The Nile description of Suhrāb (*'Ajā'ib*) survives as a 13th century manuscript. Like al-Khawārizmī , the author appears also to have worked in Baghdād and, like him, his data on Egypt comprises astronomical tables locating cities by latitude and longitude, and a separate discursive description of the Nile. Although more useful than al-Khawārizmī, his shortcomings are nevertheless apparent from the confusion of the schematic map in Appendix 1, Figure 13.

Toussoun's interpretation of Suhrāb has been widely adopted (Said 1981: 82; Stanley et al. 2004b: 924), but it severely overinterprets the data: Suhrāb does not give a comprehensive set of proper names to the Nile distributaries as Toussoun states. He does refer to the "Alexandria" and "Sardūs" waterways, but it is not clear that he intends these as proper nouns, and he names none of the others. Nor does Suhrāb state that a branch met the sea at Rashīd and as Toussoun claims (Toussoun 1925: 1.151-2, 171, 191)

Suhrāb identifies three distributaries with reference to Alexandria, one entering the sea 'with' the city (Arabic: *ma'a*), and two 'below' (*asfal*) it. The first, which he calls the 'Alexandria canal [*khalīj*]', is given a detailed but confused account. Having said that *all* of his Delta branches rise at latitude 54°30, he then says that this one rises at 51°20" (*'Ajā'ib*: 48, using latitude and longitude conversions in Kamal 1932: 3.1.571r). Descriptively, he has this canal beginning above the 'Pyramids of Yūsuf', passing 'the palace of Yūsuf' and the desert, before entering the sea 'with Alexandria'.

Suhrāb describes a series of waterways apparently branching from this Alexandria canal, the details of which suggest that what he intends is not the same 'Alexandria canal' described by other Islamic-era authors – that is, the erstwhile Canopic branch-Schedia canal route already suggested by al-Khawārizmī and later described in detail by Ibn Ḥawqal and al-Idrīsī – but something else. The first of the branches from this canal runs to al-Bahnasā (ancient Oxyrhyncos), and from that another waterway branches to Asyūt. Both towns are upstream, in Middle Egypt (Appendix 2, Figure 3), making these waterways in fact tributaries, rather than distributaries. The settlements that Suhrāb locates on them identify them with the modern Baḥr Yūsuf and Ibrahīmiyyah Canal respectively (Toussoun 1925: 1.155-157) (see Appendix 1, Figure 12; Appendix 2, Figure 3). The latter, a 19th century canal, broadly follows the bed of what was also formerly considered the Baḥr Yūsuf (Brown 1887: 614). Together, they occupy the western littoral of the modern Nile valley, and may represent an earlier course of the main Nile river (Said 1993: 61). The ancient Baḥr Yūsuf flowed parallel to the Nile until al-Lahūn, after which it emptied through the Ḥawarat Canal into the Fayūm depression (Butzer 1976: 92; Hayes 2006: 89-91). This depression came under intense cultivation during the Ptolemaic era (Butzer 1976: 92), and the existence of major ancient settlements along the Baḥr Yūsuf, such as Herwer and Oxyrhyncus, confirm this waterway's existence long before the Islamic period. The first Islamic-era reference to the canal is by Ibn 'Abd al-Ḥakam, who says the prophet Yūsuf dug the 'al-Manhā channel' from Ushmūn (al-Ashmūnayn) to al-Lahūn (*Futūḥ*: 6, 15) (Appendix 2, Figure 3).

The original artificial connection between the Nile and the Baḥr Yūsuf may have been made a mile above Dayrūt, after which a later larger channel shifted the offtake further upstream to near Manfalūt (Brown 1887). Al-Idrīsī extends this channel's intake further upstream again, to Sūl in the Suhag area (*Nuzhat*, 3.328) (Appendix 1, Figure 17; Appendix 2, Figure 3). Toussoun (1925: 1.174) suggests that the mouth of the al-Manhā channel was at the modern Suhagiyyah canal mouth, near Suhag, joining the Baḥr Yūsuf at Dayrūt. Cartography of the 18th century, however, suggests that by then the Baḥr Yūsuf once more separated from the Nile near or below Manfalūṭ (de Fer 1720; De l'Isle 1707; de Maillet 1740) (Appendix 1, Figures 32, 34-35).

The Baḥr Yūsuf was probably navigable only during the Nile flood, being too low in other seasons for cargo vessels to navigate (Brown 1887: 614; Pococke, *Description*: 1.74).

As for Suhrāb's Alexandria-bound channel itself, the author gives no detail other than that it passes the Pyramids and Palace of Yūsuf. He provides no information about its course through the Delta. Toussoun (1925: 1.157-158) proposes that what Suhrāb is

describing is not the Alexandria channel of later authors, but a more minor channel that separated from the Bahr Yūsuf at al-Lāhūn, fringed the western edge of the Delta, and finally entered Lake Maryūṭ (Mareotis), rather than the sea proper. Toussoun identifies this route with the al-'Azārah canal depicted in the maps of the Description de l'Égypte (Jomard 1809-28: Atlas, pl. 18-21, 24-25, 29-30, 36-37), and with the Manaf (Memphis) channel named, but not described, by Ibn 'Abd al-Ḥakam (*Futūḥ*: 6). The waterway is also indicated in the cartography of Robert de Vaugondy and Pococke (Appendix 1, Figures. 36-7). It might also be identified tentatively with the Dhāt al-Sāḥil canal that al-Mas'ūdī (*Murūj*: 2.363-4) names among his four major seasonal "mother canals" of Egypt. Ibn Ḥawqal and al-Idrīsī name a town called Dhāt al-Sāḥil on the west bank of the modern Rashīd branch. The site is unknown today, but lying between Jurays and Tarnūṭ, it cannot have been more than 5km from the al-'Azārah canal, which fringed the edge of the Delta. A similar canal is also depicted in the catography of de Maillet (1740), Sicard *et al* (1753) Pococke (1743-45: 1.xvi), Robert de Vaugondy (1753), and d'Anville (1765) (see Appendix 1, Figures 35-38). Meanwhile, De Cosson (1935: 79) identifies this canal with the "Dragon Canal" that the late-seventh century author John of Nikiou (*Chronicle*: 423, 429) says came "very close to Alexandria, to the west". This waterway to the lake had been in place since the Middle Kingdom (Boak 1926: 358).

Suhrāb says that yet another waterway separates from the Alexandria channel at Qasr Yūsuf, passes Dalāṣ, and rejoins its parent at Qantarat Dhāt al-Ḥammām. This depiction is problematic, since Suhrāb says it encloses the town of Fayūm, which is deep within the eponymous depression (Appendix 1, Figure 13; Appendix 2, Figure 3).

Suhrāb has two other Delta channels – his 'third' and 'fourth' – entering the sea 'below' Alexandria. Toussoun identifies the 'third' with the Alexandria channel of later authors, and the 'fourth' with the Rashīd branch. But he is on extremely weak ground. Suhrāb does not, as Toussoun (1925: 1.151) claims, say that one of these enters the sea at Rashīd. Moreover, Suhrāb gives longitudes for the mouths of each of these channels that place them *east* of the channel correlating to the modern Dumyāṭ branch: the result is a confusing cross-over (Appendix 1, Figure 13). It may indeed be tempting to discount these longitudes and associate the distributaries with the Alexandria canal and the Rashīd branch, but this is conjecture.

Suhrāb is more helpful in hinting at the layout of the distributaries in the eastern Delta. Three of the settlements he places on his 'second' or Sardūs channel – Banā, Būṣīr and Samanūd – are known locations on the modern Dumyāṭ branch, suggesting the latter's existence at this time (Appendix 1, Figure 12; Appendix 2, Figure 1). Suhrāb has this

distributary branch twice. The first is at Būṣīr (Abūṣīr Banā), from where the distributary enters the sea at Absarūdhat. This latter place is unknown, but it is implicitly in the Lake Tinnīs area. It is interesting that the maps of the *Description de l'Égypte* (Jomard 1809-28: Atlas, pl. 30, 35) depict a canal called the Canal de Baṣarūd, the name of which suggests an etymological link. However it begins just north of Daqadūs, 20km too far north to match Suhrāb's description exactly. The canal also stands as a candidate for the Daqadūs channel of Ibn Ḥawqal, and will also be considered vis-à-vis the Shanasha channel of al-Idrīsī, both of which are discussed below.

The second bifurcation is further down the Dumyāṭ branch, at 'Shatayūf'. This place is unknown, and despite the difference of just one diacritic dot in the script, it is far from the Shaṭanūf that Ibn Ḥawqal and al-Idrīsī later place at the head of the Delta (see Appendix 1, Figures 14-16). Nevertheless, the existence of a bifurcation this far down the branch hints at the bifurcation of the Dumyāṭ and Tinnīs branches discussed by later authors.

Finally, Suhrāb includes a branch going to al-Faramā (ancient Pelusium) as his 'seventh channel' (*'Ajā'ib*: 48). He calls this *'amūd al-nīl*: 'the Column of the Nile'. Toussoun (1925: 1.171-2) argues that Suhrāb is here describing a surviving ancient Pelusiac branch. However, the three settlements on the branch that Suhrāb names are extremely ambiguous from the surviving manuscript, and as a result the route is open to multiple interpretations. In any case, more recent research indicates that the Pelusiac branch was by this time defunct (*see Pelusiac branch, p.63).*

Ibn Ḥawqal (f. 977)

The earliest surviving Islamic-era geography of the Nile of any detail is that of Ibn Ḥawqal (*Ṣūrat*: 131-143). His textual account of the river does not give mathematical locations as Ptolemy Claudius or al-Khawārizmī did, but is rather a narrative description of his map, which also survives in a number of later manuscript versions (Ducène 2004) (see Appendix 1, Figure 14). The narrative progresses along each Nile waterway, recounting the sequence of settlements on it, and the points of river bifurcation. The western and eastern parts of the Delta are given different treatment. In the west, the text gives distances between places in *saqs* – an unknown and inconsistent unit – and only occasionally specifies the bank on which a town falls. In the east, it never gives distances, and almost always says the bank on which a town falls. This may be an indication of multiple hands in the sourcing of the data. A schematic map representing Ibn Ḥawqal's data, including place names, appears in Appendix 1, Figure 15. It is interpreted in Cartesian space in Appendix 2, Figures 6-8.

Many of Ibn Ḥawqal's place names can still be identified in the modern landscape. The

locations of those in the Delta are listed in Appendix 3 (drawing in part on the previous works of Guest (1912) and Toussoun (1925)). These are then plotted in Appendix 2, Figure 6, showing the waterways connecting them as straight lines. An interpretation of the routes in the modern landscape is offered in Appendix 2, Figures 7 and 8.

Western Delta distribuaries

Ibn Ḥawqal is the first author to provide details of the course of the Alexandria Canal plotted in no detail to by al-Khawārizmī, and named also by Ibn 'Abd al-Ḥakam (*Futūḥ*: 6), al-Ya'qūbī (*Buldān*: 339) and Qudāmah (*Kharāj*: 220). It begins, he says, as the main western distributary of the Delta after the Delta apex. Below Shābūr, it becomes navigable only during the Nile flood, a feature also noted by al-Idrīsī (*Nuzhat*: 3.331). The place names cited along its perrenial upper section indicate that here it corresponds broadly to the modern Rashīd branch, and thus to the ancient Canopic branch (Ball 1942: 28; Toussoun 1925: 1.185). The point at which the seasonal section begins is the place at which its course separates from the modern Rashīd branch. Since this occurs after Shābūr, Ibn Ḥawqal places the offtake some 11km downstream from Zāwiyat al-Baḥr, where Toussoun (1925: 1.203-5) argues – tenuously – that the ancient Canopic bed separated from the modern Rashīd branch even at the time of the conquest (Appendix 2, Figure 1). He points out (1925: 1.162) that the name Zāwiyat al-Baḥr, meaning 'angle' [or 'corner'] of the river', also suggests a river junction at that place in the Arabic-speaking era.

This apparent change in the offtake of the Alexandria canal does not significantly affect its subsequent course. The ancient Canopic bed from Zāwiyat al-Baḥr to the village of Gambaway some 30km to the north has been identified with the modern Abū Diyāb canal (Ball 1942: 25; Toussoun 1925: 1.162) (Appendix 2, Figures 1 & 2). Ibn Ḥawqal's Alexandria route joins it at al-Naqīdah, some 10km from Zāwiyat al-Baḥr, thereafter passing Dinshāl, also on Abū Diyāb canal. The next two known places that Ibn Ḥawqal names – al-Qartasah and Barsīq – accord broadly with the route of the Canopic branch proposed by Toussoun and Ball (Appendix 2, Figures 1, 4-5, 12). Thereafter, near modern Kafr al-Ḥamaydah it follows the route identified by Stanley and Jorstad (2006a) to al-Karyūn, ancient Schedia (Bergmann and Heinzelmann 2003, 2004). After al-Karyūn, Ibn Ḥawqal's placenames suggest that it departed the Canopic bed, and followed the ancient Schedia canal to Alexandria. The Schedia canal approximates to the modern Maḥmūdiyyah Canal, but followed a more meandering course, as can be seen in the cartography of the *Description de l'Égypte* (Jomard 1809-28: Atlas, pl. 36-37). Ibn Ḥawqal does not indicate the existence of the Canopic branch below al-Karyūn.

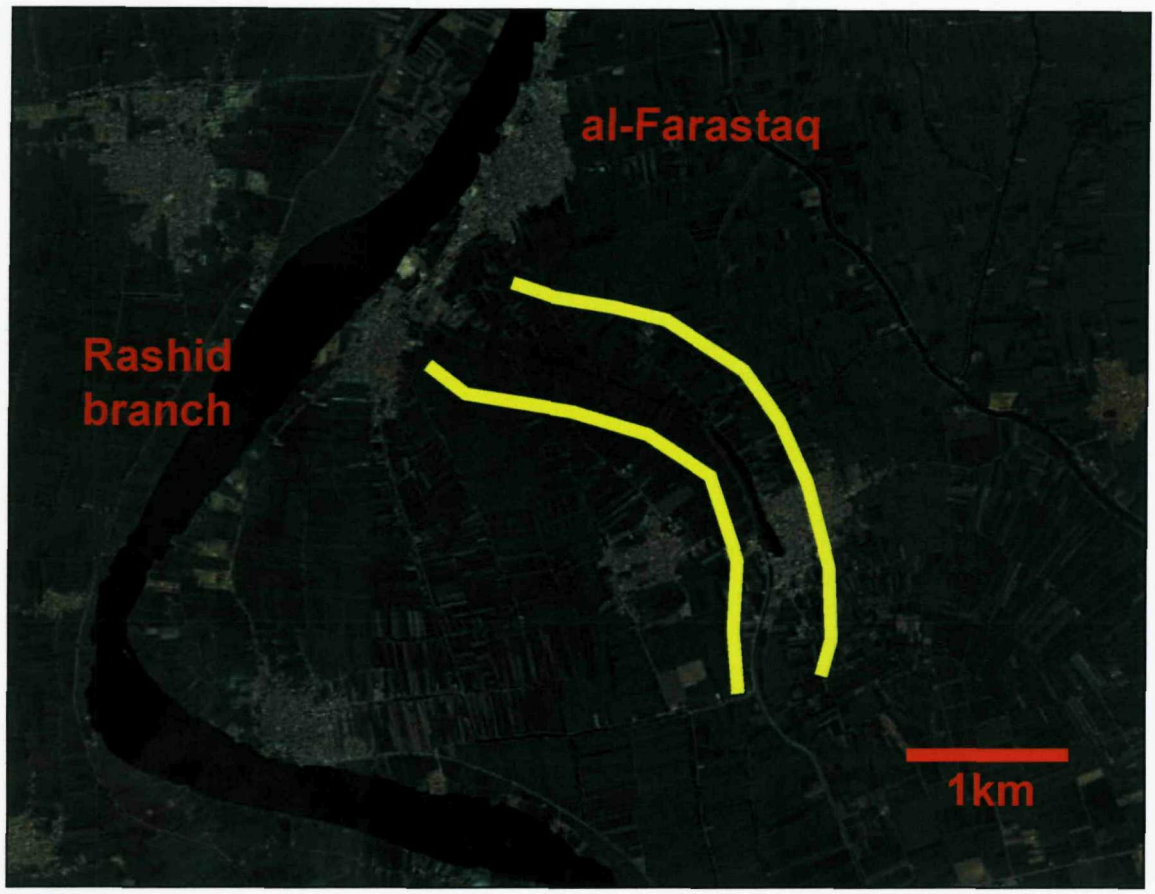

Figure 3.1: The vestiges of a canal (outlined in yellow) can today be seen heading for the Nile near al-Farastaq – reflecting al-Qalqashandī's account that his 'Ibyar" channel joined the Nile there (Google Earth™)

The seasonality nature of the lower Alexandria Canal indicates that this was not the main distributary of the western Delta. Even so, Ibn Ḥawqal presents the route from the apex of the Delta to Alexandria as a single itinerary, and lists it first: thereby implying both its primacy in his view of the other distributaries and its unity as a route. The waterway that Ibn Ḥawqal describes as leading to Rashīd "takes off [from this channel] to the left [i.e. north]". (*Ṣūrat*: 140): he gives this route secondary billing in the text, even though it recognisable as the modern Rashīd branch, and must have been more substantial.

Ibn Ḥawqal has two waterways branch from the Alexandria canal. The first he describes as rising just below Abū Yuḥannas, unknown today, but lying 10 *saqs* downstream of al-Juraysāt (modern Ashmūn: see Appendix 2, Figure 1) and six *saqs* upstream of Tarnūṭ. This latter name is an Arabisation of ancient Terenuthis, which gave its name to the Thermuthiac River of Ptolemy Claudius. The site of Terenuthis, modern Kom Abū Billū, is 2.5km west of modern al-Ṭarrānah, which latter town also appears also to share the etymology (see Appendix 2, Figure 1). Thereafter, the towns Ibn Ḥawqal names on the waterway indicate a trajectory to Babīj – modern Abīj, on the Rashīd branch – which is not reflected in its entirety by any modern waterway, although the section between al-

Bindariyyah and Maḥallat Marḥūm resembles the existing Batanūniyyah Canal (Appendix 2, Figures 2 & 6). A very similar waterway to this one is described two centuries later by al-Idrīsī: it may also be the Baḥr Ibyar branch named by al-Qalqashandī (*Ṣubḥ*: 3.292) in the 14th-15th centuries. Al-Qalqashandī has his branch leave the Rashīd branch at Abū Nishshābah, known today (Appendix 2, Figure 1) that fits Ibn Ḥawqal's account. Al-Qalqashandī has it pass through Ibyār: Ibn Ḥawqal and al-Idrīsī have it passing through Qalīb al-'Ummāl (modern Qalīb Ibyār) 5km to the northwest of Ibyār and on a comparable trajectory. Al-Qalqashandī has it rejoin the Rashīd branch at al-Farastaq, today just 4km downstream of Abīj. A vestigial channel can be seen on modern satellite imagery heading for al-Farastaq that matches al-Qalqashandī's account (see Figure 3.1) – the course may have shifted since Ibn Ḥawqal and al-Idrīsī were writing. Similar secondary waterways, leaving the Rashīd branch in the Ashmūn area and rejoining it in the Abīj/al-Farastaq area are broadly depicted in the 18th century cartography of Robery de Vaugondy and d'Anville (Appendix 1, Figures 36 & 38). The similarities between this now-defunct waterway and the upper reaches of the Thermuthiac River of Ptolemy Claudius have been noted by Toussoun (1925: 1.174). The implied hypothesis is that at least this section of Ptolemy's waterway was still in existence at the time of the Islamic conquest.

The second of the waterways rising from Ibn Ḥawqal's Alexandria-bound waterway does so at the point at which the latter becomes a seasonal waterway. In other words, it is the modern Rashīd branch, which can be traced thereafter to the city of Rashīd and the sea (see Appendix 1, Figures 14-15; Appendix 2, Figures 6-7). Between Babīj (modern Abīj) and the unknown Maḥallat Babīj, a new waterway branches west from the Rashīd branch, rejoining it at the unknown Bulhīb, somewhere between Fuwah and Dayrūṭ – perhaps near today's al-'Aṭf – having passed through the known towns of Farnāwah, Mahallat Abī Kharāshah (modern Abū Kharāsh - see Appendix 2, Figure 1), and Fīshah.

Downstream of Farnāwah there is no modern waterway that is candidate for this waterway. However, further upstream, its course can perhaps be identified with reference to al-Makhzūmī's 12th century description of the canals of the western Delta (in al-Maqrīzī, *Khiṭaṭ*: 1.459-463 - See Appendix 1, Figure 18 for Toussoun's interpretation of al-Makhzūmī). From this, it appears that the upper course of Ibn Ḥawqal's channel, as far as Farnāwah, had by the 12th century become part of a new Alexandria Canal. Its course can be seen to follow closely the modern al-Ḍāhirī and Sāḥil Marqas canals (*see below*). These canals come within 1.5km of the Rashīd branch at Abīj (Appendix 2, Figure 1), suggesting that the canal's offtake from the branch was nearby. Toussoun's assertion (1925: 1.207) that the now-unknown Maḥallat Babīj – the first town on Ibn Ḥawqal's Farnāwah-bound

distributary – was 3km *upstream* of Abīj at al-Ḍāhirīyyah cannot be reconciled with Ibn Ḥawqal's account. Instead, the offtake of this waterway was probably moved to al-Ḍāhirīyyah in the mid-13th century (*see below*).

Eastern Delta distributaries

As for the eastern Delta, Ibn Ḥawqal mirrors Suhrāb in calling the main eastern branch at the Delta apex the Sardūs channel. He allocates the name quite differently, however. While Suhrāb's Sardūs channel appears to correlate to the modern Dumyāṭ branch along its length, Ibn Ḥawqal's Sardūs channel is shorter. His version begins, like the Dumyāṭ branch, as the main eastern fork at the Delta apex, but it "runs dry" after Ṣahrajāt (*Ṣūrat*: 133). There, a new waterway, which Ibn Ḥawqal dubs the "Column", flows to the sea near Dumyāṭ. Again, it is apparent from the towns Ibn Ḥawqal places on it that this Column is the continuation to the sea of the modern Dumyāṭ branch (see Appendix 1, Figures 14-15, Appendix 2, Figures 6-7).

Ibn Ḥawqal depicts a number of dependent waterways to the west and east of what is now considered the modern Dumyāṭ branch. Of the western branches, the first separates at Tanūhah (Appendix 1, Figure 15, Appendix 2, Figures 6-7). Ibn Ḥawqal places Tanūhah between Dijwah and Binhā al-'Asal (modern Binhā), and refers to the distributary as the 'Tanūhah arm'. Tanūhah is probably to be associated with the modern town of Iṣtanhah (Appendix 2, Figure 1), given a similarity in name, and also that al-Idrīsī later says that Tanūhah (his Intūhī) is opposite Muniyat al-'Attār, a known location opposite Iṣtanhah (Appendix 1, Figure 16). Al-Idrīsī also has a distributary rising there. Thereafter, Ibn Ḥawqal's waterway flows past Mukhnān, modern Umm Khinān, to Milīj. The route so far reflects no present-day waterway. After Milīj, the only known town that Ibn Ḥawqal locates on his Tanūhah arm is Damīrah, some 65km to the north-northeast. Both Milīj and Damīrah lie on the modern Baḥr Shibīn waterway (Appendix 2, Figures 1 & 2), and at first glance it appears that it is this Ibn Ḥawqal intends, except with its offtake from the Dumyāṭ branch at Iṣtanhah. The Baḥr Shibīn is recorded in the *Description de l'Égypte* maps as the 'Canal de Mélig' (Jomard 1809-28: Atlas, pl. 25, 29, 30, 35). Comparable waterways parallel to the main Dumyāṭ branch are also depicted by de Fer (1720), Pococke (1743-45: 1.xvi), Sicard *et al* (1753), and d'Anville (1765), pushing its date back to the 18th century (Appendix 1, Figures 34, 36-8).

However, Ibn Ḥawqal's description of the first of the waterways to split from his Tanūhah arm suggests that it may be this un-named sub-branch that follows the route of the modern Baḥr Shibīn rather than its parent. The sub-branch rises from the Tanūhah arm 'around Mukhnān', passes through Taṭayah, and rejoins the modern Dumyāṭ branch at

Damsīs (Appendix 1, Figure 15). However, modern Taṭay is also on the Baḥr Shibīn, some 16km downstream from Milīj (Appendix 2, Figure 1). Hence, and problematically, both the Tanūhah arm and this sub-branch of it seem to follow the Baḥr Shibīn.

The later cartography of al-Idrīsī (*see below*) also has a channel leaving the Dumyāṭ branch at Iṣṭanhah, passing several known places on the modern Baḥr Shibīn including Milīj, and rejoining the Dumyāṭ branch at Damsīs. The fact that Ibn Ḥawqal in addition places Sundabasṭ (modern Sunbāṭ) and Ziftā Jawād (modern Ziftā) between his Damsīs-bound waterway and the main Dumyāṭ branch suggests further resemblances between it and al-Idrīsī's Damsīs-bound branch (see below). If that is the case, then Ibn Ḥawqal's error was to placing Milīj after, not before, the bifurcation of the Damsīs-bound waterway.

If this sub-branch follows the Baḥr Shibīn, then it follows that Ibn Ḥawqal's Tanūhah arm after Mukhnān must follow another trajectory. However, the settlements Ibn Ḥawqal places on it after Milīj are not known today and no modern waterway, or one from historic cartography, suggests itself. It seems safest, therefore, to conjecture that Ibn Ḥawqal's work contains some error in this region of the Delta, and that his 'Tanūhah arm' does indeed correlate to the modern Baḥr Shibīn between Milīj and Damīrah: The sub-branch passing through Taṭayah to Damsīs would then be a minor spur, unknown today or in early modern cartography, returning to the Dumyāṭ branch.

After Damīrah, Ibn Ḥawqal's Tanūhah arm reconnected to the modern Dumyāṭ branch. In this area, the modern Baḥr Shibīn and Dumyāṭ branch are just 5km apart. No such waterway connecting them exists today, although channels are depicted running between the two in the vicinity on d'Anville's 1765 map (Appendix 1, Figure 38).

Ibn Ḥawqal says that a second sub-branch of his Tanūhah arm separates from the west bank of its parent before Milīj and rejoins it after the unknown Zamzūr, having passed through Tūkh and Maḥallat Rūḥ. These latter two are known towns, lying some 4-6km west of the Baḥr Shibīn (Appendix 2, Figures 1 & 2). They are on no indicative modern waterway. However, the *Description de l'Égypte* maps (Jomard 1809-28: Atlas, pl. 29) depict two canals leaving the modern Baḥr Shibīn near Milīj and passing close to Tūkh. Ibn Ḥawqal's canal may have followed a similar northward trajectory as these. The onward route of the waterway to Maḥallat Rūḥ has no candidate.

Ibn Ḥawqal has a total of five waterways branching to the east of the modern Dumyāṭ branch. The first two are spurs that do not reach the sea. The first is the final stretch of his Sardūs channel below Ṣahrajāt, after it parts from the modern Dumyāṭ branch (see Appendix 1, Figure 15). Only the town at which it rises is known today. Ibn Ḥawqal's near

contemporary al-Mas'ūdī names the Sardūs channel as one of the four seasonal 'mother channels' of Egypt that were opened in September at the time of the Nile flood (*Murūj*: 2.363-364): it is presumably to the section after Ṣahrajāt to which al-Mas'ūdī is referring.

Ibn Ḥawqal calls the second of the eastern spurs the Daqadūs channel, which separates from the Column at Ashīh (Appendix 1, Figure 15; Appendix 2, Figure 6-7). The place-order of this town suggests modern Mit Ishnā, which it also closely resembles in Arabic script. However, there is also a suburb of modern Zifta called Daqadūs, 9km further upstream, which may equally represent the beginning of this channel. The latter settlement is also marked on the *Description de l'Égypte* maps (Jomard 1809-28: Atlas, pl. 30), at which time it stood at the beginning of the Canal de Baṣarūd already mentioned above with reference to Suhrāb's Nile geography (*see p.42*).

Ibn Ḥawqal has two more distributaries separate from the Dumyāṭ branch further downstream. These come together at an unspecified point, and flow together to the sea via Lake Tinnīs (Appendix 1, Figure 15; Appendix 2, Figure 6). Ibn Ḥawqal names this distributary system the Daqahlah canal, apparently after the settlement on the modern Dumyāṭ branch at which the lower of its feeder channels rises. However, he names few settlements allowing the course this channel to be plotted with confidence. When al-Idrīsī later describes the waterways in this area of the Delta (*see below*), his data is enough allow the identification of a more sinuous version of the modern Baḥr Saghīr as his main Tinnīs-bound branch (Appendix 1, Figure 16; Appendix 2, Figure 2). Ibn Ḥawqal's data is more opaque, but allows the possibility that the Daqahlah canal corresponds to the Baḥr Saghīr. There is no candidate in the contemporary landscape for the feeder channel leading from Daqahlah to join the Baḥr Saghīr. However, the *Description de l'Égypte* maps (Jomard 1809-28: Atlas, pl. 35) show a waterway – in fact a small complex of waterways – connecting the Nile at Daqahlah to the Baḥr Saghīr at several nodes along its length (see Figure 3.2).

There is further evidence from outside Ibn Ḥawqal's text to associate his Daqahlah channel with the Baḥr Saghīr. Ibn Duqmāq (*Intiṣār*: 68) says that the city of Ashmūn Tanāh (also known as Ashmūn Rummān) is the principal town of the administrative *kūrah* of al-Daqahliyyah[2]. Moreover, Ibn Duqmāq places that city on "the eastern channel of the Nile": it is today on the Baḥr Saghīr (Appendix 2, Figures 1 & 2). Further, the *Description de l'Égypte* maps (Jomard 1809-28: Atlas, pl. 35) depict a large marsh area south of the Baḥr Saghīr in Arabic as *Birkat al-Daqahliyyah*, i.e. the "al-Daqahliyyah Lake" (see

[2] The toponym is an adjective derived from Daqahlah.

Figure 3.2). This depression is discussed below as candidate for al-Idrīsī's Lake Zār. It appears therefore, that the name of the *kūrah* and the depression of al-Daqahliyyah, both adjoining the eastern Baḥr Saghīr, took their name from the main waterway running through the region, which in turn took its name from Daqahlah, the location at which it separated from the modern Dumyāṭ branch

Today's Baḥr Saghīr is a much-straightened version of its earlier self. Its more sinuous early 19th century course was recorded on the *Description de l'Égypte* maps (Jomard 1809-28: Atlas, pl. 35). The meanders depicted by the *Description* maps can still be traced in the contemporary landscape as irrigation canals and field boundaries using satellite imagery: it is this route that is represented in the reconstructions produced here (Appendix 2, Figures 7,10, 12-19). The 19th century branch entered Lake Tinnīs at modern al-Maṭariyyah, still today the port of the southern lake-shore.

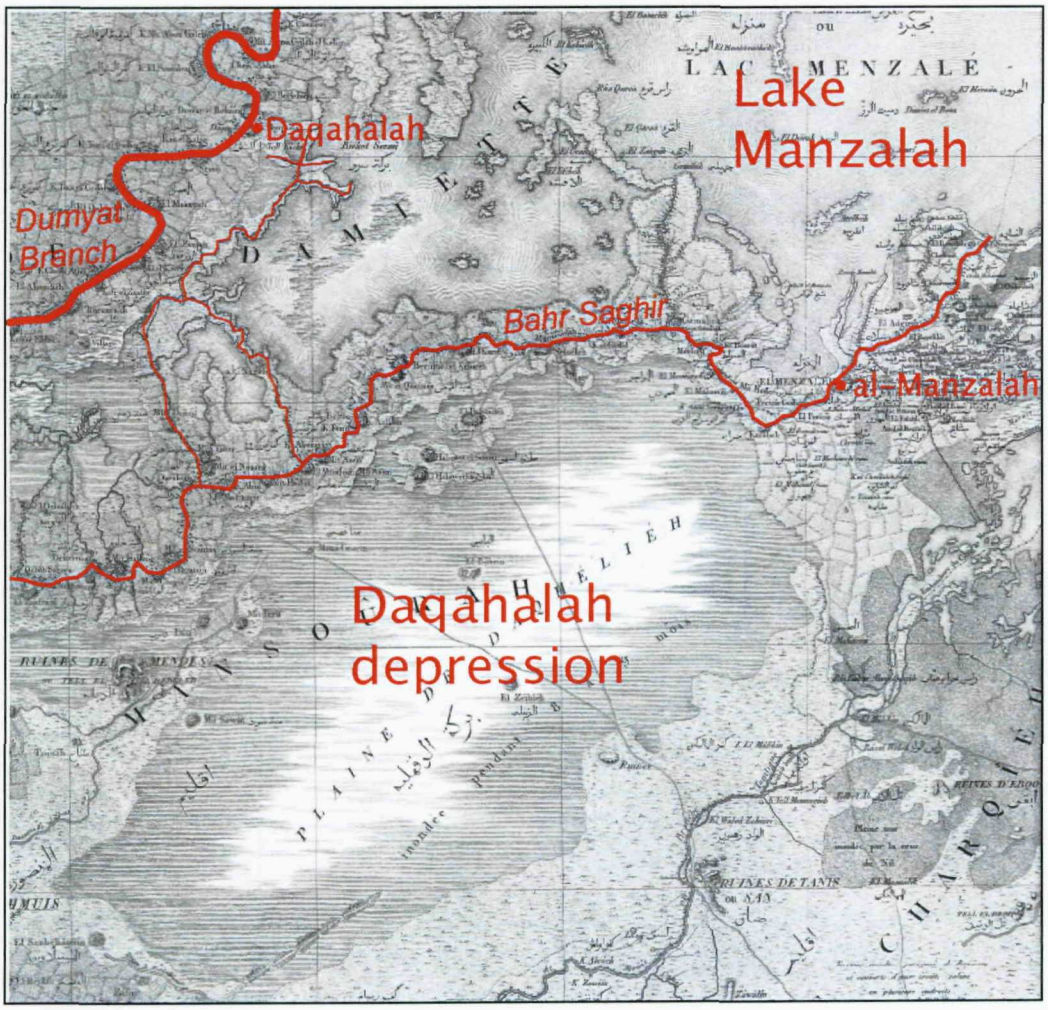

Figure 3.2: The Daqahalah depression region of the northeastern Delta, according to the *Description de l'Égypte* (Jomard 1809-28: Atlas, pl. 35). The Baḥr Saghīr and the canals connecting it with Daqahlah on the Dumyāṭ branch are depicted in red.

Ibn Ḥawqal's places the last of his eastward distributaries of the Column somewhere between Shārimsāh and Dumyāṭ (although the latter town was not at its modern location: see Section 5.3) from where it connected to Lake Tinnīs. Ibn Ḥawqal places Shārimsāh downstream of Daqahlah, when it is in fact upstream. That suggests that this waterway was downstream of Daqahlah. The *Description de l'Égypte* maps (Jomard 1809-28: Atlas, pl. 41) shows the Dumyāṭ branch in this area separated from a lobe of the lake by nothing more than a dyke near modern Awlād Ḥammām: this was therefore probably a very short waterway connecting lake and river.

Finally, Ibn Ḥawqal also identifies a waterway he calls the Za'farāniyyah canal running west from the Dumyāṭ branch to Nuqayzah (See Appendix 1, Figure 15). His text does not specify where this canal rises. The earliest surviving manuscript version of Ibn Ḥawqal's map, the MS Topkapi Sarayi 3346 dated 1086 (Appedix 1, Figure 14) has the Za'farāniyyah canal separating from the modern Dumyāṭ branch below Būrah, a town unknown today, but downstream of Shirimsāh (see Appendix 2, Figure 1). The implication is of a junction low on the coastal plain. Since modern Kum Nuqayzah itself is just 10km inland (Appendix 2, Figure 1), the implication is of a canal running broadly parallel to the coast. Ibn Ḥawqal's text gives no indication that he intends the Za'farāniyyah canal to continue westward after Nuqayzah. However, the medieval manuscript images of his map depict it doing so, ultimately joining the Rashīd branch (Ducène 2004, see also Appendix 1, Figure 14). This western part must have been largely through Lake Burullus. Indeed, the Description de l'Égypte Atlas depicts Kum al-Nuqayzah at the eastern tip of the lake (Jomard 1809-28: Atlas, pl. 41). At its western end, the Atlas depictions suggest that the onward channel connecting the lake to the Rashīd branch may have been as little as 2-3km in length, since the lake and branch were so close (Jomard 1809-28: Atlas, pl. 36, 40). Al-Bakrī in the 11th century (Masālik: 3.3.730r) and Abū al-Fidā in the 14th (Taqwīm: 38-9) also both report a waterway connecting the lake and the Rashīd branch near Rashīd. Moreover, the maps of Piri Reis, Forlani, Blaeu, Celebi, Robert de Vaugondy and Pococke (Appendix 1, Figures 26-28, 30-1, 36-7) also show similar channels – sometimes more than one – connecting the lake and the Rashid branch at points downstream of al-'Aṭf.

Al-Idrīsī (f. 1154)

The final medieval source to be discussed in detail is the 12th century Spanish-Islamic scholar al-Idrīsī, who produced his geography for Roger, the Norman King of Sicily, in 1154. Like Ibn Ḥawqal, al-Idrīsī gives his account of the Nile waterways as sequences of named locations on the branches, and in even greater detail (*Nuzhat*: 3.329-343). His

description is represented in schematic form in Appendix 1, Figures 16 and 17, and that schematic form is projected and interpreted onto the modern landscape in Appendix 2, Figures 9-11. Al-Idrīsī again gives distances between locations, this time in 'miles' (*amyāl*), but again the length of this unit varies wildly. For reasons of space, these distances have therefore been omitted from the schematic maps.

Western Delta distributaries

Al-Idrīsī's description of the western distributaries of the Delta suggests little change from Ibn Ḥawqal's. Unlike the latter, however, he broadly regards what correlates to the modern Rashīd branch as the main western waterway, rather than the Alexandria canal – his Shābūr channel – which he has branching from it (*Nuzhat*: 3.331).

Al-Idrīsī's first sub-branch from the modern Rashīd branch bifurcates at Rimāl Ṣanīm and rejoins the parent branch at Babīj (*Nuzhat*: 3.342). It is recognisable as the branch that Ibn Ḥawqal describes leaving the Rashīd branch "just below" Abū Yuḥannas and running to Babīj, and to al-Qalqashandī's canal running through Ibyār (*see p.45 above*).

Al-Idrīsī provides a somewhat confused account of what is today considered the main Rashīd branch downstream of the Rimāl Ṣanīm bifurcation just described. He considers the 75km-section of the modern Rashid branch from here to Shābūr as the first part of his Shābūr channel leading to Alexandria (see Appendix 1, Figure 16; Appendix 2, Figures 9 & 10). Below Shābūr, the place names he supplies confirm that it follows the same course as Ibn Ḥawqal's Alexandria channel. Al-Idrīsī says, like Ibn Ḥawqal, that this Shābūr canal is seasonal:

"Water only enters this channel, and it is only traveled upon, with the rise of the Nile, because its mouth [bed] is elevated above the flow of the Nile … " (*Nuzhat*: 3.342)

However, it can only have been the section after Shābūr that was seasonal, since the part before was the main Rashīd branch.

Another element of confusion pertains to the offtake of Alexandria-bound canal. Al-Idrīsī's main description of the canal shows that it passed through Shābūr, and resembles Ibn Ḥawqal's canal. However, elsewhere, in his brief preamble to his description of the Delta (*Nuzhat*, 3.330-1), he says that the Alexandria-bound canal separated from the main Rashīd 9km further downstream, at Babīj (modern Abīj). He does not mention this offtake location again. However the existence of just such a waterway leading to Alexandria and rising just below Babīj is elaborated by al-Idrīsī's close contemporary, al-Makhzūmī (*al-Minhāj*: 1.459), who produced a study of the irrigation canals of the al-Buḥayrah province, which lay between the Rashīd branch and Lake Maryūt. The study survives in al-Maqrīzī

(*Khiṭaṭ*: 1. 459-463), and provides valuable detail on the Alexandria-bound canals of the 12th century. A geographical interpretation of al-Makhzūmī's canals is provided by Toussoun (1.213-227; see also Appendix 1, Figure 18 of this thesis).

Al-Makhzūmī describes the same Alexandria/Shābūr canal outlined by Ibn Ḥawqal and al-Idrīsī, but he calls it the Baḥr Ramsīs (*al-Minhāj*: 1.461). He also describes a separate waterway that he calls the Alexandria Canal, but which is markedly different from that described by Ibn Ḥawqal and al-Idrīsī. The settlements he places on it (Appendix 1, Figure 18) suggest a route following the modern Ḍāhirī and Sāḥil Marqas canals (Appendix 2, Figure 2). The early part of this route also bears a resemblance to Ibn Ḥawqal's channel that left the modern Rashīd branch below Abīj bound for Farnāwah, in that Farnāwah is also on the modern Ḍāhirī canal. From al-Makhzūmī's data, it seems that the 12th century waterway, rather than turning north-northwest after Farnāwah and returning to the modern Rashid branch as it had in the tenth century, instead heads west-northwest to form an alternative Alexandria-bound canal to that described by Ibn Ḥawqal and al-Idrīsī. The trajectory of the modern Ḍāhirī canal suggests that this 'new' route to Alexandria would have joined the 'old' Alexandria canal somewhere near Damanhūr (Appendix 1, Figure 18; Appendix 2, Figure 1).

In the late 12th century, the Ayyubid vizier Ibn Mammātī (*Qawānīn*: 221), relates that he learned from "experts" that if a barrage were to be placed across the Nile between Babīj and Muniyat Babīj, then water would have remained in the Alexandria canal all year round. The implication is that this Alexandria-bound waterway, like its counterpart rising at Shābūr, was again only seasonal.

Elsewhere in the western Delta, al-Idrīsī omits the 'Farnāwah loop' of Ibn Ḥawqal discussed above, and includes a small island below Fuwah. Otherwise, the course of the modern Rashīd branch can again be traced.

Further downstream, al-Idrīsī makes an interesting addition: he describes a route to Alexandria that begins as a "small arm of the Nile" that separates from the Rashīd branch "close to and below Samdīsī" (*Nuzhat*: 3. 343). Samdīsī is unknown, but al-Idrīsī places it upstream of Sindiyūn (Appendix 2, Figure 1). This branch flows to 'a lake', presumably Lake Idkū, which in turn connects to another lake, presumably Lake Abū Qīr, which latter extends to within six 'amyāl' of Alexandria. From there "... People transfer from boats to land, and they travel by pack-animal to Alexandria."

A similar waterway is named by Ibn Sa'īd in the late 13th century as the al-Ḥāfir channel (*Untitled*: 4.1.1088v). According to Ibn Sa'īd, it was excavated earlier in his century under

the Ayyubid Sultan al-'Ādil (1200-1218). He describes it as follows:

"When [the Alexandria channel] is not in use [i.e. when the Nile is not in flood], the lake to the east of Alexandria is used. It is salty, seawater entering it between Rashīd and Alexandria. Boats travel on it to places on the Nile via a channel known as the al-Ḥāfir channel." (*Untitled*: 4.1.1088v)

Al-Idrīsī's evidence suggests that al-'Ādil's was not, in fact, the first excavation of this channel. Al-Maqrīzī (*Khiṭaṭ*: 1.459) also names the al-Ḥāfir canal, implying it was contemporary to him, and adding that it entered 'Lake Alexandria' (i.e. Lake Abū Qīr). It was, he says, 'half a day" in length.

The existence of waterways connecting the lower Rashīd branch to Lake Idkū is attested in early modern cartography. Forlani (1566; Appendix 1, Figure 28) depicts such a channel departing the Rashīd branch just below 'Tebe', modern Dibī (Apendix 2, Figure 1), some 5km too far downstream to match al-Idrīsī's channel precisely. It may be on Forlani that his contemporary Ortelius (1570: 52) bases his very similar Delta cartography. Sanuto (1588) has an "*Atacone Fossa*" or 'Idkū Channel' leaving the Rashīd branch somewhere between Dayrūṭ and Rashīd and connecting to Abū Qīr lake, which in turn connects to the sea. Later, d'Abbeville (c.1655) has a channel to the lake starting somewhere downstream of Dayrūṭ (his 'Derutha': Appendix 1, Figure 29). Blaeu (1665, see Appendix 1, Figure 30), like Forlani, has the canal begin just below Dibī. D'Anville (1765) has his channel begin between Dayrūṭ and Sindiyūn, towns which today face each other across the Nile (Appendix 1, Figure 38). These broadly resemble al-Idrīsī's waterway (Appendix 2, Figure 10). Meanwhile, Pococke's 1763 map has four channels linking the Rashīd branch with the lake (Appendix 1, Figure 37). These variously leave the Rashīd branch near Fuwah and above a place known as Elhamel (modern al-Ḥamād?). One of these, starting between Dayrūṭ (his Deirout) and Fazārah (his Farana), again resembles al-Idrīsī's channel. A variant of this channel appears on Homann's 1715 map (Appendix 1, Figure 31). Finally, the *Description de l'Égypte* depicts two parallel 'abondonné canaux' linking the Rashid branch and the lake depression. These leave the former at a point between Dayrūṭ and Fazārah, and pass through the village of Minyat al-Ṣa'īdah (Jomard 1809-28: Atlas, pl. 36, 40), where today several minor canals fan from the river (see Figure 3.4). These *Description* canals are also candidates for the al-Ḥāfir canal.

Figure 3.3: Channels leading to the Lake Idkū depression from the Rashīd branch, according to the Description de l'Égypte (Jomard 1809-28: Atlas, pl. 36), including two 'abandonné canaux' that are perhaps vestiges of the al-Ḥāfir canal.

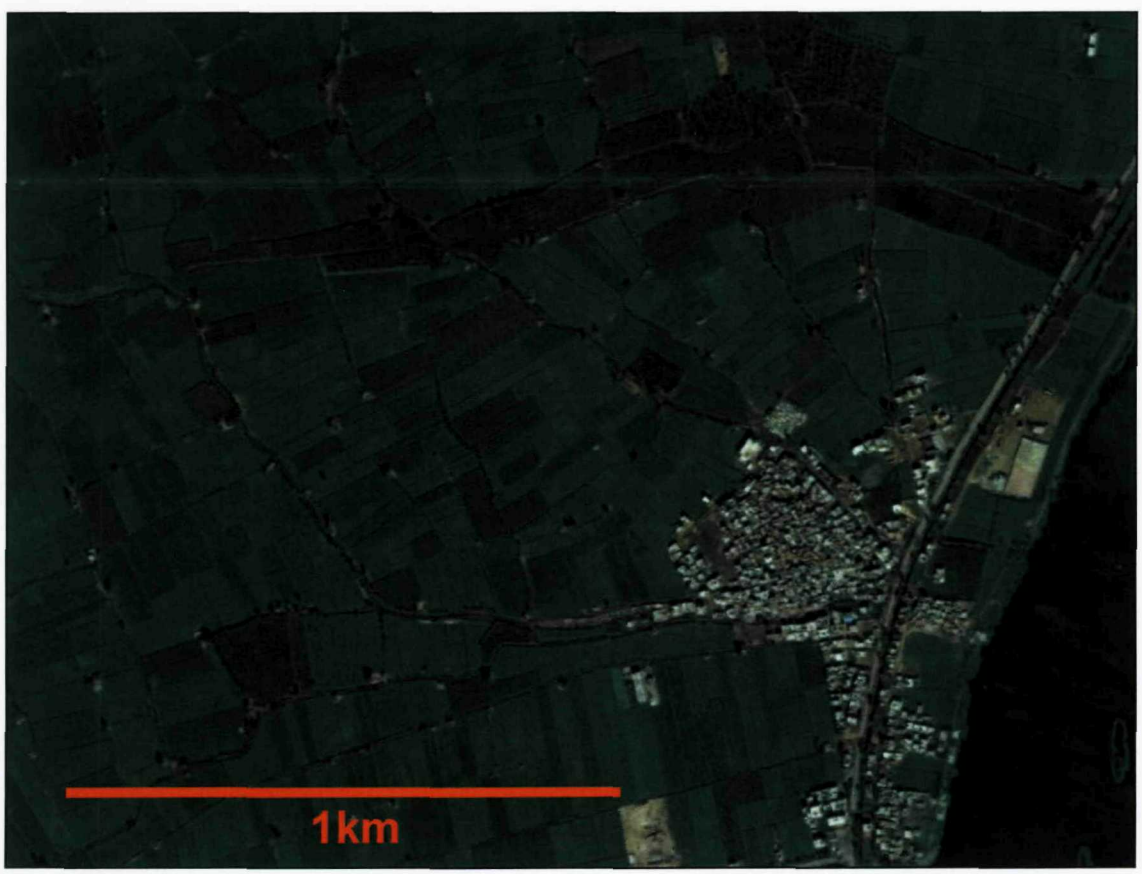

Figure 3.4: The modern village of Minyat al-Ṣa'īdah on the Rashid branch, showing minor canals heading northeast towards the Lake Idku depression as the al-Hafir canal once did (Google Earth™).

Eastern Delta distributaries

Moving to the eastern Delta, the modern Dumyāṭ branch can be clearly identified from al-Idrīsī's work on something very close to its present course (Appendix 2, Figure 10). However, he does not conceptualise it as such. For him, from the Delta apex to Ṭarkhā (Talkhā), the modern Dumyāṭ branch is the 'branch to Tinnīs' (*Nuzhat*: 3.330). When it reaches the bifurcation just after Ṭalkhā, this 'branch to Tinnīs' forks east, following the course of the modern Baḥr Saghīr to Lake Tinnīs, the eponymous port city, and the sea. Al-Idrīsī calls this Tinnīs-bound branch "the major channel" (Arabic: *mu'ḍham al-khalīj*; *Nuzhat*: 3.336). It is only after the Talkhā bifurcation that al-Idrīsī gives what is today's Dumyāṭ branch it's modern name. Since the Dumyāṭ-bound branch was probably larger channel at this time, Al-Idrīsī's nomenclature perhaps suggests the relative navigational importance of the Tinnīs branch.

Al-Idrisi has no connection between Lake Tinnīs and the lower reaches of the modern Dumyāṭ branch such as Ibn Ḥawqal describes, but his near contemporary al-Birūnī does say that the town of Dumyāṭ "connects" to the lake (*Qanūn*: 3.3.712r).

The connection to Tinnīs along what is today the Baḥr Saghīr persisted throughout the medieval period. In the 14th-15th century, al-Qalqashandī calls it the Baḥr Ashmūn, after the town of Ashmūn Ṭanāh (*Ṣubḥ*: 3.308). His near contemporary Ibn Duqmāq (*Intiṣār*: 68) says the channel was dredged under al-Ḍhāhir Baybars (1223-77), suggesting its transition from natural waterway to maintained canal. It is probably also this channel that is depicted in the 16th century maps of Piri Reis (Appendix 1, Figures 24-5). Thus the waterway survived long after the island city of Tinnīs was apparently abandoned at the end of the 12th century.

The only other waterway al-Idrīsī has branching from the east of the modern Dumyāṭ branch is the Shanashā channel. This bears little immediate resemblance to any channel named by al-Idrīsī's predecessors. It begins further downstream from Ibn Ḥawqal's Sardūs and Daqadūs channels, at Muniyat Badr (modern Mit Badr Ḥalāwah). It ultimately enters 'Lake Zār', which al-Idrīsī says is contiguous with Lake Tinnīs. The only known location on the channel is the eponymous Shanashā, just 9km from its origin.

There is no waterway today connecting Muniyat Badr and Shanashā. Nor is there any depicted in early modern cartography, except where the depiction appears to be a direct incorporation of al-Idrīsī's work (for example, d'Anville: see Appendix 1, Figure 38). However, Shanashā is just 3km from Mīt al-'Āmil, a village that lies on the 'Canal de

Baṣarūd' of the *Description de l'Égypte* – considered above (*p.42*) as a candidate for the Daqadūs channel of Ibn Ḥawqal. Moreover, this same canal finds its way to the Daqhaliyyah depression, which the Description de l'Égypte maps (Jomard 1809-28: Atlas, pl. 35) label as "flooded for eight-to-nine months" (see Figure 3.2). Perhaps this is the Lake Zār to which al-Idrīsī refers. Where this Canal de Baṣarūd enters the depression, it also comes close to Ashmūn Ṭanāḥ – al-Idrīsī's Ṣanāḥ – between it and which he says there was a land connection of 20 *amyāl*.

Parallels to the Shanashā channel/Lake Zār route of al-Idrīsī are also seen in later medieval cartography. Sanuto's 16th century map of the Nile Delta, like that of al-Idrīsī, shows *two* waterways branching from the main Dumyāṭ branch and entering Lake Tinnīs (Skelton 1965: Africae Tabula VII). The toponyms on that map are too sparse to locate these waterways with precision, but the one departing furthest upstream is depicted, like al-Idrīsī's, as passing through a lake before it reaches Lake Tinnīs. The settlement Sanuto depicts on the Lake, Zurafa, is unknown. The fact that he does not place the same toponyms on the route as al-Idrīsī suggests that this is not a direct copy.

It may be that the Shanashā channel of al-Idrīsī, the Daqadūs channel of Ibn Ḥawqal, and Suhrāb's channel bound for Absarūdhat are all attempts to describe the same, or a similar channel, with differences due to error or variations over time. The principle difference in these routes may simply have been the point of off-take from the modern Dumyāṭ branch.

It is worth noting that none of the channels described by the Islamic-era authors corresponds to traditional interpretations of the course of the Tanitic or Mendesian branches of earlier ancient authors (Ball 1942: 27, 59; Toussoun 1925: 1.190, 177-8; van Wesmael 1988: 128), nor of interpretations of the Busiritic branch of Ptolemy Claudius (Ball 1942: 127; Toussoun 1925: 1.158-161) (see Appendix 2, Figures 4-5). The implication – that this was a highly dynamic section of the Delta whose channels changed course frequently over time – is underlined by seismic studies of the region (Stanley 1988, 1990) (*see below*).

Like Ibn Ḥawqal, al-Idrīsī describes a complex of distributaries from the west bank of the modern Dumyāṭ branch. Also like Ibn Ḥawqal, he describes a waterway separating from the main Dumyāṭ branch at Antūhī (modern Istanḥah), passing through Milīj, and rejoining the Dumyāṭ branch and Damsīs. Several of the places he locates on it are also on the modern Baḥr Shibīn. Somewhere after these, presumably where the modern Baḥr Shibīn and Dumyāṭ branch come within 5km of each other near modern Sunbāṭ, al-Idrīsī's channel breaks from the modern Baḥr Shibīn and rejoins the modern Dumyāṭ branch at

Damsīs. This more precise picture clarifies Ibn Ḥawqal's earlier confused description of the canals in this region. Al-Idrīsī's gives no indication that the Baḥr Shibīn continued northward of a point near Sunbāṭ as it does today.

Meanwhile, the offtake of al-Idrīsī's Maḥallah channel between Taṭay, al-Ja'fariyyah and Bulūs can be quite precisely located, as these places are close together (see Appendix 1, Figure 16; Appendix 2, Figure 1, 9, 10). Its early trajectory flows considerably to the west of the Baḥr Shibīn, although after Sandafah the two appear to be back on the same course again until Damīrah. After that, the Maḥallah channel turns to rejoin the modern Dumyāṭ branch, as Ibn Ḥawqal's Tanūhah arm had done. Ibn Duqmāq (*Intiṣār*: 2.82) reports that the al-Maḥallah canal was seasonal.

The al-Maḥallah channel features in the histories of the Crusader invasion of Egypt of 1217-21. Having taken Dumyāṭ in 1219, the Crusader army in 1221 advance on Cairo, and made camp within the fork of the Dumyāṭ and Tinnīs branches, facing the Ayyubid army across the water. According to Ibn al-Āthir (*al-Kāmil*: 12.122), the Ayyubid rulers al-Kāmil and al-Ashraf sent galleys along the Maḥallah channel in order to cut off river-borne supplies reaching the Crusaders from Dumyāṭ. Al-Maqrīzī (*Khiṭaṭ*: 1.601) says the galleys were carried to the canal overland using camels. According to the Christian author of *L'Estoire de Eracles Empereur* (3.4.939r) – who believed that the Muslim ships had been sent "from the great river of Reissit [Rashīd] via a halige [Arabic: *khalīj*]" – the Muslims scuppered the ships in the Dumyāṭ branch, cutting off the Crusader supply chain.

Figure 3.5: Al-Ḍhāhiriyyah village, west of the Rashīd branch. The patterning of fields between village and river suggests the river course has moved east. (Google Earth™).

Finally, al-Idrīsī describes a channel departing his Maḥallah channel at Tur'at Bulqīnah, and continued to Ṣakhā. It is not safe to conclude from al-Idrīsī's text that this channel leading to Ṣakhā went on to join the Rashīd branch at Ṣanhūr al-Madīnah, as Toussoun (1925: 1.229) and others following him have done. Toussoun comes to this conclusion because of a dubious co-indexing of the pronoun *hā* ['it (f.)/she'] in al-Idrīsī's text. This is the result in turn of his misinterpretation of the Arabic word *tur'ah*, which in modern Egyptian Arabic is a canal, but which in classical Arabic is rather the mouth of a canal (Lane 1863-1893: 1.303). When al-Idrīsī writes of *Tur'at Bulqīnah* (*Nuzhat*: 3.339-40) he means 'Bulqīnah Canal-Mouth', which he specifically describes as "a village, of many gardens, densely-packed buildings, and crops. From it ... a canal bears west ..." (*Nuzhat*: 3.340). He does not mean 'Bulqīnah Canal', since the canal itself he calls "*khalīj* Bulqīnah" (*Nuzhat*: 3.336), *khalīj* being the term he employs for all the channels of the Delta. Thereafter, when al-Idrīsī writes that "from al-Maḥallah, fifty miles by land, is Ṣanhūr al-Madīnah, and Tur'at Bulqīnah joins it [*wa 'ilayhā taṣilu tur'atu bulqīnah*]" (*Nuzhat*: 3.339-40), the pronoun *hā* can only refer to al-Maḥallah, and not Ṣanhūr al-Madīnah, since Tur'at Bulqīnah is a village, and not the canal. What is meant is that Tur'at Bulqīnah is connected to al-Maḥallah on the al-Maḥallah channel. Al-Idrīsī puts the city of al-Sandafah 'opposite it [the same '*hā*'], a mile and a half to the east'. Again, he means the *village* of Tur'at Bulqīnah. Of the Bulqīnah canal, he says (Nuzhat, 3.340) that it "bears west straight to Ṣakhā" which is "amid land" [*wa Ṣakhā fi-l-burriyyah*]. Having named three towns on the canal before Ṣakhā, he names none after. There is therefore no reason to suppose that al-Idrīsī is proposing a connection by this route between the main western and eastern distributaries of the Delta.

Even though Ibn Ḥawqal did not mention the Bulqīnah channel two centuries earlier, it is named by his near contemporary, al-Mas'ūdī (*Murūj*: 2.363-364), who describes it as a major seasonal irrigation canal, opened when the Nile flood reached plenitude.

The Alexandria canal in the Mamluk period

The route of the main Alexandria canal described in the 12th century by Ibn Hawqal, al-Idrīsī and al-Makhzūmī underwent a radical reconfiguration in the Mamluk period. In the late 14th-early 15th century, al-Qalqashandī (*Ṣubḥ*: 3.304-5) reports that the offtake of the Alexandria canal at his time was at al-'Aṭf, where today the Maḥmūdiyyah Canal leaves the Rashīd branch for Alexandria (Appendix 2, Figures 1 & 2). That is some 40km further downstream from the 12th century offtake at Babīj (modern Abīj).

However, there was an also intermediate phase between the situation described by al-Idrīsī and al-Makhzūmī and the contemporary reality of al-Qalqashandī. The latter

author says that the canal's mouth on the Rashīd branch prior to the switch to al-'Aṭf had been at the village of al-Ḍhāhiriyyah, some 3km *upstream* from Abīj. Although al-Ḍhāhiriyyah, today called al-Ḍāhiriyyah, is now 2km west of the river, the field patterning to its east suggests it was once much closer, and that the river has migrated eastward (see Figure 3.5) As noted already, al-Makhzūmī and al-Idrīsī had in the 12th century each identified at least one Alexandria-bound canal mouth lying just *downstream* of Abīj. Al-Qalqashandī's evidence implies, therefore, that there was an intermediary situation.

That intermediary situation might be elucidated by consideration of the chronology of the changes outlined above. The configuration of the main Alexandria-bound channel described by Ibn Ḥawqal and al-Idrīsī appears to be a more-or-less seamless inheritance from the antiquity. Although the tenth-12th century Alexandria channel departed the Rashīd branch at Shābūr rather than Zāwiyat al-Baḥr as it perhaps did in antiquity, its subsequent course along the ancient Canopic branch and Schedia canal was unchanged. The addition of the Alexandria Canal rising below Maḥallat Babīj, as detailed by al-Makhzūmī, cannot be dated as an Alexandria-bound waterway before the 12th century, although its course until Farnāwah matches that of Ibn Ḥawqal's Farnawah loop.

Al-Maqrīzī (*Khiṭaṭ*: 1.459-466) gives a history of the Alexandria channel in which he details a number of occasions on which major works on the canal were carried out, and which begins to shed light on the chronological development from the situation described in the 12th century, through that described by al-Qalqashandī, to the modern day. Al-Maqrīzī reports works carried out in 245 AH (859/60)[3], 259 AH (873),[4] 404 AH (1013/4), 332 AH (943/4)[5], 662 and 664 AH (1263/4 and 1265/6), 710 AH (1310) and 826 AH (1422/3)[6], among others at unspecified times.

On the basis of al-Maqrizi's dates, Toussoun (1925: 1.210) propose a chronology for the changes in route, or at least point of offtake, of the Alexandria canal over time – although it should be noted that al-Maqrizi's account do not actually detail changes in route to accompany the works for which he gives dates. Toussoun suggests that the offtake of the canal shifted from Zāwiyat al-Baḥr to Shābūr in 330 AH (941-2; for locations see Appendix 2, Figure 1): it has already been noted that the evidence that the Alexandria channel *ever* began at Zāwiyat al-Baḥr in the Islamic era is thin. Moreover, authors other than al-Maqrīzī give dates of *earlier* excavations of the canal that might equally represent

[3] Al-Maqrīzī takes this from al-Kindī.

[4] Al-Maqrīzī takes this from *al-Sīrah al-Ṭulūniyyah.*

[5] Al-Maqrīzī takes this from al-Mas'ūdī.

[6] Al-Maqrīzī takes the dates from 662-826 AH from al-Musabbiḥī.

the shift to Shābūr, Severus (*Tārīkh*: V.42) reports that Egypt's Umayyad governor 'Abd al-'Azīz (684/5-705) had the channel excavated from 'the mouth of Nafīṭah [i.e. Naqīdah]' to Alexandria – that is, along its entire length. Al-Kindī (*Quḍhā'*: 469) reports a further excavation under the Abbasid Governor al-Ḥārith (851-859): Ibn Mufraḥ (*Siyar*: 3.3.746v) perhaps reports the same work when he says there was an excavation under the Abbasid Caliph al-Mutawakkil (847-861).

It appears, from al-Idrīsī and al-Makhzūmī, that by the mid-12th century there were two offtakes leading to Alexandria – one at Shābūr, and one just below Abīj (Appendix 2, Figure 16). The shift of offtake from Abīj to al-Ḍāhiriyyah – the location that al-Qalqashandī says was the offtake of the canal before his time – perhaps occurred during the works of the Mamluk ruler al-Ḍhāhir Baybars (1260-77) conducted in 1264/5 – the settlement at its mouth may have been named after him (Toussoun 1925: 1.208).

Toussoun further suggests the subsequent shift to al-'Aṭf took place as a result of the works of al-Nāṣir Muḥammad ibn Qalāwūn in 710 AH (1310). This theory fits with al-Qalqashandī's description, and also by the account of Symon Semeonsis (*Itinerarium*: 4.2.1192r), who in the early 1320s passed through al-'Aṭf on his way up the canal from Alexandria to Cairo. The route via al-'Aṭf was also subsequently taken by the Christian pilgrims Frescobaldi (*Viaggio*: 65-68), Sigoli (*Viaggio*: 13-16) and Gucci (*Viaggio*: 96) in 1384. Toussoun proposes that the subsequent shift to al-Raḥmāniyyah, took place in 1422 under the Mamluk Sultan al-Malik al-Ashraf Barsbāy (1422-38): al-Jabartī in the early 19th century, says the contemporary Alexandria canal rising at al-Raḥmāniyyah – after al-Qalqashandī's time – was called the Ashrafiyyah canal, probably after the Sultan (*'Ajā'ib*: IV.18, 277). Al-Maqrīzī (*Khiṭaṭ*: 1. 466) reports a major re-excavation of the Alexandria canal under al-Malik al-Ashraf, but again does not mention a change in offtake.

The *Description de l'Égypte* depicts this 'canal d'Alexandrie' rising at al-Raḥmaniyyah as it stood in the early 19th century (Jomard 1809-28: Atlas, pl. 36). The course of this pre-modern canal between its offtake and Kafr al-Ḥamaydah, where it met the ancient Canopic bed, cannot clearly be located in the modern landscape. West of Kafr al-Ḥamaydah, the route followed that of the earlier Alexandria canal.

The canal mouth switched back to al-'Atf in 1816 with Muḥammad 'Alī's excavation of the Maḥmūdiyyah canal: Al-Jabartī reports that the 19th engineers decided to cut the canal from the mouth of the old 'al- Nāṣiriyyah' canal – further suggesting that it was al-Nāṣir Muḥammad ibn Qalāwūn who had moved the canal mouth to al-'Aṭf. The reason was that the al- Nāṣiriyyah route was shorter (*'Ajā'ib*: IV.18, 277).

Summary

The above discussion represents the main historical cartographic dataset informing the attempt of this thesis to reconstruct the layout of the Nile riverscape in the early Islamic period. What is striking from the descriptions contained in the texts are the similarities between the medieval courses of the Rashīd and Dumyāṭ branches and their course in the contemporary riverscape. To a lesser exent, this also applies to secondary waterways such as the modern Baḥr Shibin, the Abū Diyāb canal, and the Baḥr Ṣaghir. Even where no correlation with modern waterways exists, the accounts of Ibn Ḥawqal and al-Idrīsī nevertheless allow the trajectories of waterways to be identified in a manner far more precise than is possible using pre-Islamic texts.

What is also striking from the Islamic-era accounts of the Nile is the absence of any account of the Canopic, and Pelusiac branches that were so prominent in the pre-Islamic period. Also absent is any branch entering the sea in the central Delta to correspond with the Thermuthiac or Athribitic Rivers of Ptolemy Claudius, or the Sebennytic branch of earlier authors. Given the absence of historical data for first three centuries of Islam, the timing of the decline of these branches must be found in other data sources.

The Canopic branch

It has already been noted that the Canopic branch is not entirely defunct even today. Its upper course between the Delta apex and Zāwiyat al-Baḥr persists, broadly, as the modern Rashīd branch. In the medieval period, its bed from there to al-Karyūn, ancient Schedia, peristed in much diminished form as a seasonal, flood-dependent waterway: it survives today along much of its length as the Abū Diyāb Canal.

The two possible references to a Canopic mouth by George of Cyprus and al-Khawārizmī already discussed are on their own too opaque to confirm that the Canopic branch reached the sea in the Islamic era. However, geoarchaeological investigations in Abū Qīr bay (Stanley *et al.* 2004a; Stanley *et al.* 2001) do suggest that the branch persisted in its entirety until the eighth century. These investigations located two former Canopic-mouth port cities, now submerged in the bay. The first, Heraklion, was occupied from around the sixth century BC to the first century, after which the Canopic mouth migrated westward within Abū Qīr bay (see Figure 3.6). A new city, Eastern Canopus, was founded at this new mouth. Arab-era gold coins found there indicate that it continued to be occupied until the mid-eighth century (Stanley *et al.* 2001). Stanley *et al* (2004a) suggest the city was destroyed in 741/2, when a major Nile flood induced catastrophic substrate failure, leading to the sinking of the river mouth area, including the city, into Abū Qīr bay.

Even this event did not mark the end of the distributary, however. The Canopic mouth subsequently migrated eastward to a new location within Abū Qīr bay (Chen *et al.* 1992; El Fattah and Frihy 1988; El-Bouseily and Frihy 1984; Stanley et al. 2004a) (see Figure 3.6). Stanley *et al.* (2004b) date the Canopic branch's final closure to some time at the beginning of the second millennium. It does not achieve prominence in the Islamic-era histories. Al-Bakrī (*al-Mughrib*: 86), for example, mentions no port apart from Abū Qīr between Alexandria and Rashīd in his coastal sailing itinerary from Alexandria to the Levant that would indicate a working port at the mouth of the Canopic branch.

However, a vestige of the Canopic branch downstream al-Karyūn/Schedia does appear to have survived into the 13th century, or at least to have been revived by then in canalised form. The author of *La Devise des Chemins de Babiloine* (1289-91) – a Crusader assessment of the defensive vulnerabilities of Egypt – writes that:

> "...on the other part of the river, going to Alexandria, there is a settlement [*casal*, see Hindley, Langley *et al* (2000: 104)] called Schidye where there is an arm of the river that goes to a settlement called Ethou, and forms a small lake [there]. By this branch, the merchandise of Sehid [= al-Sa'īd, i.e. Upper Egypt] and Cairo and Babylon is transported. And from there it is carried to Alexandria by land." (*Devise*: 245-246)

Such a channel is also described by al-Qalqashandī (*Ṣubḥ*: 3.307), who says it was, like it's parent waterway, seasonal.

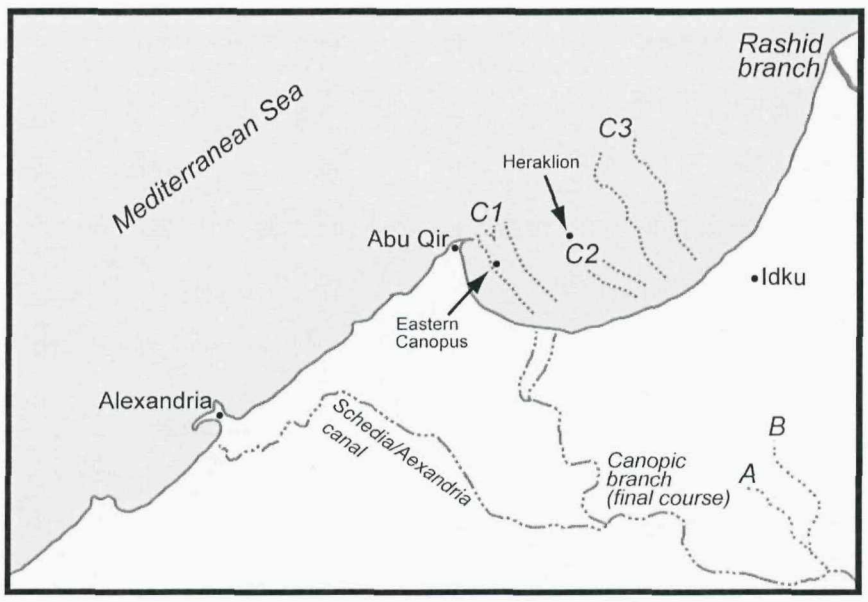

Figure 3.6: Paleochannels of the Canopic branch into and through Abū Qir bay, showing the course of the branch past Heraklion (C2) until the first century, and past Eastern Canopus (C1) until the eighth. Paleochannels channels A, B and C3 represent other (earlier?) Canopic channels (Stanley, Goddio *et al* 2004; Stanley and Jorstad 2006a).

The interesting point to note is the apparent presence of a waterway linking Schedia to Lake Idkū. Its point of connection with the Alexandria channel suggests it was a survival, or perhaps a canalisation, of the defunct Canopic branch surviving into the 13th century. Early modern cartography also captures such a link from the Alexandria channel through lake Idkū to the sea in the 18th century (Anon. 1790; Bourguignon d'Anville 1765; de Fer 1720; Homann 1715; Pococke 1743-45: 1.xvi; Robert de Vaugondy 1753; see Appendix 1, Figures 31-2, 35-7 in this thesis).

The Pelusiac branch

Like the Canopic branch, the Pelusiac branch of the ancient authors is absent from the Islamic-era Nile geographies. It had been in slow decline since at least 3100 B.P., when a dwindling flow prompted the abandonment of the royal city of Avaris in favour of Tanis (Bietak 1981; Butzer 1975). Geological investigations indicate that its sea mouth was finally blocked by the rapid formation of a strand plain – a flat area of marine sedimentary deposits – that in the 1970s stood 35km long and up to 12km wide. Initial investigation of this feature by Sneh and Weissbrod (1973), involving the carbon-dating of mollusc-shell deposits on beach ridges on the plain, concluded that it started to form around 25 AD ± 90 years. Thus, by their analysis, the distributary was defunct long before the Arab conquest.

As Sneh and Weissbrod themselves acknowledge, their dating conflicts with historical texts. Apart from featuring in Ptolemy's geography (*see above*), the Pelusiac branch is also illustrated in the fourth-century Peutinger Table (Ball 1942) (Appendix 1, Figure 8), and its mouth is mentioned in the fifth-century work of Martianus Capella (*Nuptiis*: 2.2.284v). Albeit problematically, Suhrāb suggests it might even have existed in the tenth century (*see p.39*).

The Pelusiac branch had in antiquity formed the eastern flank of the navigable Delta. The Roman-era *Apospasmatia Geographica* (2.3.425v) described it as "the first mouth of the Nile for those coming Asia", meaning the Levant. Its existence is noted in historical and iconographic reference as early as the 13-14th centuries BC (Daressy 1929; Sneh and Weissbrod 1973).

Subsequent geological work by Goodfriend and Stanley (1999) extends the life of the branch beyond the first century, reconciling it with the historical accounts, and bringing it into the Islamic era. Using amino-acid racemisation and radiocarbon dating of shells from a number of core samples taken at sites across the plain, they propose a geological age for the strand plain of between 800-1100. They further conclude that the entire plain formed in less than 60 years, the result of a major reworking of pre-existing coastal sands.

Goodfriend and Stanley propose (1999: 150) that the agent of the formation of the strand plain was a series of major Nile floods in the early ninth century that "triggered [a] sequence of rapid Nile evolution, starting with the blockage of the [Pelusiac] branch and opening of the Dumyāṭ branch." By their interpretation, "the floods would have swept vast quantities of pre-existing delta sediments into the sea, as [the Nile's] new course evolved across the delta." The sediment would have found itself transported to and deposited in the Pelusiac mouth area by the west-to-east longshore currents of Egypt's Mediterranean coast (Emelianov and Shimkus 1972; Frihy *et al.* 1988; Manohar 1981; Said 1958; Sestini 1989; Sharaf el Din 1977; Stanley and Hamza 1992; Stanley *et al.* 2004b; Summerhayes *et al.* 1978).

In particular, Goodfriend and Stanley propose a link between these cataclysmic events and three major Nile floods that historical data (Hassan and Stucki 1987) show occurred in the years 813, 816 and 820. They propose these years in part because of the exceptional magnitudes of those floods, but also because of a reference to the city of al-Faramā in al-Ya'qūbī (*Buldān*, 330), who visited the region in the 870s and described the city as being three miles from the sea. They take this as evidence that the strand plain had already been deposited by that time. In fact, al-Ya'qūbī's description of al-Faramā's location relative to the sea is not very different from Strabo's, eight centuries earlier. Strabo puts Pelusium "more than twenty stadia [3.7km] from the sea" (*Geographia*: XVII.1.21).

Whatever its fate in the ninth century, the historical data do suggest the branch had disappeared by the early tenth. Al-Maqrīzī (*Khiṭaṭ*: 1.119, 2.103 3.577) relates two historical events that suggest the waterway was no longer available to navigation by then. He writes that when the Abbasid Caliph al-Muktafī Bi-llāh sent a fleet from the Levant against Harūn, the Tulunid ruler of Egypt, in 903-4, those ships met the defending Egyptian navy at Tinnīs – not al-Faramā. Likewise, in 934-5, the future Ikhshidid ruler of Egypt Muḥammad bin Tughj sailed from the Levant with a fleet to wrest control of Egypt from the Tulunid Ibn Kayghalgh. The latter sought to prevent Bin Tughj from taking al-Faramā by sending a navy from al-Fusṭaṭ to Tinnīs – suggesting again that the more direct Pelusiac branch itself was no longer available to him.

Later in the century, al-Muqaddasī (945-988 A.D) (*Aḥsan*, 201-2, 212-4) provides a set of trans-Egyptian itineraries that include routes to al-Fusṭāṭ from Dumyāt, Tinnīs and al-Faramā: the first two are given as river journeys, but the latter as a land itinerary. Al-Muqaddasī does provide two waterborne itineraries from al-Faramā, but these are by sea or lake to Tinnīs, Dumyāṭ and Alexandria. None are by river. Likewise, Qudāmah, writing c.930, places al-Faramā on the two main land routes – one summer, one winter – from the

Levant into Egypt (*Kharāj*: 219-220). The summer route passes through towns formerly on the Pelusiac branch, such as Fāqūs and Bilbays, yet Qudāmah makes no mention of a river there.

A description of the city of al-Faramā by the geographer al-Muhallabī (*Masālik*: 3.88) gives compelling evidence that the branch was defunct by the late tenth century. Writing during the reign of the Fatimid Caliph al-Azīz (975-996), he describes the city as:

"... a fortification on the sea shore, fair, but with foul air, because on every one of its sides there is surrounding marsh, and it is often foggy in summer or winter. It has no agriculture, and no drinking water except rain that is stored in cisterns. They also store Nile water that is carried to them in boats from Tinnīs and, from the surrounding desert, water called al-'Udhayb, and other water from far-off wells that are deep and brackish."

Clearly, al-Faramā was no longer on a Nile distributary by this time.

The Pelusiac branch was partially and artificially revived in the 12th century with the excavation of the Abū-l-Manajjah canal, which al-Maqrīzī (*Khiṭaṭ*: 1.191) says was excavated in 506 AH (1112). It followed the defunct natural channel as far as Shibīn al-Qanāṭir. By the 15th century, al-Zāhirī says the canal, extended and renamed the Banī Manajjah canal, ran to the sea at Tīnah, close to al-Faramā (Toussoun 1925: 1.229). It was open only during periods of high Nile (Paton 1870; Ibn Duqmāq, *Intiṣār*: 2.51), and did not attract interest from later geographers, suggesting it was not a navigation of significance.

Central Delta distributaries

By the time of Ibn Ḥawqal and al-Idrīsī, it appears that the central Delta was empty of distributaries flowing independently to the sea. The picture in the earlier centuries of Islam is not so clear. Ibn 'Abd al-Ḥakam (*Futūḥ*: 6) and subsequent Arab authors name, but do not describe, a 'Ṣakhā' channel which Toussoun (1925: 1.186) identifies with Ptolemy's Thermuthiac River on the grounds that the latter had also passed close to the eponymous town of Ṣakhā. He suggests that by the onset of Islamic era the Thermuthiac River, now the 'Ṣakhā' channel, emptied into the coastal lagoons, presumably Lake Burullus. However, this is conjecture. It is true that, on the eve of the Islamic conquest, George of Cyprus cites two Nile 'mouths' – Paralos and Chasmatos – as lying between the Rashīd and Dumyāṭ branches. Murray (1942: 176) proposes that Chasmatos is the Pineptimi 'false mouth' of Ptolemy Claudius, through which the Athribitic branch flowed. The Paralos mouth, he suggests, indicates a surviving Sebennitic branch. While Murray also notes the etymological connection between 'Paralos' and 'Burullus' he does not allow the possibility that this 'mouth' may simply have been an early mention of the entrance to the Burullus

lagoon. Ptolemy Claudius gives no reason to suggest a surviving Sebennitic branch even in the second century AD, let alone the seventh. Association of the Chasmatos mouth with the Pineptimi 'false mouth' is, likewise, conjecture.

The Nile-Red Sea canal

The historical accounts offer quite precise dates for the creation and ultimate blockage of the Canal of the Commander of the Faithful, which linked the Nile to the Red Sea canal in the seventh-eighth centuries. According to al-Kindī whose lost work *al-Jund al-Gharbī* is cited in al-Maqrīzī (*Khiṭaṭ*: 3.474), 'Amr ibn al-'Āṣ had the former Roman Nile-Red Sea canal re-excavated " ... in the year 23 A.H. (643-4), and completed it in six months."

As for its duration, al-Kindī says the canal was still in use under the Caliph 'Umar bin 'Abd al-'Azīz (717-720). However:

> "The [Caliphs] after that neglected it. They abandoned it, and the sands overwhelmed it. Its terminus became Dhanb al-Timsāḥ, near Baṭḥā' al-Qulzum."

Al-Mas'ūdī places Dhanb al-Timsāḥ one *mayl* from al-Qulzum (*Murūj*: 4.97).

However, according to the lost work of Ibn Qudayd, again cited in al-Maqrīzī, the cause of the demise was not neglect. Rather:

"...the Caliph Abu Ja'far al-Manṣūr [754-5] ordered the blocking of the canal ..."

Al-Baladhūri (*Ansāb*: 1.269) agrees with this version of events.

Figure 3.7: The blocked mouth of the Cairo Canal, final manifestation of the Nile-Red Sea Canal, at Fumm al-Khalīj Square, Cairo from a-Rawḍah (Roda) Island. The blockage of the canal mouth appears to be indicated by the sloping revetment wall visible in the picture, which contrasts elsewhere with a vertical wall. The steps to the right served a now-defunct ferry to Rawḍah Island.

The writings of the eighth century Christian pilgrim Fidelis suggest that this later date is the correct one. Fidelis traveled on the canal in 750 during his pilgrimage to Mount Sinai through al-Qulzum and the Sinai port of al-Tūr. He writes:

> "Having embarked on a boat in the river Nile we navigated to the entrance of the Red Sea. From this port to the eastern shore, until the way of Moses by the Red Sea, the way is short" (in Dicuil, *Mensura*: 27)

Having been cut off from the sea, the canal continued to function along at least part of its length. In the 12th century, Abū Sāliḥ says that the canal:

> "...has its end at al-Sadīr in al-Sharqiyyah [province], where there is a dyke." (*Tārīkh*: ٧٤)

Al-Sadīr is unknown today, but Yāqūt (*Buldān*: 3.61) visited it, describing it as a "a marsh and bush area in Egypt between al-'Abbāsah and al-Khashabī into which pours the overflow of the Nile when it rises ... It is first place you come to in Egypt going from the Levant to Miṣr". Al-'Abbāsah still exists (see Appendix 1, Figure 1), at the western entrance to the Wādi Ṭumaylāt. Yāqūt says that al-Khashabī, unknown today, was a caravanserai three days from al-Fusṭāṭ "at the first part of al-Jifār province, when coming from Egypt, and the last part when coming from the Levant." (*Buldān*: 2.445). Taken together, the descriptions suggest a location in the central Wādi Ṭumaylāt, an area that was marshy and received waters from the Nile flood as late as 1800 (Bourdon 1925: 18; Brigade Française 1847).

By the time of the Napoleonic expedition at the turn of the 19th century, the canal emptied into the lake known as Birkat al-Hajj or Birkat al-Jubb, some 25km north of Cairo (Honigmann and Ebeid 1986: 368). The section through Cairo was filled in 1899.

The route of the canal can be identified along much of its length using regressive cartography. The blockage of its 19th century mouth is still visible at Fumm al-Khalīj Square, Cairo (see Figure 3.7). Its original Islamic-era mouth was further inland, in al-Sayyidah Zaynab square: the sinuous course of the canal between these points perhaps reflects the canal's following of the westward progradation of the Nile during the 12th and 13th centuries (Jomard 1809-28: État Moderne, tome 1, pl. 15, 26; Raymond 1993: 16, 66; see Figure 5.2 in this thesis). North of al-Sayyidah Zaynab square, the canal follows the course of modern Port Said Street. Thereafter, Linant (1872: 125) reports that the canal bed is occupied by that of the Sweet Water Canal as far as the village of Kafr Hamzah (Appendix 2, Figures 1-2). The vestigial canals of the Wādī Ṭumaylāt were traced by the Brigade Française (1847) during the construction of the Suez canal with orthographic

accuracy. The proposed course of the canal through the Wādī Ṭumaylāt and Isthmus of Suez proposed in this thesis (Appendix 2, Figure 13) is based on the Brigade Française map, supplemented by the maps of the Compagnie Universelle du Canal Maritime de Suez (1920); the Survey of Egypt (1924-50) and Bourdon (1925: Cartes I-IX).

The Coastal Lagoons

As the cartography of al-Idrīsī in particular has already demonstrated, the lagoons of the Delta coastal plain were an important element in the riverscape of the medival Nile, particularly Lakes Abū Qīr and Idkū, which constituted one route to Alexandria, and Lake Tinnīs, through which the port city of Tinnīs was reached.

Lakes Burullus, Abū Qīr and Idkū

The dwindling of the distributaries that had flowed through the central Delta in antiquity was in part responsible for the expansion of the Burullus lagoon, which, like the other major lagoons along the Delta coast, was growing and expanding southward in the early Islamic period (Arbouille and Stanley 1991). As the sedimentary supply from the distributaries dwindled, the rate of marine erosion of the coastal zone began to outstrip that of fluvial deposition. The same process was under way in the Abū Qīr bay area, where the Canopic branch was in terminal decline. These areas were further subject to a more generalised substrate subsidence that was compounded by a modest rise in sea level (Audebeau 1919; Cordier 1809; El-Sayed 1988; Le Père 1809; Stanley 1990; Stanley and Warne 1993). The net consequence of land subsidence, rising sea levels and diminished Nilotic deposition was the expansion of Lakes Burullus, Idkū and Abū Qīr during the early Islamic period (Butzer 1976; Hayes 2006; Sestini 1976, 1989). All of these coastal lagoons were connected with the sea through small openings in the limestone bars that formed their seaward littoral (Ibn Sa'īd, *Jiyūghrafiyyah*: 4.1.1087v-1088r; al-Muhallabī, *Masālik*: 1.276-7; Yāqūt, *Buldān*: 1.881-4); Mas'ūdī, *Murūj*: 2.364; Ibn Ḥawqal, *Ṣūrat*: 92; Nasir i Khusraw, *Safarnama*: 39; al-Bakrī, *Masālik*: 3.3.730r; Qazwīnī, *'Ajā'ib*: 49v).

The rôle of Lakes Abū Qir and Idkū in forming a navigational route between Alexandria and the rest of the Nile waterway network was noted by al-Idrīsī. The position of Lake Burullus should also be taken into account. That it was probably a constituent element of the Za'farāniyyah waterway of Ibn Ḥawqal has already been noted, as has the cartographic evidence for the connection of the lake to the Rashīd branch downstream of al-'Aṭf in later centuries. However, there is also other, later evidence that the lake was also connected by waterways to both the Rashīd and Dumyāṭ branches further upstream.

Lake Burullus was also known as Lake Nastarū (or Nastarāwah) after the eponymous

island city that stood within it (Ibn Ḥawqal[7], *Ṣūrat*: 138-9; Abū al-Fidā, *Taqwīm*: 38-9, al-Qalqashandī, *Ṣubḥ*: 3.292). The connection from the sea mouth via the lake and onward to the Nile is referred to by the Venetian traveller Marinus Sanutus in 1321, who names this route 'Strion', which he says is one of the four large branches of the Nile, albeit a shallow one for small vessels (*Liber Secretorum*, 1.4.25-6). He places the mouth five miles from Burullus, and 40 from Rashīd, a location that correlates well with the modern mouth of Lake Burullus (Appendix 2, Figure 2). A waterway connecting 'Sturo' to somewhere near the apex of the Delta is also noted in the 14th century by the Pizzigani brothers (Appendix 1, Figure 21). The fact that Strion/Sturio/Sturo is one of the very few places named on these maps, and on the Pisan Carte Marine (Appendix 1, Figure 22), suggests a location of some navigational familiarity and importance to 14th century Italian travelers.

The network of connections between the lake and the major Nile waterways is complex, and its chronology not clear from the texts or cartography. The short connections between the Lake and the Rashīd branch first depicted in the manuscript copies of Ibn Ḥawqal's map have been discussed above. These short canals were however not the only connection between Lake Burullus and the wider Nile network. In the 15th century, al-Qalqashandī (*Ṣubḥ*: 3.292) says that the lake was linked by a channel to the Rashīd branch at al-Farastaq, considerably further upstream (Appendix 2, Figure 1). Something like that connection is depicted a century later by Celebi (Appendix 1, Figure 31), and in the 18th century by Robert de Vaugignon (Appendix 1, Figure 36) and Pococke (Appendix 1, Figure 37). Both 18th century maps show the connection being to the eastern end of the lake. The maps of the *Description de l'Égypte* show a similar route from the eastern end of the lake that comes within 3km of al-Farastaq (Jomard 1809-28: Atlas, pl 36. 40), but does not, ultimately, connect to the Rashīd branch. Between Barsīq and Ṣurad, *the Description de l'Égypte* route correlates closely to the modern Mashāt canal (see Appendix 2, Figure 2). Thereafter, it follows the al-Qāṣid canal to the lake (see Appendix 2, Figure 2). Both Toussoun and Ball propose parts of this stretch of the al-Qāṣid canal as parts of the Thermuthiac branch of Ptolemy Claudius.

Early modern cartography also indicates a connection between Lake Burullus and the Dumyāṭ branch at several points along its length. Connections are also indicated by Piri Reis, d'Abbeville, Celebi, de l'Isle, de Fer, Robert de Vaugignon, Pococke, and d'Anville (Appendix 1, Figures 26, 31-32, 34, 36-8), as well as in the Description de l'Égypte maps (Pococke 1763: Atlas, pl. 35, 41).

[7] Ibn Ḥawqal actually names the lake al-Bashmūr, but he places Nastarāwah on an island in it, and Burullus at its northern shore.

These connections between the Burullus lagoon and the wider Nile Delta network, together with its connection to the sea at Burullus, gave the lagoon a certain strategic significance throughout the medieval period. The eponymous port of Burullus at the lagoon mouth was considered one of the *thughur*, or frontier towns, of the Delta coast (al-Ya'qūbī, *Buldān*: 338; Ibn Zūlāq, *Faḍā'il*: 3.2.685v).

Lake Tinnīs

The region of Lake Tinnīs was affected by the same eustatic and isostatic processes impacting upon other coastal regions of the Delta. In addition, however, is was also subject to localised tectonic processes that were responsible for a substantial expansion of the lagoon area in the mid-late first millennium. The region is bounded to the northwest and southeast by two major geological faults lying perpendicular to the coast (see Figure 3.8). The area in between these has been subsiding at a rate of about 0.5cm/yr for some 7500 years (Orlova and Zenkovich 1974; Stanley 1988, 1990). This subsidence was accompanied by sea-level rises of ~1mm/yr over the same period (Milliman and Haq 1996). The net outcome of these processes was the formation of a depression that in turn experienced inundation, resulting in the expansion of Lake Tinnīs over an area comparable with Lakes Manzalah, Belīm and Mallāḥah (Sestini 1976), the latter two of which are today areas of increasingly reclaimed marshland rather than lakes (Appendix 1, Figure 2).

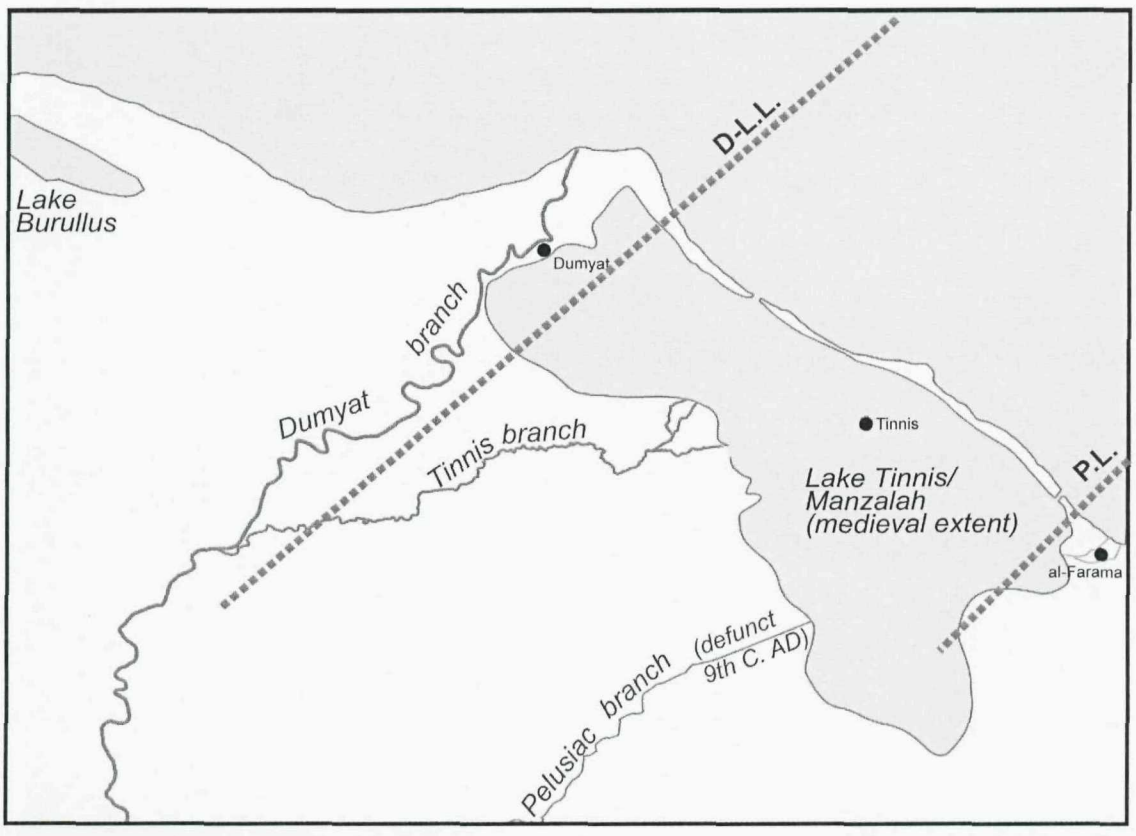

Figure 3.8: Fault lines (D-L.L. and P.L) lying perpendicular to the northeastern Delta shore, and enclosing Lake Manzalah (Stanley 1988: 499)

The contemporary Lake Manzalah is predominantly less than 1m deep, and rarely more than 2m, since the depression caused by the tectonic subsidence has acted as a sink for Nile sediments (El-Wakeel and Wahby 1970; Randazzo *et al.* 1998; Stanley 1988, 1990). Nevertheless, this depth was enough to allow Lake Tinnīs to become an important waterway at least until the abandonment of the city of Tinnīs, probably in the early 13th century (see Section 5.3). Al-Ya'qūbī, the first author to mention the place of Islamic-era Tinnīs in international trade, says of the lake that "large ships and boats sail in it" (*Buldān*: 338). The lake was, as it is now, separated from the open sea by a narrow sand bar, one or more natural gaps in which allowed the passage of both water and maritime traffic. In the modern era, the connection is at al-Jamīl, some 14km west of Port Said (El-Wakeel and Wahby 1970; Montasir 1937). The historical texts suggest a picture that varied over time. Al-Muhallabī (*Masālik*: 1.276-7), in the tenth century, describes a single opening at the fort of al-Ashtūm, which he places six farsakhs (33km) from Tinnīs island and three farsakhs (16.5km) by water from al-Faramā. That suggests a location east of the modern Suez canal. In the 13th century, Yāqūt (*Mu'jam*: 1.881-4), gives his own description of the connection between lake and sea:

> "Between [Lake Tinnīs] and the Great Sea is a bar of land, an island between the two seas. The start of this land is near to al-Faramā and al-Tīnah, where there is an opening through which the Great Sea enters Lake Tinnīs at a place called al-Qurbāj. Here boats cross from the al-Faramā bank to the land bar ... One travels for around three days along that bar until one approaches Dumyāṭ, where there is another opening between the Great Sea and the Lake. The mouth of the Nile is close to it." (*Taqwīm*: 1.881-4)

Yaqūt's description is reflected in al-Qazwīnī's geography of later in the century, the British Library manuscript of which also includes a diagram of the lake and its connections with the land and sea (Appendix 1, Figure 20). Dual mouths are also indicated in the cartography of Piri Reis (Appendix 1, Figure 24-25). One of those was guarded by the tower of al-Tīnah, the ruins of which were still visible in the 19th and early 20th centuries (Clédat 1923: pl. II; Spratt 1859: A). The vestiges of the Lake inlet beside the ruins al-Tīnah are still visible on satellite imagery (Google Earth™: 31° 3'37 N, 32°30'44"E; see figure 5.9).

By the time of the *Description de l'Égypte*, the main mouths of the lake were called Foum el-Fareg and Foum el Debeh: sixty years later, Spratt (1859: A) says these were

"now impracticable; the latter being entirely closed and its tower retired fully half a mile by the encroachment of the shore since the French expedition." He noted also that the new Jamīl mouth that replaced them had itself moved "3/4 of a mile in less than 20 years."

The relative paucity of the flow of Nile water through the distributaries entering Lake Tinnīs outside of the flood period is indicated by the changing salinity of the water of the lake according to the time of year. Several authors from the period – al-Mas'ūdī (*Murūj*: 2.364), Ibn Ḥawqal (*Ṣūrat*: 92), Nasir i Khusraw (Safarnama: 39), and al-Bakrī (*Masālik*: 3.3.730r) – describe the phenomenon by which the lake water was fresh for six months of the year as a result of the Nile flood, and saline for the remaining six months. The inhabitants of Tinnīs took their drinking water from the lake during the former period, filling cisterns to tide them over the to latter (*see Tinnīs, section 5.3*).

The geological processes behind the expansion of Lake Tinnīs/Manzalah probably also underlay the dwindling of the Pelusiac branch and the emergence of the Dumyāṭ branch as the principal distributary of the eastern Delta (Coutellier and Stanley 1987; Orlova and Zenkovich 1974; Stanley 1988, 1990; Stanley and Warne 1993; van Wesmael 1988). They perhaps also explains the constantly changing configuration of the other branches distributing to the east of the modern Dumyāṭ branch described by the ancient and medieval authors already noted.

Lake Maryūṭ (Mareotis)

Unlike the coastal lagoons, Lake Maryūṭ was landlocked, receiving instead fresh Nile water from a number of canals. It was also in antiquity far more extensive than it is now, stretching much further south, and incorporating a total area of some 700km^2 (Goodfriend and Stanley 1996). The lake had received water via the Schedia, al-'Azārah and other canals since antiquity. It is this latter waterway that Suhrāb appears to describe rising from the Baḥr Yūsuf and flanking the western Delta, and which is depicted on several 18th century maps (*see Suhrāb in Section 3.3*). If the association between this and the Dhāt al-Sāḥil canal of al-Mas'ūdī (*Murūj*: 2.363-364) is also correct, then this too was a seasonal waterway. Another canal supplying the lake in the 12th century appears to have been the al-Tayriyyah (Tabarinah) canal of al-Makhzūmī, which had its offtake further downstream, at al-Tayriyyah in the Delta (see Appendix 1, Figure 18). The sporadic flow through these channels would partly help to explain why Lake Maryūṭ had dwindled to little more than salt lakes and sabkhas by the 12th century (De Cosson 1935; Goodfriend and Stanley 1996; Warne and Stanley 1993). It does not appear from the medieval texts to have been a significant waterway as it had been in antiquity.

3.4 Conclusion

The early centuries of Islam were a period of significant change in the configuration of the major waterways of the Nile, particularly in the Delta region. The two major Nile distributaries of antiquity, the Canopic and Pelusiac branches, ceased to be the major waterways that they had been in antiquity, the former dwindling to insignificance by the end of the first millennium, and the latter ceasing to flow in the ninth century. With the demise of the latter, the most easterly route to the sea was now through distributaries leading to Lake Tinnīs, in which the eponymous island city lay. The Dumyāṭ branch formed a second connection to the sea in the eastern Delta.

In the western Delta, the Canopic branch was a spent force. The catastrophic destruction of the river-mouth city of Eastern Canopus in the eighth century had much diminished its navigational significance, and by the tenth century it had transformed into a seasonal waterway serving Alexandria through the erstwhile Schedia canal. The sole surviving natural distributary in the western Delta was the Rashīd branch.

A number of artificial canals emerge as significant to this study. For a little over a century after the Islamic conquest, the ancient Nile-Red Sea canal once again allowed vessels to sail from what is now modern Cairo to Suez – it will be shown in the next section that this was a highly seasonal canal. Later, some time before the 12th century, a canal was excavated between the Rashīd branch near the city of Rashīd and Lakes Idkū and Abū Qīr, creating new possibilities for vessels sailing the Nile to and from Alexandria. The Alexandria canal, meanwhile, had to be artificially maintained, and its offtake was changed several times, especially in the Mamluk period, in a bid to improve the duration of its navigable season.

This chapter has established, as much as is possible given the data available, a geographical layout and chronology for the main waterways of the Nile in the early centuries of Islam. Time-slice maps summarising the course and chronologies of these waterways are shown in Appendix 2, Figures 12-19. These maps set the stage for an interpretation of these waterways in the context of environmental and navigational conditions found on them, and the geopolitical and economic events of the period.

4. Navigating the Nile

So far, this thesis has sought to identify, locate and give a chronological period to the principle navigable waterways of the Egyptian Nile in the medieval period. This next section considers what it was like to navigate one those rivers, canals and lakes. In particular, it considers those environmental conditions that influenced the navigational experience. In doing so, it does not assert these as the only factors determining the existence or choice of route, but rather adds these as the next 'layer' of data relevant to an understanding of life and activity on these waterways. By presenting and examining available hydrological, meteorological, and historical data, this section draws conclusions that are relevant to our understanding of the choices made in the location of the major river and sea ports of medieval Egypt. This section argues that navigation on the Nile, was a more laborious and far less passive activity than has previously been recognised. It also emphasises the seasonality of Nile navigation – not only on the flood-dependent canals identified in the previous section, but throughout the river network. This seasonality was particularly the case for laden cargo vessels, and is an important factor in understanding the interaction of waterborne activity on the Nile with that of the adjacent Mediterranean and Red Seas. This section also highlights the treacherous conditions at the mouths of the Nile, and the implications this had for navigators choosing their route between river, lake and sea.

4.1. Introduction

> "Nile navigation was easy." (Semple 1932: 159)
>
> "...navigating on the Nile was comparatively dangerous and required much skill and experience" (Goitein 1967: 1.296).

It has been widely observed that the environmental conditions on the Egyptian Nile were uniquely felicitous for waterborne transportation: the river flows, with some exceptions, in a broadly northerly direction, while the prevailing winds blow, again broadly, in the opposite (Mayhoub and Azzam 1997; Semple 1932: 159; Willcocks 1890: 39). Lane, in the 19th century , captures this idyllic view thus:

> "... while vessels with furled sails are carried down by the stream with great speed others ascend the river at almost equal rate, favoured by the strong northerly winds, which prevail most when the current is most rapid." (Lane 2000: 30)

By this view, Nile navigators appear almost passive, indeed absent, creatures. Boats drifted downstream, leaving a crew with little to do but tweak the tiller to maintain course. Travelling upstream, crews had only to hoist sail: the winds did the rest.

This observation of navigational conditions contains within it a certain truth, albeit highly generalised, as the data presented in this section shows. However, the reality of navigating the Nile was far more nuanced: it was an active, variable and hazardous enterprise requiring far more expertise and physical effort than Lane, Semple and others suggests. In short, the sailing conditions discussed in this chapter favour the view of Goitein, quoted above.

4.2. Hydrology: the Cycle of the Nile

The Nile flood

> "Among the rivers of the world there is none referred to as 'a sea' apart from the Nile of Egypt, given its size and its inundation." (al-Maqrīzī, *Khiṭaṭ*, 1.133, quoting al-Mas'ūdī).

The first factor to consider in understanding Nile navigation is water level, changes in which affected the extent, speed, risk and indeed viability of navigation on all the Nile's waterways.

Egypt's river is dependent for its flow not upon meagre local precipitation, but on rains falling on the distant African Lakes plateau and Ethiopian highlands. In the former region, rain falls all year, peaking in April. In the latter, the pattern is highly seasonal: rains begin to fall in March or April, building to torrents in July and August (Hurst 1952: 6-7; Shaheen 1985: 105-8; Springuel and Ali 2005: 349). These uneven rainfall patterns are felt in Egypt in the form of the annual, and highly predictable, Nile flood. Before completion of the Aswan high dam in 1964, the onset of the flood was normally detected in Egypt in mid-late June. The rise in water levels accelerated during July and August, peaked in late August or September, and rapidly fell away again in October and November. The curve of the water volume discharged at Aswan in a typical year in the early-20th century is shown in Figure 4.1. The lag before the corresponding level reached the Delta apex was as little as six days during the flood, and almost two weeks at low Nile (Atkinson 1934: 1.87; Hurst 1952: 270).

The annual flood was fundamental to the economic life of Egypt. Until Muhammad Ali introduced perennial irrigation to parts of the country in 1820 (Willcocks 1890: 164), the country's irrigation system, and therefore the sustenance of the entire population, was almost entirely dependent upon it.

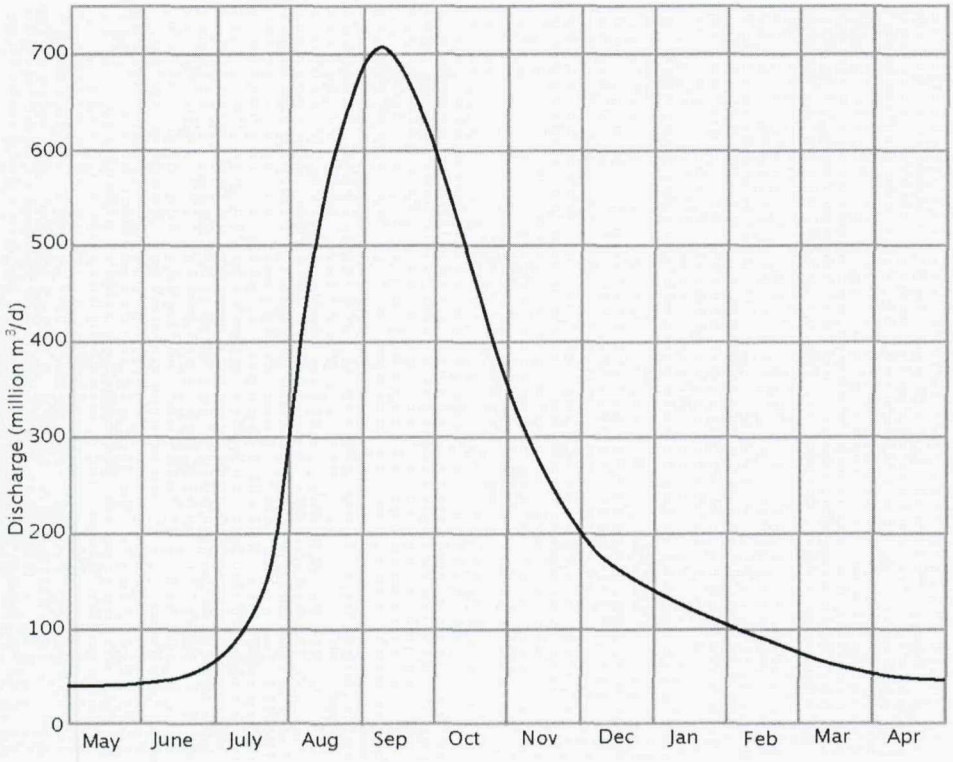

Figure 4.1: Annual discharge of the Nile at Aswan, after Hurst (1952: 241)

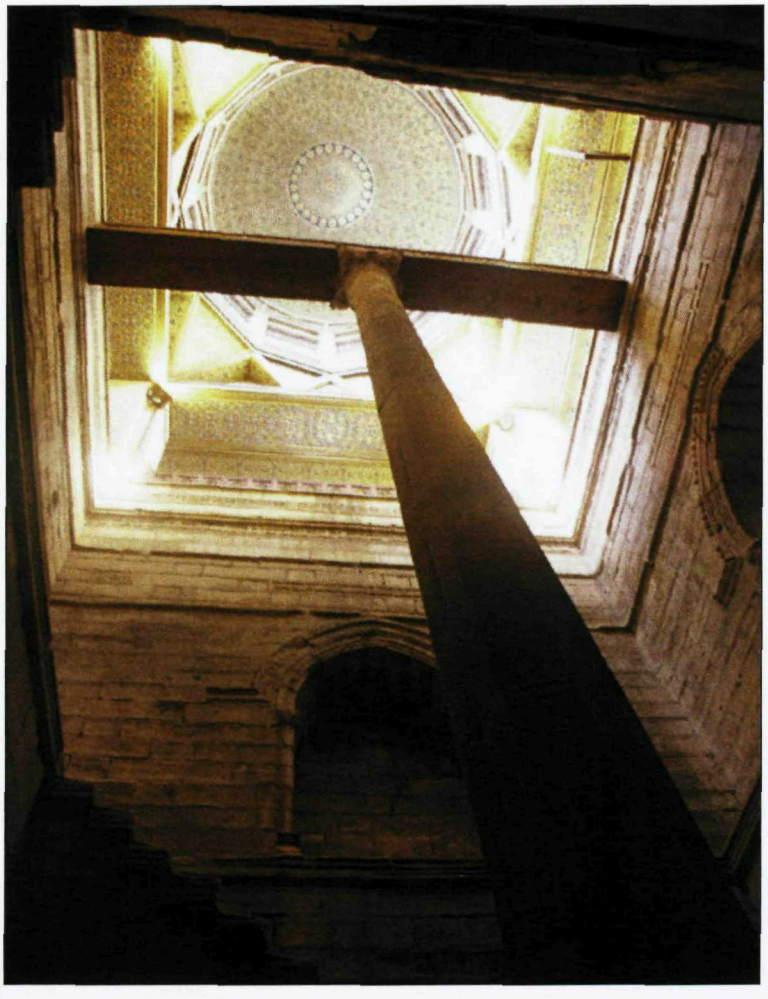

Figure 4.2: The Nilometer at Rawḍah, viewed from within the well. The level of the Nile was measured using a scale carved on the central column (Photo: John P Cooper)

The progress of the flood was therefore closely monitored and measured using a device known as the nilometer, a practice established in pre-Islamic eras (Ardagh 1889: 28-9; Bell 1970; Borchardt 1906; Lutz 1923; Pearl 1956; Popper 1951: 5; Westermann 1919). From 715, the principal nilometer of Egypt was that of al-Rawḍah Island, facing al-Fusṭāṭ, today in modern Cairo (Kubiak 1987: 47; Popper 1951: 16) (see Figure 4.2). Its central function was as predictor of the harvest and arbiter of the *kharāj* or land tax.

One helpful consequence of the importance that Egyptians attached to the measurement of the flood is that data on the levels of the Nile at al-Rawḍah have been preserved in historical sources for most of the period from 641 until the twentieth century (Aguado 1982; Evans 1990; Popper 1951: 91). The data confirm that the cycles observed in modern times pertained also in the medieval period.

While the *levels* of the flood are recorded for almost the entire period since the Islamic conquest, there is no data on its *timing* from before 1074. Data for the 11th and 12th centuries suggest that the river in that period normally reached 'plenitude' (Arabic: *wafā'*) in early-to-mid September, while data for later centuries suggest that it was more normally reached in August (see Table 4.1). Plenitude was not the maximum level reached by the river in a given year, but rather the point at which the river was deemed to have achieved the level required for normal irrigation of most agricultural lands and payment of *kharāj*. This was, by convention, when the gauge on the nilometer read 16 cubits (Popper 1951: 69). Given the trajectory of the curve indicated in Figure 4.1, the flood maximum must have followed soon after: it was normally no more than 3 cubits (1.4m) above that level (Popper 1951: 105, 173-179). Indeed, the data available for the timing of the maximum suggest that it was normally reached in late September or early October (Popper 1951: 87-88).

Low Nile, as Figure 4.1 suggests, lasted broadly from February to June. During this time, the river felt the effects of the dry season in the Ethiopian highlands: the flow of water into Egypt at Aswan was typically less than 7 per cent of what it was at the height of the flood (Dawson 1909: 12; Hurst 1952: 241). The lowest point was normally reached in Lower Egypt in early June. A Coptic ceremony anticipating the onset of the new flood was performed annually on St Michael's Day, 12 June ('Abd al-Laṭīf, *Ifāḍah*: 111; al-Qalqashandī, *Ṣubḥ*: 3.293). Its origins can be traced back to Pharaonic times (Popper 1951: 68). The event implies that the start of the flood was normally imminent on that date. Indeed, in the medieval period, daily measurement of the rise normally started on or close to 20 June (Popper 1951: 64-67).

Years (AD)	Number of data	Average date
641-850	0	-
851-1040	0	-
1041-1080	6	Sep 19-20
1081-1250	12	Sep 1
1251-1330	48	Aug 29
1331-1380	20	Aug 25
1381-1522	138	Aug 15
1587-1630	0	-
1631-1720	30	Aug 13
1721-1840	54	Aug 12
1841-1890	45	Aug 9

Table 4.1: Summary of available Nile plenitude data from the al-Rawḍah nilometer, suggesting a gradual shift over time towards an earlier date (Popper 1951: 192)

High Nile

> "Most navigation takes place with the rise of the Nile." (Ibn Ḥawqal, *Ṣūrat*: 137)

The annual inundation transformed almost the entire inhabited land of Egypt. Authors incuding al-Qazwīnī (*'Ajā'ib*: 175) and al-Maqrīzī, quoted above, have described this phenomenon as changing Egypt into something resembling a sea. The villages of the Nile basin, built upon raised ground, were transformed into temporary islands, with communication between them achieved either by boat or by walking along the narrow dykes that separated irrigational basins. A very high flood took the water level to 1m above the surrounding countryside in Upper Egypt, 2m above in Middle Egypt and the Rashīd branch, and up to 3.5m above in places on the Dumyāṭ branch. A more typical flood was up to 1m below these levels (Willcocks 1904: 66).

Ibn Ḥawqal says that during the flood:

> "Because the water covers the surroundings of most of its cities and farmlands, they take to [boats] in all its lands, and the journeys of one of them to the other are by water in boats." (Ibn Ḥawqal, *Ṣūrat*: 137)

It is certainly true that high Nile was the optimal time for navigation in Egypt, not only because of water level, but also for meteorological reasons that are examined below. However, when Ibn Ḥawqal describes navigation *across* the flood plain, he can only have meant a very localised form of traffic between adjacent settlements. The extensive basin-irrigation system of the Nile valley meant that the floodplain was crossed with dykes that held the floodwater for set periods. It is likely that river-going vessels remained hemmed within the main channels and canals as in other times of the year. Navigators are unlikely

to have wished to risk the unknown of the wider floodplain at a time when conditions on the main channels were at their best.

Low Nile

> "Navigation on the Nile depends absolutely on the flood and the ebb of the waters, which together determine duration. [Navigation] ceases progressively for vessels depending on the water they draw ..." (*Description de l'Égypte*, Jomard 1809-28: État Moderne 1.112)

> "The only hindrance to the navigation of the Nile below the First Cataract is the want of water at low Nile." (Willcocks 1890: 39)

> "Navigation is ... most unreliable ... during the summer months when, on account of sand bars, [the river] becomes almost impossible on certain reaches, except for the shallowest draught boats." (Dempster 1917: 1)

During the early summer months, water levels recorded on the al-Rawḍah nilometer were about 6.5m below those of the flood (Baker 1880: 371). The width of the river was reduced to half its 'normal' level (Said 1993: 96), and river travellers could hardly see beyond the river banks that loomed up around them (Lane 2000: 52). As water levels fell, navigational conditions became increasingly laborious and hazardous – and ultimately impossible for larger cargo vessels.

A significant gap in our understanding of the impact of the Nile flood is the lack of direct archaeological evidence for medieval Nile vessels (Khalilieh 2005: 314), and hence of their probable draughts. However, data presented in the Napoleonic *Description de l'Égypte* relates the draught of vessel types existing in the early 19th century to the number of months a year they could operate. This data, summarised in Table 4.2, is particularly useful because it relates to a Nile that had not yet been transformed by modern hydro-engineering projects.

This table indicates that the largest Nile vessels of the time – the 160t *falūkah* and 200t *markab* drew over 2m of water: these could navigate for only five months of the year – presumably September-January. The 100t *nuṣf-falūkah*, drawing 1.9m, could sail for only seven months (roughly August to February) in Upper Egypt, as could the *qanjah kabīr* (1.5m/60t) in the Delta. The *kabīr qayyās*, also carried 60t, but drew 20cm less than the *qanjah kabīr*, and so could navigate the Delta for an extra month. The 30t *nuṣf-qanjah* displaced 1.2m, and could sail in the Delta for 10 months. Boats drawing less than 0.5m could sail year-round.

Vessel type	Dimensions								Navigable period
	Water drawn		Length		Width		Cargo		
Upper Egypt	**ft†**	**m**	**ft†**	**m**	**ft†**	**m**	**Ardebs**	**Tonnes**	**Months**
Markab	7.7	2.5	54.7	17.8	18.3	5.9	1000	200	5
Falūkah	7.0	2.3	50.5	16.4	16.5	5.4	800	160	5
Nuṣf-Falūkah*	6.0	1.9	47.7	15.5	15.3	5.0	500	100	7
Falūkah - from:	4.5	1.5	37.0	12.0	10.0	3.2	200	40	9
Ṣughayr‡ - to:	1.5	0.5	19.0	6.2	7.0	2.3	30	6	12
Lower Egypt									
Qanjah Kabīr	4.5	1.5	50.5	16.4	13.8	4.5	300	60	7
Nuṣf-Qanjah	3.8	1.2	43.8	14.2	12.5	4.1	150	30	10
Qanjah Ṣughayr	1.5	0.5	40.5	13.2	5.0	1.6	40	8	12
Kabīr Qayyās§	4.0	1.3	48.0	15.6	13.0	4.2	300	60	8
Nuṣf-Qayyās*	1.7	0.5	39.0	12.7	11.5	3.7	150	30	11
Qayas Ṣughayr‡	1.5	0.5	19.0	6.2	7.0	2.3	30	6	12

†French feet; *Nuṣf = half; ‡Sughayr = small; §Kabīr = large

Table 4.2: Table of vessels navigating on the Nile, canals and lakes according to the *Description de l'Égypte* (Jomard 1809-28: État Moderne 1.123). The units of the original table – labelled 'ds.' and 'o.' are obscure – but the quantity of subdivisions of the major unit and accompanying footnotes suggest that what are intended are French feet and inches.

Willcocks (1890: 39) broadly agrees with this assessment for Upper Egypt: he reports that only boats drawing less than 1m could ply the Nile valley below Aswan in the dry season, and not even those in very low years. During the flood, he says vessels of 2m draught could move easily. He is a little more generous for the navigability of the Delta, saying that vessels drawing 1.5m could sail the lower Rashīd branch year-round; that the Dumyāṭ branch was navigable year-round to boats of less than 1.5m draught, and to boats drawing more than that for eight months of the year. However, conditions had altered in the Delta by Willcocks's time due to the completion of the Delta barrage in 1861, and by the practice, of unknown vintage, of damming the lower Rashīd and Dumyāṭ branches in February and March to prevent sea-water ingress (Hurst and Phillips 1931: 1.21; Nile Commission 1925: 30).

The observations of travellers from the 16th-19th centuries add supporting anectodes to the assessments of Willcocks and the *Description de l'Égypte*. Thus, in the 16th century, Belon reports that the largest '*gerbes*' [= Arabic *jarm*: a flat-bottomed Nile barge] "...only navigate during the flood" (*Observations*: 104a).

A footnote in the Templeman edition of Norden (*Voyage*: 1.87) quotes a Dr Shaw as saying he found the main Nile above the nilometer "at medium, about three cubits [c.1.4m] in depth" – and that in December, with six months of further decline ahead. That year,

even shallow-draught vessels were already encountering difficulties on the Dumyāṭ branch:

> "... in the same month ... they frequently struck upon the ground in the very middle of it, though the vessel drew less than three foot [0.9m] of water."

On the Rashīd branch, Sandys found that by early February 1611 grounding was hampering the progress of his *jarm:* its crew of seven implies quite a large vessel. He found the branch:

> "...in many places so ſhallow, that oft we had much ado to free our ſelves from the flats that had ingaged (*sic*) us." (*Relation*: 117)

Grounding

Grounding was neither a minor nor an avoidable inconvenience. As water level fell, navigators sought to reduce the risk by avoiding night sailing (Pococke, *Description*, 1.116). Nevertheless, Lane (1890: 302) reports that:

> "... even the most experienced pilot is liable frequently to run his vessel aground; on such an occurrence, it is often necessary for the crew to descend into the water, to shove off the boat with their backs and shoulders."

On his descent of the Rashīd branch in mid-July 1599 – a time when water levels were normally rising once again – Rocchetta noted that:

> "What gave us the greatest trouble was that from time to time we were stopped by a sand-bank; our moorish boatmen were then obliged, almost every time, to descend into the water to release the *jarm* trapped in the sand."
> (*Pelegrinatione*: 65)

This method of dislodging a grounded boat was illustrated by Norden (see Figure 4.3).

The detailed accounts of two Nile travellers – Norden in the 18th century and Swinburne in the 19th – provide an insight into the problems of grounding, even in November-January, when levels were not at their lowest.

Swinburne sailed from Cairo to Aswan in November-December 1850, in a *dhahabiyyah* – a relatively rapid and luxurious passenger vessel (see Figure 4.4). She describes two grounding incidents between Cairo and Qīnah (Swinburne 1850-51: entries for 24 November, 4 December). She notes further that the river:

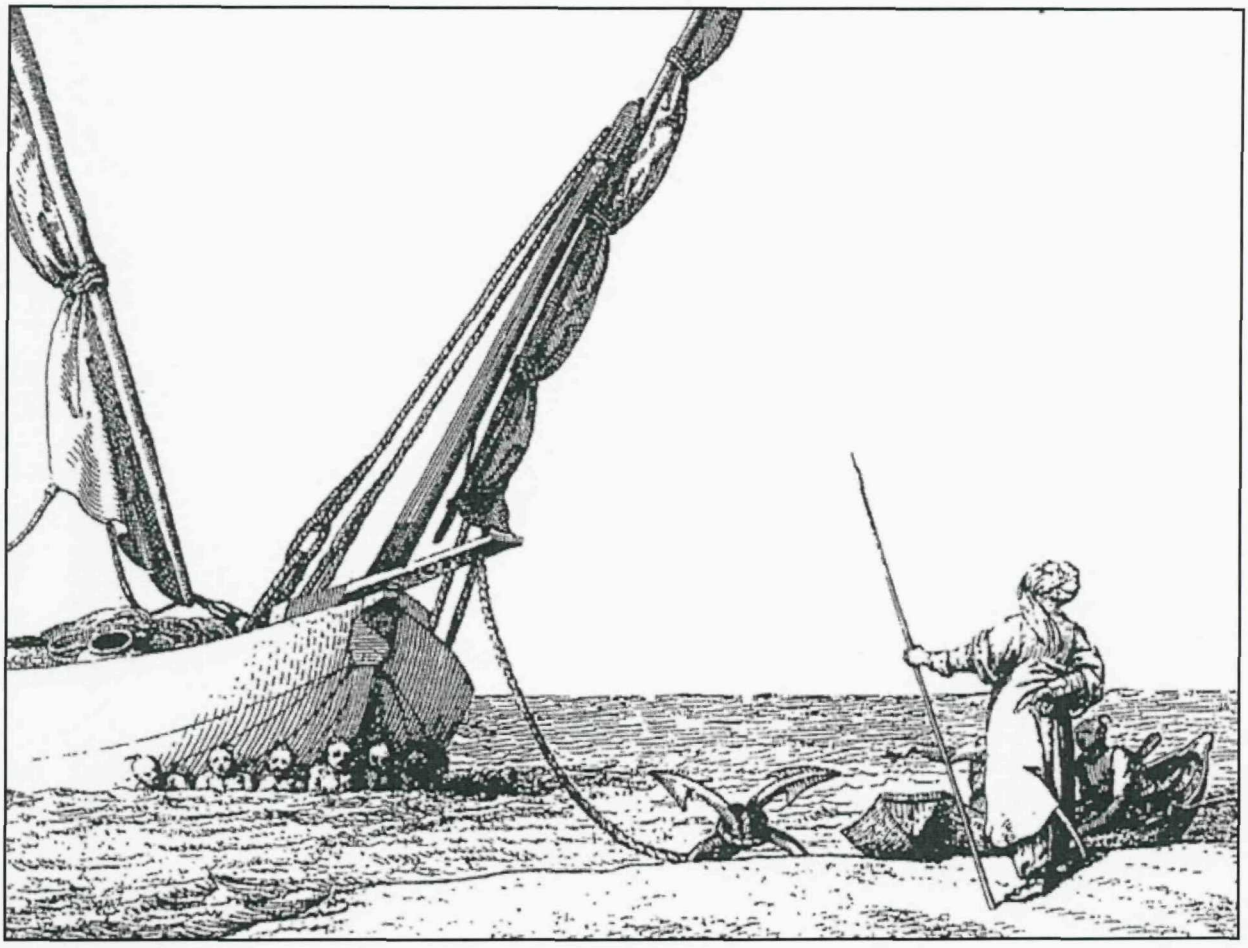

Figure 4.3: Dislodging a Nile boat from a sand bank (Norden, *Voyage*: pl.31, fig. 2). With the vessel anchored, the crew enter the water and push it off with their shoulders.

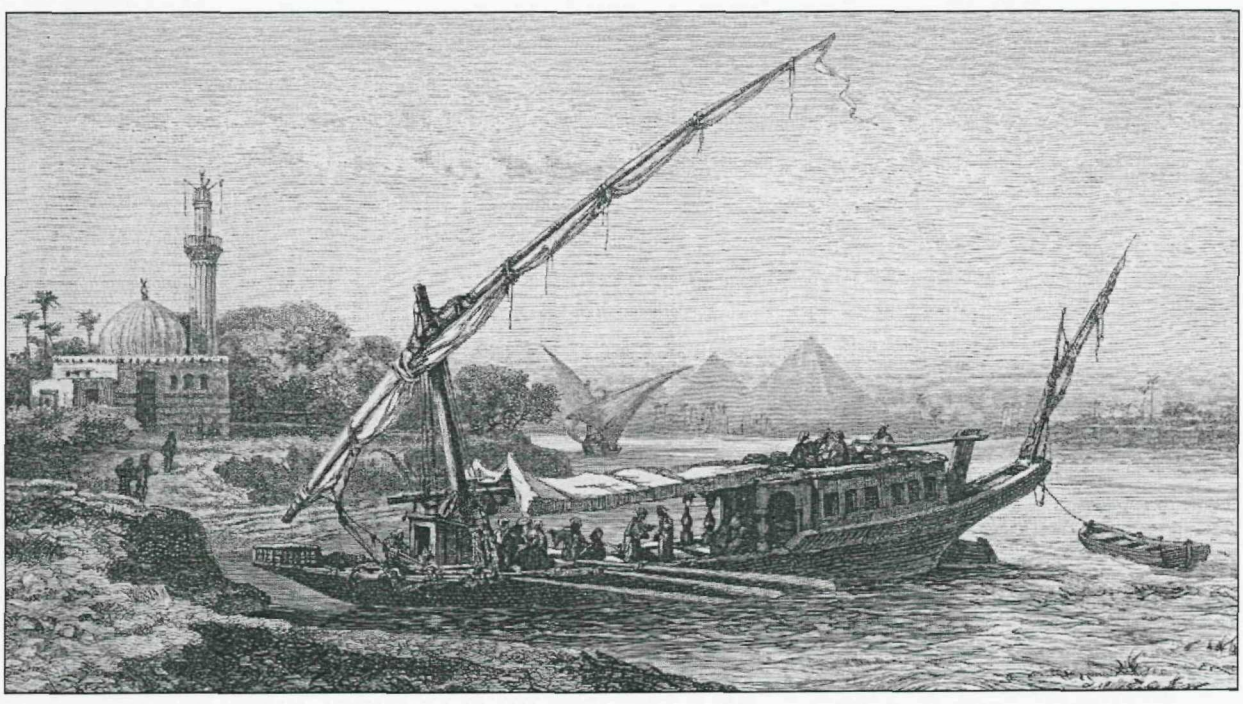

Figure 4.4: A *dhahabiyyah* on the Nile near Cairo. Detail from 'The Main Stream of the Nile' a lithograph by Fiedler dated 1876. The main mast has been stepped.

> "... seems unaccountably diminished since we passed Siout [Asyūṭ] ... we have been continually running aground far from the shores." (Swinburne 1850-51: entry for 9 December)

Norden, meanwhile, traveled up the Nile into Nubia in November 1737 in a two-masted vessel that had taken on cargo (*Voyage*: 2.9, 18). Even in that season, his vessel grounded seriously twice, at Samalūṭ, and just below Asyūṭ (*Voyage*: 1.32, 34). His downstream journey took place in January-February 1738. His vessel on the return journey was a barge that drew "no more than a foot and some inches water when empty" (*Voyage*: 2.177). However, the vessel was laden – so much so that the captain refused to take on additional cargo during the journey (*Voyage*: 2.192) – and even with its shallow draught struggled to progress downstream.

In late January-early February, Norden found the river levels too low to allow his barge to visit the west bank of the river at Aswan, or to land him at Karnak or Luxor (*Voyage*: 2.170, 192-3). In each case his vessel had to make land elsewhere – up to two leagues away.

However, the real problems set in further downstream, and after the captain, perhaps unwisely, had dismissed his pilot (*Voyage*: 2.197). Near Nāj Ḥammad the vessel became stuck on a sand bank overnight:

> "Our people laboured hard to get off the barque. They all went into the water in order to lift it up. The *reys* [captain] assisted them with a long perch, but it broke, and he fell into the water..." (*Voyage*: 2.200)

Later the same day, near Samanūṭ:

> " ...we had a great deal of difficulty in advancing forwards. The bed of the river had changed this year, and had thrown banks of sand across the passage. We went over three of them with great labour, and we found still some others before us. The *reys* [captain] was obliged to go, from time to time, on shore, to be informed of the depths of the water ... sometimes we made use of the oar, and sometimes had recourse to the cord ... By this means we got free from the banks." (*Voyage*: 2.201)

The next day, however:

> "... we found ourselves so perplexed by the banks of sand that we knew not what method to take in order to get out of them. Two large barques loaded with sena, had unloaded there already a week before, without being able to put off.

We were afraid of finding ourselves under a necessity of doing the same." (*Voyage*: 2.201-2)

They avoided this necessity by paying a man in a canoe to pilot a course for them.

The next day, below Jirjah, the barge grounded again, 'violently' (*Voyage*: 2.202). Two days later, it came to the village of Marāghah, which that year had been half-swept away by the river. The vessel became stuck on the detritus of the bank collapse, and could only be towed off the following day (*Voyage*: 2.204). The boat suffered several further minor groundings that day.

On 16 February, near Asyūṭ, Norden's vessel came across an "extremely dangerous" section of fast-flowing river passing through "divers banks of sand. We saw there a barque that had lately been lost." (*Voyage*: 2.207). On 21 February:

"... in approaching [Banī Ṣuwayf], we found ourſelves embarraſſed in the midſt of a little flotilla of barques, loaded with corn for Cairo. Some of them were aground, and the ſame would have happened to us, if we had not found the method of getting unto the current..."

The vessel grounded twice more before arriving at Cairo (*Voyage*: 2.210-1).

Experimental archaeology, involving the recreation of river journeys on traditional craft, has been rendered meaningless by the Aswan High Dam, since the 'natural' conditions of the river can no longer be experienced. Hence the accounts of travellers such as Norden become uniquely useful in informing our understanding of the experience of Nile travel. Norden's account is particularly instructive because he travelled downstream in a laden cargo vessel: already, by January-February, navigation was becoming difficult. Sailing in later months can only have become more so. Norden's experience supports the assessment of the *Description de l'Egypte* that cargo vessels were restricted in their navigation to a period of five-seven months, depending on their size.

That large cargo vessels could not move on the Nile during the lowest levels of the river is implicit in the Roman-era practice of shipping grain to Alexandria in a narrow window of time just before the height of the flood. Grain that had been harvested in March-April and stored in riverside granaries had to be on the move before the river burst its banks and ruined the stores. The stores were emptied in order, from south to north, and from riverside granaries to those further inland (Khalil 2005: 1.79). In a document of 40 AD, a landlord writes to his agent:

"... get the corn in the granary moved because of the flood, the whole lot of it". (Lindsay 1968: 145)

Another from al-Fayūm in 42 AD indicates that all wheat and barley had been removed from granaries before the 23 *Epeiph* (about 17 July) (Lindsay 1968: 12).

That the grain had to be moved before the river burst its banks is understandable. But it would have been harvested, depending on location, between February and April (Fuller 1829: 165; Poole 1844: 100). Subsequently, it had been stored in granaries. When it was moved, it was moved according to a system that implies the need for efficient use of time. The reason, arising from the evidence presented here, is that between harvest and the onset of the flood, shipping grain on cargo vessels would have been extremely difficult – large cargo shipments had to wait until the river started to rise.

The impact of low Nile on navigation and trade is also noted in a letter in the Cairo Geniza written in the 1060s from a trader in al-Fusṭāṭ to one in Alexandria. He writes:

> "The city is at a complete standstill. There is no buying or selling, and no one is spending a single dirham. All the people's eyes are turned towards the Nile. May God in his mercy raise its waters." (Udovitch 1977: 153)

This anxious attention to the progress of the flood was of course not just a function of the navigability of the river. The flood was also a key market indicator, since the economic health of Egypt depended on it.

The Seasonal Canals

> "...the people go out with great pomp to break open the canals [*khuljān*], and the land of Egypt becomes a single sea." (al-Qazwīnī, *'Ajā'ib*: 175)

The seasonal nature of some major Nile waterways has already been noted in the previous chapter. A glance at Figure 4.1 suggests that these seasonal waterways must, broadly, have become navigable some time in the late summer as the Nile rose, and have fallen out of use again as the flood waters ebbed. The duration of their navigability depended on the length of time in which the canals contained enough water for a Nile boat to sail in them. Apart from the Cairo canal – the foreshortened Nile-Red Sea canal that reached no further than the Wadi Ṭumaylāt – medieval sources give few precise indications of the timing of the opening, still less closure, of the main navigational canals. The length of the navigable season can be inferred, however: it was not long.

Al-Mas'ūdī relates that the main seasonal canals of Egypt in the tenth century – he names the Dhāt al-Sāḥil, the Bulqīnah, the Sardūs, and the truncated Nile-Red Sea canal – were opened in September (*Murūj*: 2.363-4). That timing places their opening close to the peak of the flood. Lane reports a similar timing nine centuries later:

> "When the river begins to rise, all the canals are cleaned out: each is closed by a dam of earth at the entrance; and opened when the Nile has nearly attained its greatest height; towards the end of September." (Lane 2000: 28)

The reason for keeping the major seasonal canals closed until this stage in the flood was in part to sustain the progress of the rising Nile towards plenitude, but also to ensure an orderly distribution of the Nile waters across Egypt's agricultural lands. An absence of co-ordination in their opening would have lead to uneven irrigation across the landscape. Thus, in the 18th century, the Baron de Tott reports that:

> "Those [canals] which convey the Water to Cairo, into the province of Fayoom, and to Alexandria, are the most attended to by the government. An officer is appointed to watch the last, and hinder the Arabs of Bachria [al-Baḥriyyah province] ... from turning them off before Alexandria be provided, or opening it before the time fixed, which would hinder the increase of the Nile. That which conveys the Waters into Fayoom ... cannot be opened before that of Cairo ..." (*Memoirs*: 4.26-27).

Descending the Rashid branch in mid-July 1599, Rochetta also observed a dam across the mouth of the Alexandria canal at al-Raḥmāniyyah (*Pelegrinatione*: 66). Thus the canals were kept artificially closed until a pre-ordained time, with the opening of the Cairo canal taken as the signal for the opening of the others.

The practice of building an earth dam across the entrance of the Cairo Canal can be traced back to the Fatimid period, when Nasir i Khusraw (*Safarnama*: 50-51) witnessed its breaking ceremony. In earlier centuries, the opening had taken place at 'Ayn Shams on 25-26 September, the Festival of the Cross, (al-Mas 'ūdī, *Murūj*: 2.364: al-Muqadassī, *Aḥsan*: 208). For four years between 1005-09 for which the date of the opening of the canal is recorded, the average was 10 September (Popper 1951: 191), and this in an era when plenitude typically occurred in early-mid September (see Table 4.1). The level of the Nile on the day that these openings took place averaged just over 15 cubits on the al-Rawḍah nilometer, indicating that the opening predated plenitude, which was 16 cubits, but only just. The dates of the ceremony, and the very rapid rise in the Nile level in the period leading up to plenitude (see Figure 4.1), suggest that the opening probably took place no more than a few days before. In the Mamlūk period, the plenitude ceremony at the nilometer and the opening of the canal took place on the same day (al-Qazwīnī, *'Ajā'ib*: 175; Ibn Taghrībirdī, *Nujūm*: 14-87). By the Ottoman period, the opening had shifted to the day after plenitude (Popper 1951: 192). In the 19th century, al-Jabartī indicates that it took place only when plenitude had been declared (*'Ajā'ib*: 4.80.14).

The evidence of al-Mas'ūdī and the Baron de Tott above indicates that the opening of the Alexandria, al-Fayūm, and probably other canals were likewise contingent on the Nile reaching plenitude, or something close to it.

Al-Makhzūmī's 12th century account of the irrigation network of al-Buḥayrah province gives some indication of when the Alexandria channel of Ibn Ḥawqal and al-Idrīsī – al-Makhzūmī's Baḥr Ramsīs – was in a navigable state, and when, perhaps, that state was coming to an end. According to al-Makhzūmī, the canal was opened some time between "the first [rising] of the Nile and 17 Tūt (27 September; in al-Maqrīzī, *Khiṭaṭ*: 1.461). According to his data, the irrigation channels served by *his* Alexandria Canal – that is, the waterway rising just below Babīj – normally opened between 8-10 Tūt (18-20 September).

The opening of the Alexandria channel is anticipated in a letter in the Cairo Geniza written from a trader in Alexandria to his cousin in al-Fusṭāṭ, which reads:

> "Could you please send the linseed oil to me with a suitable person. Otherwise, keep it until someone will be coming through the canal [*khalīj*]; for the time when it will be passable is not far off." (Udovitch 1977: 150)

The letter is not, unfortunately, dated. An earlier papyrus refers to the problem of low water levels in the Nile-Red Sea canal. This highly fragmentary document, dated in January, 91 AH (709-10), is a trader's request for a letter of credit because he cannot move his goods to or from al-Qulzum because "the water in it [i.e. the canal] has diminished." (Becker 1907: 79-80)

Some historical data also exists on the opening of other seasonal canals. Ibn Mammātī (*Qawānīn*: 206, 218) reports that the Abū Munajjah canal was opened on 23 September. He says that the Maḥallah canal, described by al-Idrīsī, was opened on 14 November – although this latter date is so late in the flood cycle as to be open to doubt.

Finding a precise date for the closure of the seasonal canals is not so easy. The fact that they remained closed until close to plenitude is not necessarily an indicator that they could only function when water levels were that high: rather, the purpose of keeping them closed during the rise of the river was to help bring the river level to plenitude and manage water distribution. The problem is therefore to find data indicative of when the water levels in the seasonal canals became too shallow for navigation to take place.

The 1925 *Nile Commission Report* notes that it was at the end of December that Egyptians cleared silt from seasonal canals in the early 20th century. The report says that the entrances to the canals were at that time blocked – again with earth dams – while the canal beds were re-excavated. These dams were removed in February (Nile Commission

1925: 70). The timing of the cleaning of the canals is quite different from that observed by Lane in the 19th century, who says it was done in the summer: nevertheless, the Report at least suggests that the navigable season of the canals had ceased by the end of December.

Historical data indicating when the flood waters began to ebb are sparse, but suggest that the fall began around 12 days after the maximum (Popper 1951: 88). Al-Qazwīnī (*'Ajā'ib*: 174-5) claims the fall started after about 40 days, but it may be that what he means here is the end of a state of widespread flood. Certainly the flood profile of Figure 4.1 suggests an incipient downturn more in line with a twelve-day plateau. Ibn Taghrībirdī (*Hawadith*: 8.549, 678) says that in 1467 and 1468 the water levels in the main Nile began to fall as soon as the Abū Munajjah channel had been opened, i.e. in late September. Le Père (1809: État Moderne 1.60) reports a rapid decline in water levels following the maximum.

One document from the Cairo Geniza suggests that the end of navigation through the seasonal canals – at least that to Alexandria – was expected considerably before that time. A letter dated 23 October 1140 from a merchant in Alexandria urges its recipient in al-Fusṭāṭ to bring merchandise quickly, before the canal falls out of use (Goitein 1967: 1.298). Given the year, the writer could mean either the canal rising at Shābūr or Babīj. Allowing time for the letter to be delivered (see Figure 4.8), the author was probably expecting closure to take place some time in November.

Efforts were made to try and keep the seasonal canals filled with water for as long as possible. In the 19th century, Lane (2000: 28) reports that "When the river begins to fall the canals are closed again, that they may retain the water."

Even the modern Maḥmūdiyyah canal to Alexandria, completed in 1819, was not, initially, a year-round waterway. It was prone to drying out (Bruce 1856), and a scheme was put forward to keep it filled using steam pumps (Lampart *et al.* 1856).

Given that earth banks were used in the medieval period to bar the mouths of the seasonal canals at the onset of the flood, it is worth conjecturing – noting the economic importance of some of these waterways in connecting the centre to such places as Alexandria and the Red Sea – that efforts would also have been made to extend the navigable season of these earlier canals. Indeed, conjecturing the use of earth dams helps to shed light on the gradual migration of the route of the Alexandria canal from that starting at Shābūr and occupying the ancient Canopic bed before the 13th century to those connecting to the Nile at al-Raḥmāniyyah and al-'Aṭf. Certainly, maintaining an approximately 80km canal between al-'Aṭf and Alexandria rather an 130km canal from

Shabūr would been less onerous. However, this cannot be the only reason for the shift in route, since the older channels continued to be maintained for irrigation.

Instead, the reason may lie in the need to keep the waterway to Alexandria open for as long a season as possible. The earliest manifestation of the Alexandria channel in the medieval period – that rising at Shabūr – has a difference in surface elevation between its head and Alexandria of around 8m (Willcocks 1890: pl. 18). Once the flood began to subside, placing a dam at either end would have ineffectual in maintaining a navigable depth of water along the length of the canal: a whole series of barriers – dams or locks – would have had to be erected to maintain water depth. Since locks are nowhere attested on medieval Egyptian canals, and since, in any case, these would have required a constant head of water to function, the other option available would have been dams. These, however, would have made passage of goods through the canal tedious and highly labour-intensive.

Migration of the head of the Alexandria canal to lower points on the Rashīd branch reduced the slope of the resultant waterway to the extent that, at al-'Aṭf and al-Raḥmāniyyah, the difference in height between the head and Alexandria was cut to about 1m and 2m respectively (Willcocks 1890: pl. 18). With such a slope, dams could be built at either end of the canal, and an almost stationary, navigable body of water maintained for a far longer period than can ever have been the case for the previous canals. The northward migration of the Alexandria canal offtake can therefore be understood as an attempt to extend the season during which Alexandria was connected to the Nile by a navigable canal. Indeed, al-Maqrīzī (*Khiṭaṭ*: 1.459-466) reports that the major excavations of the canal carried out by al-Nāṣir Muḥammad ibn Qalāwūn in 1310 and al-Malik al-Ashraf Barsbāy in 1422/3 succeeded, for a brief time in each case, in sustaining the flow of water to Alexandria year round. The fact that Alexandrians later had once again to rely for drinking water on cisterns filled during the flood is noted by many later medieval visitors to the city, including Belon (*Observations*: 94b). In 1581, Palerne (*Peregrinations*: 12) notes that the Alexandria canal was open for just "two or three months".

Current velocities

A comprehensive dataset for the surface currents of the Nile before the great changes wrought by the major hydro-engineering works of the 19th-20th centuries has yet to be found. However, what data do exist give an impression of the very different sailing conditions prevalent at varying stages in the annual cycle of the river, carrying with it implications for the progress that vessels could make.

Graph A of Table 21 in Appendix 4 represents the monthly mean of current velocity data collected by Phillips at a point downstream of Aswan during 1919 (Phillips 1924: 8-11)[1]. The data are for a single year – not a medieval one – and were collected after construction of the Aswan barrage in 1904. Moreover, they were taken from a single location on the river, and so are not necessarily indicative of all locations along the river. Finally, they are the mean cross-sectional velocities for the entire water column at that point, rather than near-surface velocities that would have most influence sailing.

These caveats admitted, the data nevertheless give a useful impression of the relative ease or difficulty of sailing upstream at different times of the year. Broadly, the navigator could have expected to meet countervailing currents in the order of 6 km/h at the peak of the flood, and less than 2km/h during low Nile. Phillips' data can be augmented by observations from other sources. Willcocks (1890: 32) similarly puts the mean velocity of the river between Aswan and the Delta barrage at a broad 3.6-7.2 km/h during flood, and 1.1-2.5 km/h during low Nile. Hurst (1954: 7) puts the mean river velocity at Aswan at 6.1 km/h during full flood, and at an average 2.5km/h between late November and late July. Elsewhere (1932: 3-10), he gives mean velocities for the Nile at Wasṭā in Middle Egypt ranging from 1km/h in early May to 5km/h in September. In the early 19th century, Lane (2000: 30) put the surface current at low Nile at 2 km/h, without specifying location.

Current could vary significantly even between nearby locations. In late March 1799, Girard recorded the surface current velocity of the river near Manfalūṭ in Upper Egypt at 2.14 km/h, when the river level was 75cm above its low. A day later he took the velocity at Asyūṭ, just 25km further upstream: the rate there was 4.3km/h (in Beardmore 1862: 183). Velocities could also be considerably lower: Measurements taken by Moore between Cairo and the Delta apex in the days around low Nile in June 1873 indicated surface current velocities of just 0.9-1 km/h (Moore 1873: 230-234).

Available data for current velocities in the Delta distributaies are limited to the Rashīd branch. Willcocks (1904: 121) puts the mean velocity in the branch at 6.25 km/h at flood, and 3.13 km/h at low Nile. The latter figure appears high compared with low Nile velocities recorded elsewhere and by others. Beardmore (1862: 184) puts the current velocity at Kafr Zayyāt, midway on the branch, at 5.8km/h at flood, and 2km/h at low Nile.

Willcocks also provides data for velocity through some of the lesser waterways. He puts the typical flow in what he calls the 'natural canals' – those meandering waterways that follow ancient courses – at 2.5 km/h. However, he puts the flow at flood time through the Abū Diyāb channel, relic of the medieval Alexandria canal of Ibn Ḥawqal and al-Idrīsī,

[1] Phillips collected no data for June: that month's figure is an average of the May and July averages.

and through the modern Maḥmūdiyyah canal, at 1.8 km/h – again at flood. The Baḥr Shibīn's flow he puts at 3.2 km/h during flood (Willcocks 1890: 32, 179, 181).

The speed of the surface current was, of course, a key element in determining the Velocity Made Good that a vessel could achieve on the river, whether travelling upstream or down. Another factor was the wind, and it is to meteorological conditions on the river that the discussion now turns.

4.3 Nile wind regimes

Two quite different wind regimes predominate in Upper and Lower Egypt: the former falls under the perennial influence of the cyclonic highs that rest over the Sahara deserts, resulting in the dominance of northerly winds all year round. The latter comes under the influence of Mediterranean weather systems, resulting in steady northerly and northwesterly winds in high summer, and a more complex mix of wind directions from autumn to spring.

The Nile valley

It is in Upper Egypt that one finds conditions that, on first glance, most easily fit the characterisation of Nile navigation set out at the start of this chapter: that is, the wind blowing vessels upstream, and the current carrying them back down again. The data in Appendix 4, tables 13-14, 17-19, show that northerly winds are prevalent in the region throughout the year.

What is remarkable, however, is what happens to the winds during the period of the Nile flood. At a time when current velocities have more than tripled to around 6km/h – threatening to hinder the upstream journey – both the strength and frequency of the northerly winds also rise sharply. For locations in the Nile valley between Ḥulwān and Asyūṭ, a two-peak pattern of wind speeds is seen during the year. The first peak is seen around June – before the Nile flood gains momentum – and the second is at the height of the inundation, in September. Thus wind speeds at Minyah average over 15km/h in September – against the mean Nile Valley current speed already noted of just over 6km/h – compared to less than 10km/h in December-January, when the mean current would have run at less than 2km/h (see Appendix 1: Tables 13, 20). Thus a positive differential of wind over current velocities is maintained – showing that sailing upstream against the rising current velocity remained entirely possible. What is more, the *proportion* of winds with a northerly component also increases sharply. Winds with a northerly component blow for more than 90% of the time between Ḥulwān and Asyūṭ in September, compared to less than 50% of the time in Ḥulwān and Minyah in December-Janaury, and less than 80% of

the time in Asyūṭ (see Appendix 1: Table 19). Of course vessels at this time also enjoyed a more accommodating depth of water, particularly important for cargo vessels of a relativey deep draught, as well as a wider channel upon which captains could choose a favourable course.

For a section of the river further upstream, however, the differential between Nile current and wind speed is not maintained during the flood season. Data for Qīnah, Luxor and Isnā show that, throughout the year, mean wind speeds at those locations maintain a much smaller differential to the mean Nile Valley current speed than at locations further north (see Appendix 1: Table 21A and B). In September, daily mean wind speeds at those locations are between 6.1-7.7 km/h (Appendix 1: Tables 15-19), barely outstripping the 6.25km/h mean current velocity reported by Phillips. Hence, the September differential between wind speed and current speed falls to 1.45 km/h at Isnā, 0.75 km/h at Qīnah, and to almost zero at Luxor. The explanation for the reduction in wind speed along this bend in the river bed between Nāj Ḥamādī and a little above Armant may lie in part with the sheltering effect of the elevated ground on either side of the valley.

The benefit that that northerly wind conveyed, at least for those sailing upstream, was also significantly compromised by the fact that in this section of the Nile – around the Dandarah bend – the wind and the current were no longer, for large sections of the river, functioning in opposition to each other. For more than 30km of the bend, the current has no north-bound component against which a northerly wind would be useful. Indeed, for some sections – around 18km in total – the navigator heading upstream would have had to battle both prevailing wind and current.

Thus it can be seen that, along a 175km section of the Nile between Nāj Ḥamādī and Isnā (see Appendix 2, Figure 2), making progress upstream must, in typical conditions during the flood season, have been considerably more difficult than in the section between Cairo and the start of the bend at Nāj Ḥamādī. Along the latter stretch, the combination of strong and frequent northerly winds, and a deep and wide river made for the best upstream sailing conditions of the year. Once at the bend, navigators must have found the onward journey, at least to Isnā, considerably more difficult. Towards Aswan, the September differential between mean current speed and wind speed rises to over 4km/h – and that with winds blowing from the northerly quadrant for over 90 per cent of the time. Thus, while never quite as favourable as at locations between Cairo and Asyūṭ, conditions at Aswan are more like those prevailing north of the Dandarah bend.

If the optimal time to sail upstream was August to October, during the height of the flood, then the best time to sail downstream must have been when water levels were still

adequate, yet the frequency of the northerly winds had abated. Table 19 of Appendix 4 shows that northerly winds dominate in far southern locations such as Aswan and Isnā throughout the year – only dipping below 90 per cent frequency in Aswan in August, and between February and June in Isnā. Thus, sailing downstream on the stretch of river south of the Dandarah bend always involved a battle against northerly winds. Later in the season, the problem of the northerly winds abated, but the help provided by the current also diminished. Further north in the Nile valley, the frequency of winds with a northerly component falls sharply between October and February. In Asyūṭ, the fall is from 91 per cent to 77 per cent. However in Minyah and Hulwan the fall is from over 90 per cent to under 50 per cent. Although by February the Nile current had fallen to about 2km/h, those sailing downstream had to contend with fewer northerly winds, and weaker ones when they did blow (see Appendix 4, table 20).

A further observation to be made about wind concerns diurnal variation. In locations for which data is available (Alexandria, Ḥulwān, Suez: See Appendix 1: Tables, 2, 9 & 10) the wind is considerably stronger in the afternoon than early morning. For example, from March to November, wind speeds at Ḥulwān are typically 20-25 km/h between 14:00-18:00 hrs, compared with 10-15km/h between 6:00-10:00 hrs. That configuration broadly argues that sailing upstream, particularly in the Nile valley, would be easier in the afternoon, and sailing downstream in the morning.

The winds of the Nile Delta

A second, quite different, wind regime acts on Lower Egypt compared to that of Upper Egypt. During the summer season, the northern Delta is, like the Mediterranean to its north, subject to prevailing winds from the north and northwest (Appendix 1: Tables 1-3). These winds are the result of Indo-Persian lows that grow over the Levant in spring and come to dominate by the summer, and of the appearance in the western Mediterranean of subtropical highs as the winter domination by North Atlantic lows comes to an end (Meteorological Office 1962: 4-5; Pryor 1988: 16-20).

The summer etesian winds blowing across the Mediterranean are typically Force 4 (21-29 km/h). From March to October, when regular diurnal sea breezes develop, the compound force of both can sometimes reach Force 5-7 (30-50 km/h). By evening, the effect of the sea breeze can sometimes be felt as far as Cairo. In contrast, countervailing nocturnal land breezes of Force 2-3 (6-19 km/h) occur, and can sometimes nullify the incoming etesian winds (Meteorological Office 1962: 92-4).

In the winter months, the most frequent wind direction in the Delta is again north-westerly. However, the region comes under the influence of anticyclonic depressions

tracking through the Mediterranean, resulting in northerly and north-westerly winds blowng behind the depression, and southerly and south-westerly winds ahead of it. Strong and gale-force winds blow frequently from the western quadrant in winter and early spring, with the southerly and southwesterly winds most frequent in March-May and again in September-October (Meteorological Office 1962: 165; Nagwa et al. 1996: 82-3; Shaheen 1985: 16). Spring winds with a southern component are in Egypt called the *khamsīn:* they characteristically blow for up to 4 or 5 days at a time, laden with dust, before the wind reverts abruptly to northwesterly (Meteorological Office 1962: 23).

The impact of these weather systems on the coastal Delta can be seen in Appendix 4, Tables 1-3 and 19. Winds with a northerly component blow for two-thirds of the time in Sīdī Barrānī, Alexandria and Port Said in September, but barely a quarter of the time in December, when the winter brings a highly variable picture comprising more westerly and southerly winds than in summer.

The situation further inland, in the central zone of the Delta, is altogether calmer. While the relative share of wind directions is similar to that of the coastal locations already mentioned, these mid Delta sites – such as Ṣakhā, Qurāshiyyah and Zagazig (Appendix 4, Tables 6-7) – are subject to substantially more extensive periods of calm during which no wind blows, presenting a problem for navigators seeking to ascend the river.

The winds of the Delta are not only more variable than in the Nile Valley, but also they occur relative to a more diverse set of current directions: waterways in the western Delta flow in a broadly northwesterly direction; those in the east are in a more northeasterly orientation: thus the ascent of a vessel up the Alexandria channel of al-Idrīsī or the Rashīd branch in summer might, with the prevailing northwesterly behind, might be expected to be easier than the ascent of the roughly east-west aligned Tinnīs branch – the modern Baḥr Ṣaghīr – which would more frequently come up against contrary winds with a western component. The meanders of the Delta waterways are also are tighter and more frequent than the main Nile, making for current directions that vary more often relative to the wind.

That ascending the river was easier in the summer – vessel draught allowing – than in other seasons is borne out by mid-19th century British correspondence about arrangements for the transport of mail across Egypt to and from India. One such document notes the problem is greatest:

> "... at the season of the year, October and November, when the mails cannot be brought by land [due to muddy or flooded roads] and when, contrary winds

prevailing, a sailing boat cannot insure (*sic.*) a rapid passage up the river to Cairo." (Walne 1847: 60)

Thus the Nile Delta, though its wind regime was more variable than that of the Nile valley, also had an optimal time for heading upstream – again, it was at the height of the flood, with the river's waters wide and deep, and northerly winds blowing most frequently.

Current velocity data for the Delta is not adequate to making a useful analysis of the differential between river and wind speeds, and in any case the greater variability of the winds in this region would diminish the usefulness of the exercise.

Storms

Although sailing conditions on the Nile were usually relatively benign, they could become tempestuous. When Coppin arrived at Alexandria in Jan 1638, he learned that "more than 80 barques had been lost on the Nile in a storm" that had just blown through. Sometimes the cause was a strong northerly wind. Veryard reports that:

> "We had so brisk a Gale, that we were forced to keep near the shore ... for the wind and stream being contrary, there arose a kind of Tempeft, by reason whereof we advanced very little." (*Account*: 290)

On other occasions, the problem appears to have been a *khamsīn*. Kiechel reports that:

> "...because of the great heat a violent wind got up in the desert, so great that we just had time bring the sail down before going to the shore. Many boats founder in these circumstances" (*Voyage*: 45)

Florence Nightingale found herself caught in a fierce southerly wind storm near Manfalūṭ in December 1849. While her own vessel was safely moored:

> "I saw one of the dhahabiehs which had overtaken us in the afternoon, floating past us, bottom up." (Nightingale 1854: 65)

Often the problem was brought about by highly localised winds. Approaching Cairo, de Monconyon's vessel was half overturned by a gust of wind (*Journal*: 33). Within sight of the pyramids, Stochove sailed through high winds, his crew fearful of putting to shore: he saw a large vessel in front of his capsized. (*Voyage*: 14).

The combination of wind and grounding was a particularly dangerous one. Sailing upstream from Isnā, Warburton's *dhahabiyyah* was suddenly almost overturned:

> "When I did emerge [from where he had fallen], I found the boat had struck upon a sand-bank, the wind had turned her nearly over, the sails were cut away, and ten Arabs were up to their necks among the crocodiles, endeavouring to get

her off ... the contest between us and the elements continued for hours." (Warburton 1845: 226)

The loss of a vessel does not appear to have been a rare one. In Middle Egypt, Martineau reports that:

> "In the morning we passed another foundered vessel, whose masts just showed themselves about the water." (Martineau 1848: 206)

The implied familiarity of that scene is supported by the Geniza documents, which suggest that such wrecking incidents were similarly not unusual in the medieval period (Goitein 1967: 1.297).

4.4 Historical accounts of Nile navigation

The Nile valley

In 1873, just two days into a journey up the Nile valley from Cairo, Emelia Edward's tourist party decided to stay on at Memphis, even though a brisk, favourable wind was blowing. She reports the dissent of her captain, who tells her:

> "You will come to learn the value of a wind, when you have been longer on the Nile." (Edwards 1878: 104)

The next morning, emerging on deck, Edwards:

> " ... found nine of our poor fellows harnessed to a rope like barge-horses, towing the huge boat against the current. Seven of the ... crew [also towing] followed at a few yards' distance." (Edwards 1878: 105)

The claim that sailing on the Nile was simply a case of riding the north wind south and, in the other direction, drifting north on the current, can be examined in the light of a number of historical accounts of river journeys in the Nile valley, to which region the claim of simple Nile sailing is most readily applied in the light of the previous discussion. The problems of grounding, especially at low Nile, have already been noted. Now it will be seen that navigators often also experienced contrary sailing conditions, requiring frequent towing, punting and rowing, sometimes even when heading downstream.

A rich set of data on navigation on the Nile valley comes from the observations of 18th and 19th century visitors to Egypt, including Norden (*Voyage*: 2.13-61, 82-106, 173-211), Pococke (Description: 1.69-129), Light (1818: 37-39, 42, 102-115), Stephens (1839: 14-22, 29-36), Martineau (1848: 31-63, 147-207), Nightingale (1854: 33-111, 169-255), Swinburne (1850-51), and Edwards (1878). These can be supported further by the altogether briefer medieval accounts of Ibn Jubayr (*Riḥlah*: 39-65), Nasir i Khusraw

(*Safarnama*: 63-7) and the Anonymous Venetian (*Voyage*: 37, 57). This body of data is inherently qualitative, but nevertheless instructive. Visual summaries of the journeys of a selection of these travellers is presented in Figure 4.5, showing upstream voyages, and Figure 4.6, showing the return leg. The journey times of all of these travellers between Cairo, Qūs and Aswan are summarised in

Table 4.3.

Upstream

Name	Month/Year	Vessel type	Cairo-Qus	Qus-Aswan	Total
Nasir i Khusraw	May-Jul 1050	-	-	-	39
Ibn Jubayr	May 1183	-	19	-	19
Norden	Nov-Dec 1737	2-masted 'bark'	20	9	29
Pococke	Dec 1737 -Jan 1738	2-masted '*marʃh*'	22	6	28
Light	Apr-May 1814	12-14t, 6 crew	-	-	32
Fuller	Feb 1819	Canjia	20	5	25
Stephens	Jan 1836	20ft, 2 sail, 10 crew	18	-	18
Martineau	Dec 1846	Dhahabiyyah	17	5	22
Nightingale	Dec 1849	Dhahabiyyah	24	6	30
Swinburne	Nov-Dec 1850	Dhahabiyyah	14	5	19
Average	**-**	**-**	**19**	**6**	**26**

Downstream

Name	Month/Year	Vessel type	Aswan-Qus	Qus-Cairo	Total
Nasir i Khusraw	-	-	-	-	-
Ibn Jubayr	-	-	-	-	-
Norden	Jan-Feb 1738	Cargo vessel	10	17	27
Pococke	Jan-Feb 1738	-	7	11.5	18.5
Light	Jun-Jul 1814	12-14t, 6 crew	-	22	-
Fuller	April 1819	Canjia	6	14	20
Stephens	Feb 1836	20ft, 2 sail, 10 crew	3	9	12
Martineau	Jan 1846	Dhahabiyyah	6	14	20
Nightingale	Feb-Mar 1850	Dhahabiyyah	7	21	28
Swinburne	Dec 1850	Dhahabiyyah	6	9	15
Average	**-**	**-**	**6**	**15**	**20**

Table 4.3: Nile Valley journey times by selected travellers from the 11th-19th centuries. The times seek to omit non-travel time, where this is apparent in the text.

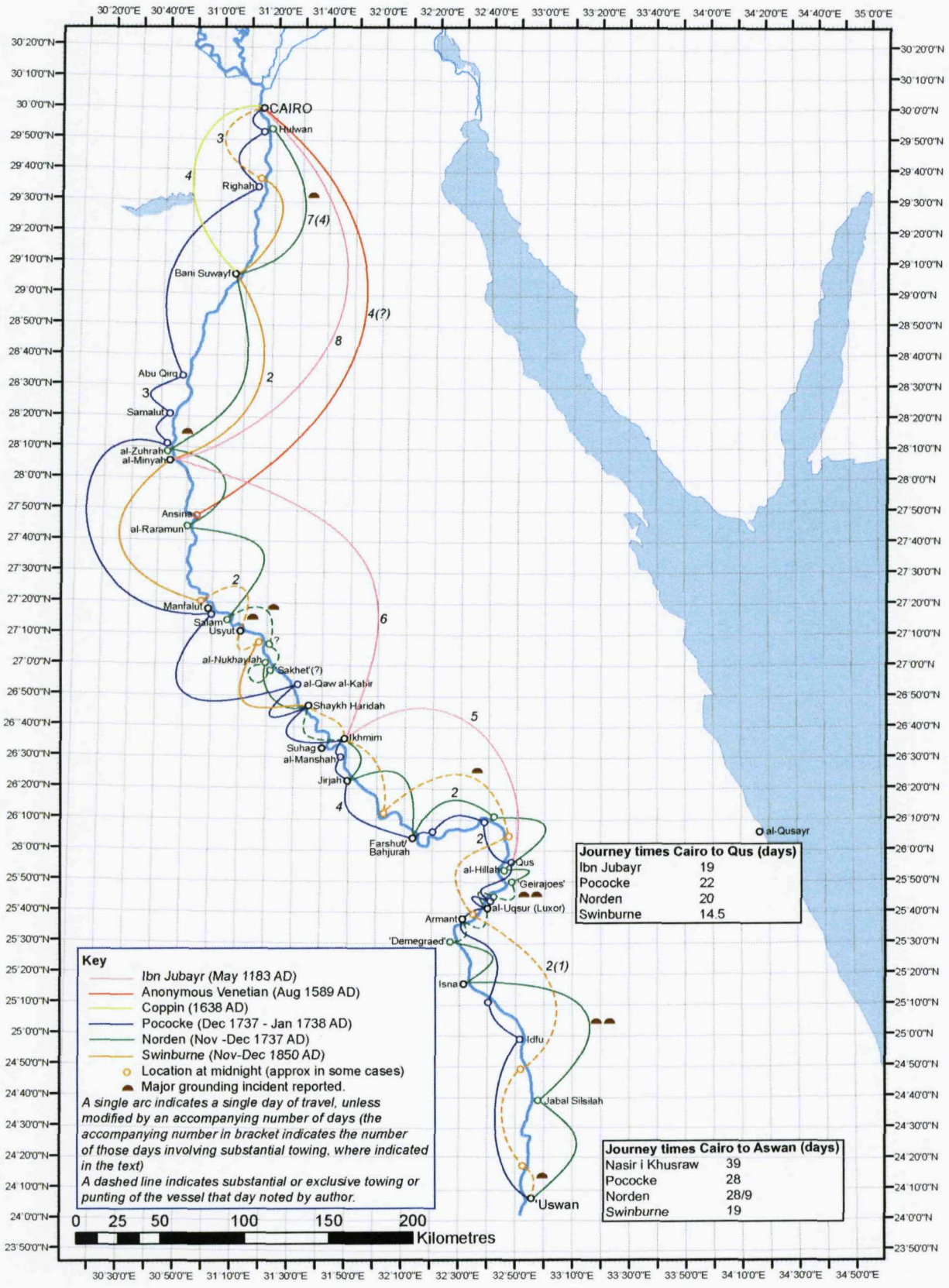

Figure 4.5: Journeys up the Nile taken by six selected travellers between the 12th and 19th centuries.

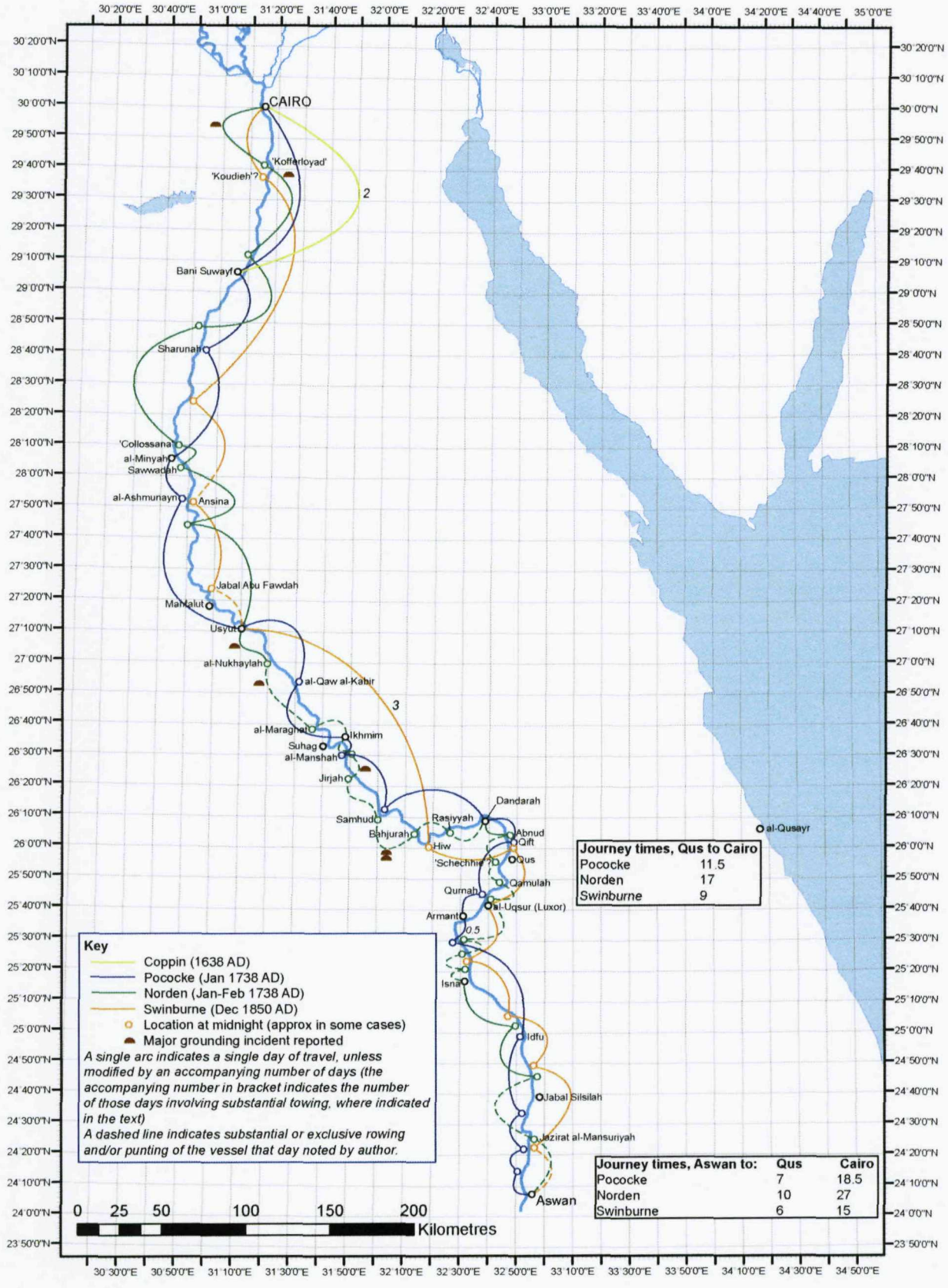

Figure 4.6: Journeys down the Nile taken by four selected travellers between the 17th and 19th centuries.

One frustrating aspect of the historical accounts is that only one of the journeys described took place in the season that the meteorological and hydrological data suggest would have been the optimal season for sailing upstream – that is, in August-to-October. That journey, by the Anonymous Venetian (*Voyage*: 37-57), went only to Ikhmīm: moreover, beyond the time taken, the author gives no information on sailing conditions.

One caveat to bear in mind in assessing these journeys is that, apart from Norden's journey, the boats in which the authors travelled were not laden merchant barges, but relatively light passenger vessels – albeit quite large ones. Certainly, Ibn Jubayr's boat, though he does not describe it, must have drawn little water to cope with the extremely low Nile levels typical of May. Norden travelled upstream in a two-masted 'bark' – we know this because the mizen yard broke (*Travels*: 2.18) – which the captain had charged with cargo against Norden's wishes (*Travels*: 2.9); heading downstream. Pococke also traveled upstream in a large, two-masted '*marʃh*' (*Description*: 1.69), but he does not describe his vessel for the return journey: it may have been the same one. Swinburne and Edwards each traveled in wealthy tourist parties on a two-masted *dhahabiyah*, being 24m and 30m in length respectively. These would certainly have been quicker than a medieval cargo vessel. Indeed, Edwards herself writes of her journey just above Asyūṭ:

> "Flying before the wind with both sails set ... The cargo-boat on which we have been gaining all the morning is outstripped and dwindling in the rear." (Edwards 1878: 149)

Moreover, it might also be the case that the crew of a *dhahabiyah*, carrying a wealthy party may have been more inclined to tow or punt to overcome unfavourable conditions than were they crewing a cargo vessel. Excluding time taken in sightseeing, Swinburne's journey from Cairo to Qūṣ in her *dhahabiyyah* took only two weeks. Wilkinson's guidebook for 19th century *dhahabiyyah* tourists says that 20 days was a "fair average for the journey from Cairo to Luxor" (Wilkinson 1847: 2). That is also in line with the journeys taken by Ibn Jubayr (19 days), Norden (20 days) and Pococke (22 days) (see Table 4.3), even though, in Norden's case, his was a cargo-carrying vessel. The onward journey to Aswan typically took a week, although Swinburne's again took less.

On the return journey from Aswan, Swinburne took six days to reach Qūṣ, and just 15 to reach Cairo. Pococke took a week to reach Qūṣ, and just under 19 to Cairo. Norden's laden merchant vessel, repeatedly grounding in the receding Nile waters, took 10 days to reach Qūṣ, and a full 27 to get to Cairo.

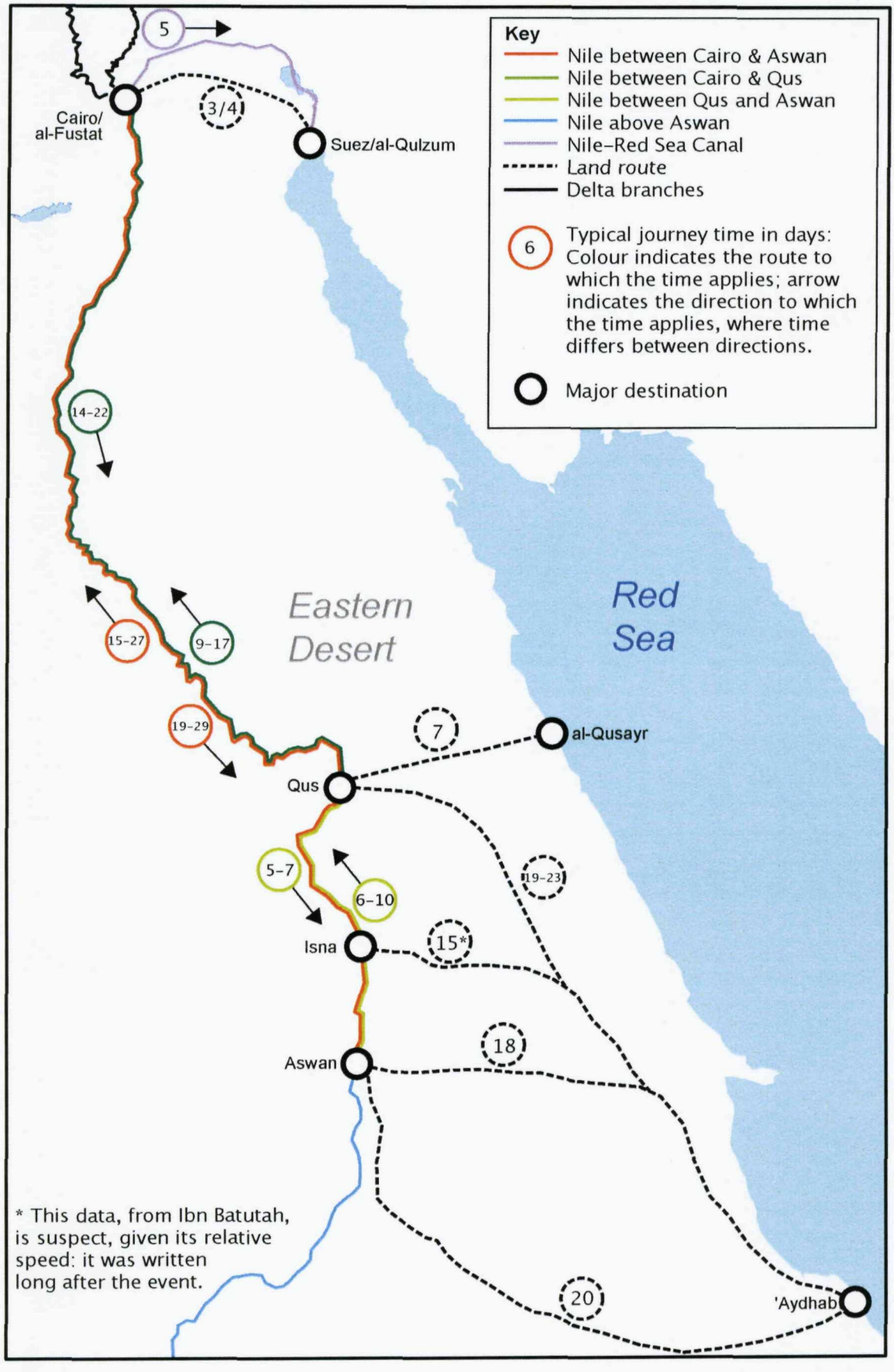

Figure 4.7: Representative travel times by river in Upper Egypt, and across the Eastern Desert to Red Sea destinations, based on historical accounts. Not all routes depicted existed contemporaneously.

The accounts of Norden and Pococke, in both directions, are in line with al-Zuhrī's 12th century assessment of the journey time by river between Cairo and Aswan – al-Zuhrī does not specify direction – as being 30 days (*Jūghrafiyyah*: 3.3.801r). Nasir i Khusraw took about 39 days to reach Aswan from Cairo in May-July 1050, excluding those rest days that can be identified (*Safarnama*: 63-4). Al-Idrīsī's text (*Nuzhat*: 2.129-30) suggests a journey time of three days from Qumūlah, just below Luxor, to Aswan: however, that would be a speedy ascent, even by Swinburne's rapid standards (see Figure 4.5,

Table 4.3). His claim (*Nuzhat*: 2: 128) that the upriver sailing times between Asyūṭ and Ikhmīm, and between Ikhmīm and Qifṭ, were each half a day appear likewise optimistic.

General assessments of journey time in historical texts tend to appear more rapid than the journeys analysed here. Herodotus (*Historia*: 2.9) claims that the journey time between Cairo (in fact, Heliopolis) and Luxor (Thebes) was just nine days, and the *Description de l'Égypte*, claims that the ascent from Cairo to the First Cataract could be made in "eight days or less" at the height of the flood (Jomard 1809-28: État Moderne, 1.122). Certainly, the journeys examined here did not take place during the flood, during which time favourable winds would have made the ascent much easier and quicker. But the times given by Herodotus and the *Description* must surely be considered racing times.

Representative sailing times in the Nile Valley, based on the above data are presented in diagrammatic form in

Table 4.3 and as a schematic map in Figure 4.7.

Heading upstream, the traveller accounts give plentiful incidents of calm, or of weak or contrary winds, in which it was necessary to tow or punt the vessel. Swinburne's relatively rapid ascent to Aswan was achieved only through extensive use of human power, with towing or punting taking place on 12 of the 19 travelling days. One day – out of a total of five in which the boat was towed all day – the vessel made "perhaps twelve miles [19.2 km] in the course of the day." In contrast, the 100-km journey from Banī Ṣuwayf to Minyah, with a favourable wind, took barely 24 hours, with the boat making "8 miles an hour [12.8 km/h] at times" (Swinburne 1850-51: entry for 26 November).

Indeed, towing and punting seems to have been a normal part of progress up the Nile valley. Swinburne (1850-51: entry for 12 November):

> "... admired the goodwill and readiness of the crew in towing ..."

Likewise, Edwards noted in that her *dhahabiyyah* crew were:

> "sometimes towing ... on a rope all day long, like barge-horses; sometimes punting for hours, which is the hardest work of all ..." (Edwards 1878: 67)

It was not only the tourist *dhahabiyyah* that was towed, however. Both Norden and Pococke experienced numerous days of calm or contrary winds that made progress against the current difficult. Norden's crew towed for two full days, and for part of the day on seven days. On three further days, the wind was such that they were unable to progress. Pococke is less meticulous than Norden in his reporting of incidences of towing, but he notes several days on which the wind failed. He also marvelled that his crew towed even during the Ramadan fast (*Description*: 1.72).

Travelling upriver was not, therefore, simply a question of riding the wind – although had the journeys taken place in September or October, they would probably have been easier given the prevalence of northerly winds at that season. Likewise, travelling down the Nile was not merely a case of riding the current. The northerly wind was often strong enough to force the crew to resort to the oar, or to stop a vessel dead. Swinburne (1850-51: entries for 11-24 December) reports that her crew rowed whenever the wind was not too strong to render the exertion "ineffectual". Norden's "six-oared" cargo vessel (*Travels*: 2.173) was routinely rowed downstream whenever the north winds abated (*Travels*: 2.183, 188, 191, 196-8, 200, 211), and was put ashore when they were too strong (*Travels*: 2.191, 196-8, 201, 204). Likewise, faced with strong northerly winds, Pococke's vessel would "lie by" until conditions improved (*Description*: 1.123). Stephens (1839: 29), travelling downstream just north of Aswan, says he encountered winds so strong that he found his vessel blown back upstream.

The Delta

A considerably larger body of data is available from traveller accounts in the Delta than those already discussed for Upper Egypt. Many are from Christian pilgrims arriving at Alexandria: far fewer travellers arrived in the eastern Delta, at Dumyāṭ or Tinnīs – the latter having been abandoned by the time of most of the historical accounts.

Just as in the Nile valley, navigators had occasion to resort to rowing, punting, and towing in order to overcome contrary currents and winds, calms – as well as groundings at low Nile. Indeed, with the more variable wind conditions of the Delta, the extensive calms of its central belt, and the more meandering nature of the waterways, rowing and towing must have been a common occurrence in all seasons. Again, traveller accounts from the 14th century onwards provide anecdotal insights.

Southerly winds, blowing broadly with the current, often made movement upstream difficult. Keichel (*Voyage*: 45), on his second day *en route* up the Rashīd branch reports that his crew, even against the very slow currents of May " ... had to tow the boat from the bank, advancing very slowly." Then: "Towards midday, a very hot scirocco [*khamsīn*] rose and met us, so that it was difficult to advance against wind and current...". Gonzales (*Hieruscalemsche reyse*: 73) reports that, because of a southerly wind on the Dumyāṭ branch, "...we were obliged to stop for a day in a small town..." Sandys (*Relation*: 117) experienced a persistent *khamsīn* ascending the Rashīd branch in February, such that "the poore *Moores* for moſt part of the way were enforced to hale up the boate ..."

At other times, the problem was the extensive calms that beset the inland Delta. Von Neitzschitz encountered calms south of Fuwah on the Rashīd branch "...so much so that for most of the time the Moors had to pull, from the land, the boat with ropes ..." (*Weilant*: 208).

Veryard, on the other hand, experienced problems with a strong following wind on the Rashīd branch:

> "We had so brisk a Gale, that we were forced to keep near the shore ... for the wind and stream being contrary, there arose a kind of Tempeſt, by reason whereof we advanced very little." (*Account*: 168).

Pococke's three-masted galley would:

> "With a good briſk wind ... sail well against the current, but when there is little wind, or it is contrary, men draw [it] up with a cord faſtened to the maſt; tho' if the wind is high and contrary, they are obliged to lie by ..." (*Description* 1.16).

Towing was also a common practice on the Alexandria canal. Gucci, ascending the canal to al-Aṭf in October 1384, says his vessel was rowed, and sometimes towed. Since the canal only operated during the flood, canal travellers inevitably emerged into a fast-flowing Rashīd branch, again often requiring their vessels to be towed (Gucci, *Viaggio*: 96-8; Teufel, *Voyage*: 154)

Movement up the later Maḥmūdiyyah canal was no easier. Swinburne (1850-51: entry for 11 November) says "the wind failed frequently", requiring the crew to tow. The 19th century British postal system for taking mail via Egypt to India used horses to tow vessels on the canal:

> "...for [the wind] blows so hard sometimes that boats tracked by men are unable to stir an inch, and are consequently delayed hours, even days." (Levich 1847: 63)

Just as in the Nile valley, travelling downstream sometimes also required rowing – and even towing on occasion – to overcome the northerly winds. Keichel (*Voyage*: 129) and Rocchetta (*Pelegrinatione* :65, 68) describe their vessels being rowed, and in the latter case also towed, down the Rashīd branch. Roccetta was travelling downstream in November, when the assisting current was relatively strong. So too was Teufel (*Voyage*: 181) who says his *jarm* was towed downstream on the Dumyāṭ branch. Savary's small *canje* had to be rowed for two days during his four-day descent of the Dumyāṭ branch (*Lettres*: 1.319-334)

Again, the traveller accounts give some insight into travel times in the Delta. These are summarised in Figure 4.8. Travellers opting to travel by sea from Alexandria to Rashīd took a day or a day-and-a-half, passing through the dangerous Rashīd mouth (Wild, *Reysbeschreibung*: 10-1; Morison, *Relation*: 21-22). Those making the journey by land took a similar a day or day-and-a-half, the journey often being done overnight (Belon, *Observations*: 97a; Palerne, *Peregrinations*: 22-3; Von Lichtenstein, *Voyage*: 23; Kiechel, *Voyage*: 43; Sommers, *Voyage*: 280-2; Neitzschitz, *Weilant*: 204-5; de Monconyons, *Journal*, 29; Gonzales, *Hieruscalemsche reyse*: 306; Veryard, *Account*: 288; Pococke, *Description*: 1.13). The land journey was harder in winter, when the flood residue made the going difficult (Gonzales, *Hieruscalemsche reyse*: 306).

There are no historical accounts of sailing through the lakes from which to extract complete journey times for that route. However, al-Dimashqī, in the 14th century, says the journey along the al-Ḥāfir canal that entered the lakes took half a day (*Nukhbāt*: 121).

Most travellers who give times for the journey from Rashid to Cairo say they did it in four days (Guilbert de Lannoy, *Voyage*: 4.4.1418v; Kiechel, *Voyage*: 45-6; Sommer, *Voyage*: 283-6; Wild, *Reysbeschreibung*: 18; Bremond, *Viaggi*: 39; de Monconyon, *Journal*: 33). Belon claims to have done it in two days at the height of the flood, traveling day and night (*Observations:* 99a-101a). Neitzschitz, travelling in early June at the lowest Nile did it in two-and-a-half days (*Weilant*: 206-10). Savary, in early October, did it in three, the north wind "being almost constant this season" (*Lettres*: 74-83). Palerne (*Peregrinations*: 37), Sandys (*Relation*: 118), Veryard (*Account*: 290) and Morison (*Relation*: 20-5) did it in five days. For Pococke (*Description*: 1.16-17), it took a week. Again, the *Description de l'Égypte* claim that it could be done in 36 hours does not appear typical (Jomard 1809-28: État Moderne, 1.122).

Lucas (*Voyage*: 27-31) claims to have done the entire journey from Alexandria to Cairo via Rashīd using the sea route, in four days. While that seems possible, it appears that the

combined journey, whether by sea or land, was more typically done in about six days of uninterrupted journey time.

During the flood, the alternative route between Alexandria and Cairo was through one of the manifestations of the Alexandria canal. Only one account, that of Bernard (*Voyage*: 3.1.533v) in the ninth century, was probably done through the canal rising at Shābur – the Alexandria channel of Ibn Ḥawqal and al-Idrīsī. His journey to al-Fusṭāṭ took six days, which is also the time that al-Idrīsī gives for the journey (*Nuzhat*: 3.331). Later travellers, passing through the canal to al-Raḥmāniyyah, could make the journey in less time. In the 1320s Symon Semeonis took a day to travel up the canal to al-Raḥmāniyyah, followed by three days on the Nile to Cairo (*Itinerarium*: 4.2.1192r). Gucci (*Viaggio*: 96-9) and Frescobaldi (*Viaggio*: 84-9) recorded the same time for their journey in 1384. In 1588, Teufel took a day to travel up the canal, followed by just two days to Cairo (*Voyage*: 151-4). Swinburne, travelling up the 19th century Maḥmūdiyyah canal, took four-and-a-half days to reach Cairo (1850-51: entries for 11-15 November).

In the eastern Delta, no traveller accounts survive of the journey time from Tinnīs to Cairo, since most historical accounts date from after the abandonment of that city in the 13th century. From Dumyāṭ, the approximately 200-km ascent to Cairo could be done within three days, based on the accounts of von Lichtenstein (*Voyage*: 4), Harant (*Voyage*: 31) and Stochove (*Voyage*: 12). Gonzales, in a merchant vessel and at the height of the flood, took five days (*Hieruscalemsche reyse*: 76).

Heading downstream from Cairo, the journey from Cairo to Dumyāṭ could be made within three days, as was the case for Guilbert de Lannoy (*Voyage*: 4.4.1418v) Palerne (*Peregrinations*: 168), Teufel (*Voyage*: 181-2), Wild (*Reysbeschreibung*: 80-1), and de Monconyons (*Journal*: 168-9), all of whom travelled during the flood. Von Neitschitz took four days in July (*Weilant*: 338). Savary, travelling in February, took five in a small boat (*Lettres*: 316-57). Al-Idrīsī claims the descent from Cairo to Tinnīs took nine days (*Nuzhat*: 3.331) – but this is considerably longer than the similar distance to Dumyāṭ.

The approximately 190-km descent from Cairo to Rashīd could, according to historical accounts, be made in two days in good conditions. Von Lichtenstein (*Voyage*: 22) and Castela (*Sainct Voyage*: 195-8) both did the journey in that time with the help of night sailing, Gonzales took three days in an 'ordinary merchant vessel' (*Hieruscalemsche reyse*: 296, 301-2), while Rocchetta took four days in the difficult conditions (*Pelegrinatione*: 63-8).

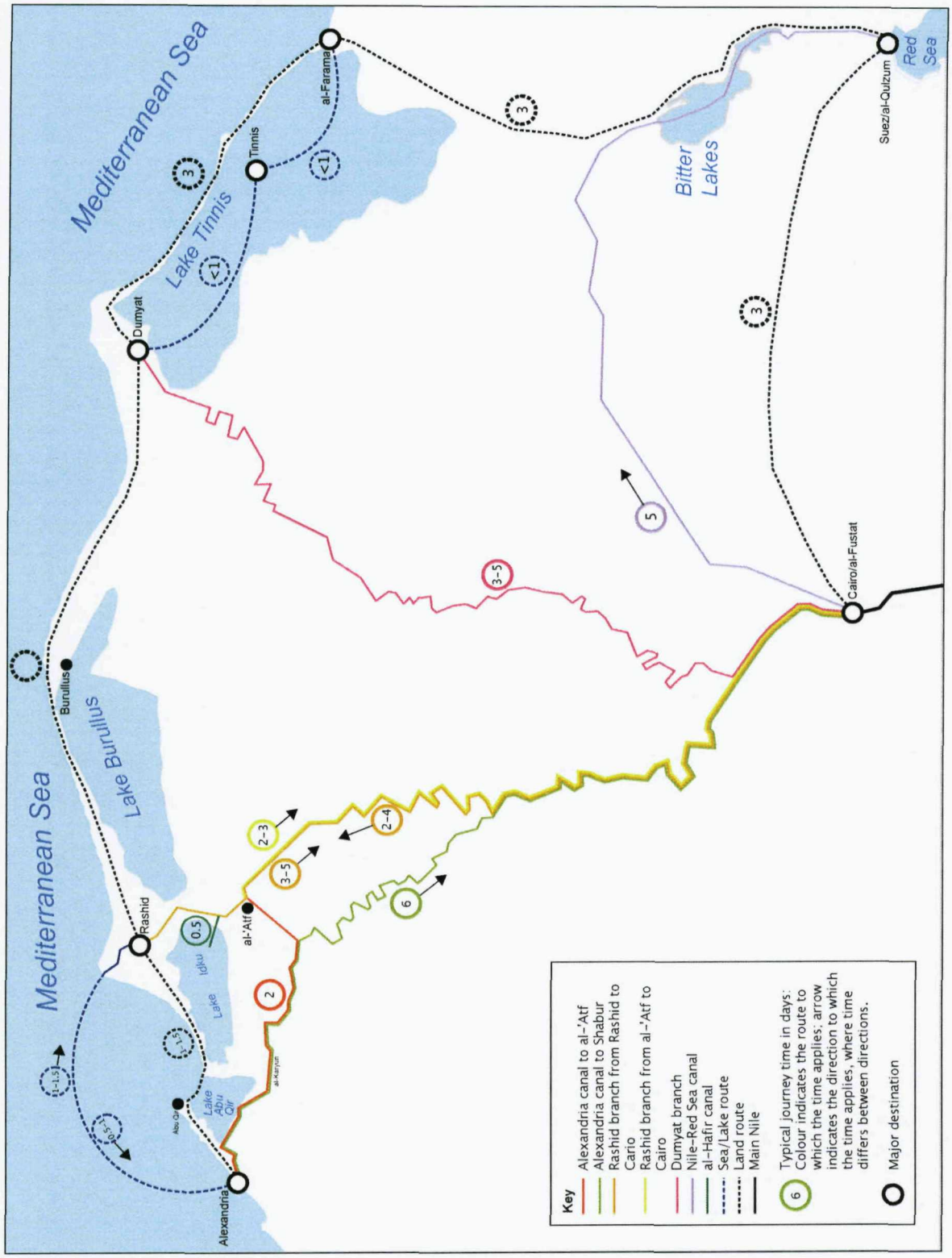

Figure 4.8: Representative travel times by river and land in the Nile Delta, based on traveller accounts.

The onward journey to Alexandria by sea could be rapid: in the 11th century, al-Bakrī says it was "a day's journey, or less" (*Mamālik*: 3.3.731v) Gonzalez says it could be done in three-four hours with a good wind, or more typically half a day (*Hieruscalemsche reyse*: 306).

Again, during high Nile, the Alexandria canal was an option. Chesneau (*Voyage*: 25) took a day and a half to reach Fuwah, near the al-Raḥmāniyyah canal mouth, and a further

two days to reach Alexandria. The Seigneur D'Anglure took three and a half days to Fuwah, and, again, two along the canal (*Saint Voyage*: 77).

As noted already in the opposite direction, the land journey between Rashīd and Alexandria usually took one-two days. However, the overall journey from Cairo to Alexandria could take more than the sum of these parts. A letter from an estate agent in Alexandria to his boss in Fayyum recounts a journey in May 735 that took 10 days (Sjipesteijn 2004: 116, 135-6)

The journey time along the Nile-Red Sea canal was, according to Ibn Ṭuwayr, five days (in al-Maqrīzī, *Khiṭaṭ*: 3.475), a figure that compares well with the four days that Herodotus (*Historia*: 2.158) says it took to travel the shorter canal of Darius. The time is unlikely to have been the same in both directions, however. The outward journey would have been assisted by the current through the canal and the prevailing north-westerly winds. The same winds would have made for difficult going up the Isthmus of Suez, requiring towing in the canal sections, and beating upwind in the lakes. Bourdon (1925: 109-10, 112, 125, Carte 1) identified towpaths on the vestiges of the canal he located in the Isthmus.

4.5 Navigational obstacles

So far, the discussion has focussed on general navigational conditions on Egypt's medieval waterways. However there were also very particular locations in which specific navigational obstacles existed, and which took a defining role in shaping the navigated riverscape of Egypt. The chief of these – the Nile mouths in the Delta and the First Cataract – formed the very boundaries of the Egyptian river network. Others made for difficult navigation at certain locations on the Nile valley itself.

The Delta mouths

> "The Turks, instructed by long and dire experience, say in a proverb well known among them, that whoever does not fear the *Bogaze* [Nile mouth] does not fear God" (Morison, *Relation*: 21)

The difficult interface between the Nile and the Mediterranean Sea was, in Semple's words, "Egypt's great handicap" (Semple 1932: 152). The mouths of the main Nile branches – known in the singular as *būghāz* – represented formidable navigational obstacles. Navigators had to contend with narrow and shallow navigable channels passing through constantly shifting sandbanks, and that in conditions of turbulent waters, standing waves, and problematic winds. So great were these obstacles that they were instrumental in defining the wider navigational landscape of the Nile Delta.

Before the impact of the major Nile hydrological engineering works of the 20th century – particularly the Aswan High Dam – the Nile waters met the sea carrying a substantial sedimentary load, particularly during the flood season (Sharaf el Din 1974: 185; 1977: 196). The result was a constantly prograding shoreline as each year's sedimentary load was dumped on Egypt's continental shelf (Inman et al. 1975: 206; Stanley and Warne 1993: 630; Summerhayes et al. 1975: 162). Prevailing northwestery winds and the east-west Mediterranean longshore current helped concentrate the deposition close to the coast (Lotfy and Frihy 1993: 655). The consequence was a shallow inner marine shelf off the Delta coast where depths do not exceed 12m until 7.5km offshore (Misdorp and Sestini 1975: 146).

Inevitably, much of this deposition took place around the major Rashīd and Dumyāṭ mouths, resulting in the formation of two mini-deltas at each. These have historically been the focus of wave convergences and intense local erosion and deposition (Frihy and Lawrence 2004: 214-216; Inman *et al.* 1975: 205). One consequence of this dynamic regime was a constantly shifting channel through the mouths. Another was the formation of sand bars that narrowed the passable channel and reduced its draught considerably, compared both to the seabed outside and the riverbed within. In the late 19th-century, the Rashīd mouth was no more than 2.1m deep, and the navigable channel "very narrow"; the Dumyāṭ mouth was at 1.8m even shallower, and its navigable width less than a cable (185m). Both branches deepened quickly a little upriver to around 6m (Admiralty 1885: 271-272). Willcocks (1890: 39) reports that vessels drawing up to 2m could ordinarily enter both mouths, but that the Dumyāṭ branch was closed for up to 15 days during the early flood. Both mouths were highly changeable, but especially the Rashīd mouth, where "... during flood ... the bar behaves very badly, and makes the passage very uncertain."

Moreover, these sedimentary obstacles were rarely negotiated in benign sailing conditions. At the Nile mouths, the broadly northward-flowing Nile encounters wind-and-wave conditions prevailing in the opposition direction, particularly during the summer Mediterranean sailing season when northwesterly winds are most frequent (Appendix 4, Tables 2A, 3A). These winds hamper the passage of vessels sailing out of the mouth, and threaten to drive those entering it out of the navigable channel. In addition, the winds generate wave fields that bear down upon the Nile mouths (Frihy and Lawrence 2004: 919, 924; Nafaa *et al.* 1991: 671; Sharaf el Din 1974: 183; Stanley and Warne 2007: 7). The net result is an extremely turbulent situation, with substantial waves breaking both over the shallows and against the countervailing river current: Heather's late 18th century map of

Egypt consequently marks both the Rashīd and Dumyāṭ mouths of the Nile as "very dangerous" (Heather 1798).

Earlier historical sources bear out the environmental data. Al-Bakrī in the 11th century is the only source in the medieval Arabic canon to describe conditions at a Nile mouth. Of the Rashīd mouth, he says:

> "This is a frightening place for ships. The waves of the Nile are greatest there due to the Nile current, and banks of sand rise up beneath the water." (*Mamālik*: 3.3.731v)

Despite his description, al-Bakrī includes the route through the Rashīd mouth as part of his waterborne itinerary from al-Fusṭāṭ to Alexandria. Moreover, a number of Geniza documents make references to vessels making the journey to Alexandria from Rashīd by sea (Goitein 1967: 1.259), suggesting that, though difficult, the route was not altogether impossible. However, it was perhaps undertaken when alternatives – in particular, an open Alexandria or al-Ḥāfir canal – were not available.

Visitors to Egypt provide vivid accounts of their experiences at the Nile mouths. In 1581, Palerne passed out through the Dumyāṭ mouth:

> "... not without great peril, all the mouths being very dangerous, because the sea obstructs their course, which is quite straitened, when it crosses and when it is at its height. It is a maxim: the more one seeks to block its course, the more the water becomes violent. A boat [caught] between two opposing currents can only become marvellously agitated, and in danger of sinking, if one does not follow the channel well" (*Peregrinations*: 174)

Sandys (*Relation*: 116) says that the bar of sand across the Rashīd mouth, like that at Dumyāṭ, changed "... according to the changes of the winds, and beating of the ſurges." Wild (*Reysbeschreibung*: 11) says that: "There are large waves there, and a bore, because the Nile flows with force and the sea pushes the waves with force against the current, so much so that it is dangerous to pass."

According to Savary:

> "The Bogaz ... is a formidable ſhoal. The waters of the river combat with the ſea to find a paſſage. When the wind freshens, the waves [at the Rashīd mouth] then run mountain-high, and form whirlpools, which ſwallow up veſſels. The Bogaz is very shallow, and in the space of a league, there is usually only one paſſage of a few *toiſes* [1 toise = 1.95m] breadth, where ships can pass. The passage is continually shifting." (*Lettres*: 1.59).

He adds (*Lettres*: 1.61) that: "The bar of the Nile [at the mouth] is totally shut during two month of the year, and the commerce of Alexandria is interrupted." He does not specify which months.

Around the same time, Pococke (*Description*: 1.15) captures something of the changeable topography of the Rashīd mouth:

> "At the mouth of the river is an island of a triangular form, called Latomia ... it is overflowed when the winds blow from the northwest, and then becomes two islands ..."

Passage was much easier when the wind was from the south. Coppin reports of the Dumyāṭ mouth that:

> "... the Midy [south wind] and Syroc [east] chase the waves afar, and give the river the means to clear its passage ..." (*Relation*: 303).

Pitts (*Manners*: 93) says he waited "ſeveral days" for safe conditions of passage through the Rashīd mouth, saying that: "Veſſels are forced to wait ten or twelve Days for a clear Mouth."

In the Ottoman period, the changing channels through the mouths were constantly monitored. Sandys (*Relation*: 116) observed "...a pilot of [Dumyāṭ] there ſounding all day long, by whoſe directions they enter..." Over a century later, and at the Rashīd mouth, Savary reports that:

> "Night and day a boatman is ſounding with his lead in his hand to point to navigators the courſe they must purſue, but frequently all their ſkill is unable to maſter the wind and waves, they miſs the paſſage, ſtrike on the ſand, and in a few minutes, all is overwhelmed in a whirlpool of mud and water. Every year is marked by a great number of ſhipwrecks." (*Lettres*: 1.59-60).

The reputation of the mouths for wrecking ships is noted by several other travelers, including Morison (*Relation*: 184), Pitts (*Manners:* 93) and Lucas, who entered the Rashīd mouth in a *jarm* (*Voyage*: 1.29). Teufel (*Voyage*: 187) records his own narrow escape when passing through the Dumyāṭ mouth in November 1588:

> "Exiting this mouth, in a germe (Arabic: *jarm*) we beached on a sandbank because the violence of the sea pushed us out of the channel. One wave came after another, [and] our *germe* became almost full of water, to the point that we were in great danger. But Almighty God helped us, and each of us pushed

> forcefully, using oars and poles, until we were able to lift the germe off the sandbank ..."

Stochove reports that, as a result of the "great violence" of the waters of the Dumyāṭ mouth, "we ran the risk of being lost, because three times we saw our boat half covered by water" (*Voyage*: 4).

Morison passed safely through the Rashīd mouth in October 1697. However:

> "...we had the pain of being spectators to the misfortune of others, for we saw a quite large vessel halted on the sands, battered by winds that were about to tip it on its side, and causing the loss withal of a quite considerable number of people."

The nub of the problem was that the draught of the channel was such that passage was extremely difficult for larger seagoing vessels, while conditions on and outside the mouths could be dangerously rough for the flat-bottomed, deck-less Nile barges of the historical accounts.

Keichel (*Voyage*: 44), says that at Rashīd, goods from vessels descending the Nile were transshipped onto "bigger and more solid [vessels] called *tschurma* [*jarm*]. These go on the sea, and coast to Alexandria"

Bremond (*Viaggi*: 37) notes that:

> "Bulky and heavy merchandise are carried on long boats, with flat bottoms, called *germes* [Arabic: *jarm*], which can exit over these sand banks, and which draw little water. But at the slightest bad weather, on the sea, [they] are easily wrecked on this stormy coast."

Whether earlier medieval seagoing vessels also drew too much water to pass the Nile mouths is unclear. Larger seagoing vessels started to appear in the Mediterranean in the late 13th century (Pryor 1988: 88). By the 16th century, transshipment between seagoing ships and Nile vessels across the Nile mouths was the norm. Teufel (*Voyage*: 187) and Sommer (*Voyage*: 282) reported that the sand banks at the mouths were impassable for seagoing ships. Earlier that century, Piri Reis notes that when a large sea-going merchant *gripars* arrived off the Rashīd mouth:

> "... small craft will approach from inside and offload the cargoes of this gripars, after which they may take their ships inside." (*Bahriye*: 4.1511)

Of the Dumyāṭ mouth he notes that: "A galley can enter the Dimyad channel and sail as far as Misr [Cairo]." However, seagoing cargo ships anchored offshore, and transhipped onto small craft that carried the cargoes into the Nile (*Bahriye*: 4.1519).

Gonzales also reports that his ship was discharged of cargo before being tugged through the mouth by sailing boats crewed by "sailors of proven experience." Pococke (*Description*: 1.19) also noted that large vessels did not enter the Rashīd mouth laden, but rather goods were lightered from them two leagues offshore.

Conditions at the Delta lake mouths were, in contrast, altogether more benign than those of the river, although the passage would have been open only to vessels of shallower draft. During the flood, the flow of water would have been constantly outward, into the sea. However, the absence of delta cones at the lake mouths, such as those at the river mouths suggests a less dynamic and tumultuous encounter between Nile water and the sea, and thus an easier passage for boats.

As already noted, Medieval accounts speak of Lake Tinnīs/Manzalah being sweet during the Nile flood, when the inhabitants of the lake shore filled their cisterns, and saline for the remainder of the year (al-Ya'qūbī, *Buldān*: 337; Ibn Ḥawqal, *Ṣūrat*: 156; Mas'ūdī, *Murūj*: 2.364; Nasir i Khusraw, *Safarnama* 39; al-Qazwīnī, *'Ajā'ib*: 118; al-Tinnīsī, *Anīs*: 35; al-Maqrīzī: *Khiṭaṭ*: 1.158). The advantage of the lake's connections with the open sea was therefore that the lake water was maintained at a constant depth – up to 2m in some places – throughout the year. The 1885 pilot puts the depth of water at the al-Jamīlah mouth of the lake (Appendix 2, Figure 1) at about 1.2-1.8m (Admiralty 1885: 274). The depth at the al-Tīnah mouth is unknown: the maps of Piri Reis depict a large seagoing vessel moored outside the mouth, with smaller Nile vessels on the inside (Appendix 1, Figure 24).

Entry and exit from the lake was also not without hazard. The 1885 Mediterranean Pilot says that, at al-Jamīl:

> "... [the tide] sets along the coast from the westward and enters the lake obliquely; the latter, or ebb, rushes out at the change of tide with great velocity, carrying with it quantities of mud." (Admiralty 1885: 274)

However, unlike the at the river mouths, navigators could at least wait for the tide to slacken, at which time these currents would have been much reduced.

At the other side of the Delta, the mouth of Abū Qīr Lake at al-Ma'ādiyyah presented an alternative entry into the Nile network. The mouth – vestige of the Canopic branch – was not deep, however. Several travelers of the 16-17th centuries give their account of traveling by land from Alexandria to Rashīd along the coast. Of these Rochetta (*Pelegrinatione*: 73),

Brémond (*Voyage*: 36) and Gonzales (*Hieruscalemsche*: 307) say that they crossed the mouth on a dedicated ferry – their passages being in July, November, and an unknown month, respectively. However, in late-August or September 1547, Belon was able to cross the mouth "by fording [it], at the very time the Nile was in flood" (*Observations*: 98a).

Like Lake Tinnīs, Lakes Idkū and Abū Qīr were, once through the mouth, passable in a shallow vessel. Al-Idrīsī's account of the route through the lakes and the al-Ḥāfir canal has already been noted in Section 3. Likewise, the *Devise des Chemins de Babiloine* of the following century decribes a route to Alexandria through the lakes that begins as a canal from the Alexandria channel:

> "By this branch the merchandise of Upper Egypt, Cairo and Babylon are discharged at Idkū, and from there are carried to Alexandria by land." (*Devise*: 245)

Gonzales indicates that a route to Cairo via this mouth and the lakes beyond was still open, seasonally, in the 17th century:

> "When the Nile inundates the land, return voyage by boat to Cairo is possible" (*Hieruscalemsche reyse*: 307).

Finally, the mouth of Lake Burullus in the northern Delta provided another alternative entrance into the Nile system for vessels of shallow draught. Van Ghistele, visiting Egypt in 1462-63, says its entrance, and that of Lake Tinnīs, was forbidden to Christian vessels (*Voyage*: 104). However, it features prominently in the otherwise sparse 14th Century Italian cartography of the Delta, suggesting the mouth was a well-known feature (Appendix 4, Figures. 21-23). Marinus Sanutus (*Secretorum*: 4.1.1162v) says it "possesses a less deep estuary that the three others [Rashīd, Dumyāṭ and Tinnīs], and can only receive vessels of slight tonnage". Piri Reis agrees, saying that:

> "If they [seafarers] come in small ships, they may enter the haff … When the river floods … they sail between Misr to Burulus in small craft." (*Bahriye*: 5.1515)

His cartography (Appendix 4, Figure 26) depicts Nile boats on Lake Burullus. It also indicates onward connections to the Rashīd branch – as does Abū al-Fidā two centuries earlier (*Taqwīm*: 38-39) – and also to the Dumyāṭ branch.

The entrances to the coastal lagoons of the Delta therefore provided a less turbulent and less dangerous entry into the Nile waterway network. Their drawback was that they were too shallow for most seagoing vessels. Gonzales (*Hieruscalemsche*: 307-308) who noted

that the route from the Lake Idkū mouth to Cairo was open during the flood, otherwise says that the lagoon mouths:

> "... are in our day, for the most part, blocked and silted, so much so that, when the Nile has receded from the land ... there are just two open and navigable mouths to the Nile ..."

These were the Rashīd and Dumyāṭ branches.

The First Cataract

The rapids of the First Cataract constituted the effective upstream boundary of Egyptian river-navigation, and also the limit of Egyptian political power. It was there that Egypt's Muslim conquerors called a halt to the initial military expansion, reaching a pact with Nubia in 652 (Ibn 'Abd al-Ḥakam, *Futūḥ*: 169-170). In the 13th century, Yāqūt still describes the cataracts as "...the furthest point of Upper Egypt, close to the land of the Nubah." (*Buldān*: 2.123).

That the Cataracts were at once physical obstacle and cultural-political boundary was, of course, no coincidence. Al-Mas'ūdī says of Aswan and the rapids:

> "It is to that place that boats ascend from al-Fusṭāṭ. Some miles from Aswan are mountains and rocks amongst which the Nile flows [i.e. the Cataract]. There is no way of passing a boat through them. This mountain and place is [the site] for portering [Arabic: *wāriz*] between the places of the ships of Abyssinia (*al-Ḥabashah*) on the Nile, and [those of] the ships of the Muslims." (*Mūruj*: 1.208-9).

In effect, goods were offloaded at each end of the rapids, and carried, probably by pack animal, to waiting vessels at the other side. According to the Anonymous Venetian:

> "Whatever boat wishes to pass into Nubia when they arrive in Aswan, all the goods they have on board they discharge, and they go on camel back for a distance of seven miles ... At the end of the seven miles the goods and their owners await the boats that are, when the Nile is flooded, easily carried by the wind [over the Cataract] so long as the wind is fresh. Otherwise, if there is no strong wind, they are defeated by the great current and cannot ascend. They are forced to take to the bank. Then by force of men with a strong rope they are pulled against the force of the current, and by that means they arrive at that place, all in a day." (*Voyage*: 122-3)

Likewise, in more recent times, the cataracts were not viewed as entirely impassable for sailing vessels in all seasons. The 1884 *Sketch Map to Illustrate Obstacles to Navigation of the Nile* notes that: "... both *dahabiyehs* and *nuggurs* pass [the Cataracts] with their cargoes at high Nile. At low Nile, both when ascending and descending, they usually discharge cargo." (Intelligence Branch 1884) The map further notes that "Nile steamers can pass the First Cataract from August to January and boats of not more than 60t at all seasons."

Lane (2000: 432) says that: "During the period of the inundation, boats may, with a strong northerly breeze, sail up the rapids, which then merely foam, and form eddies, but have no perceptible fall" He saw his 10.6m *qanjeh* vessel piloted up the cataracts in May 1826 – that is, at low Nile. The process took 70 men and 60 hours.

The method of towing vessels up the cataracts was illustrated by Talbot Kelly in 1899 (see Figure 4.9)

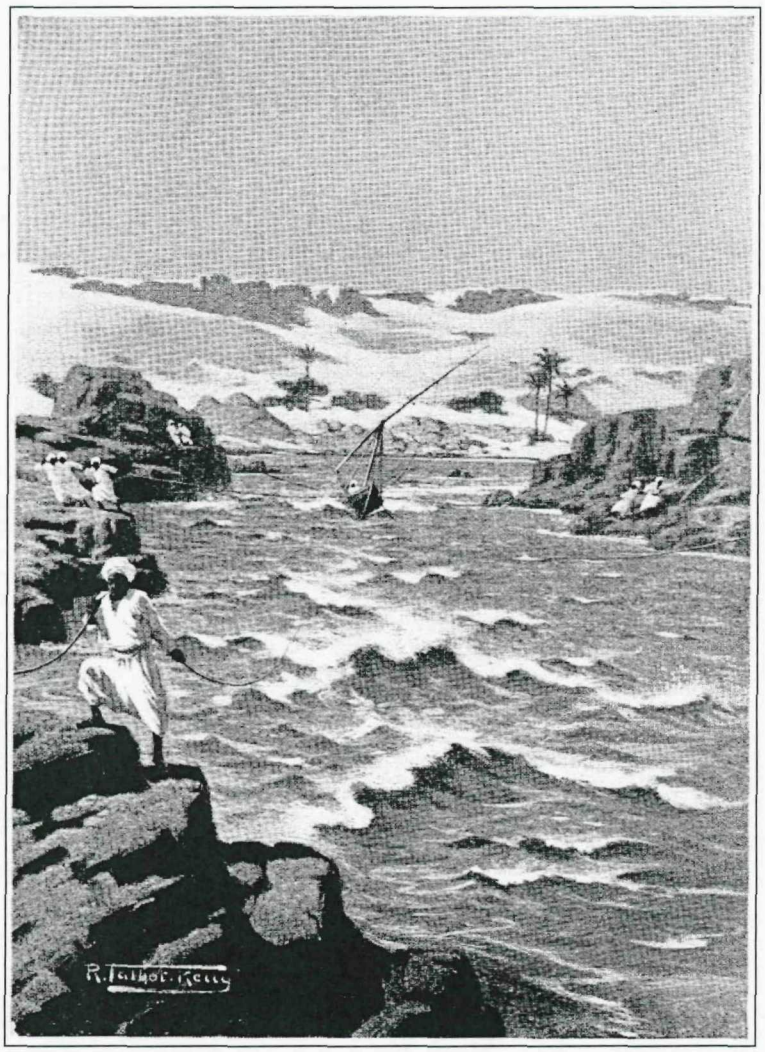

Figure 4.9: *Natives hauling a boat up the "Great Gate"* by Talbot Kelly, 1899 (published in Penfield 1899). The depiction shows men towing a vessel up the First Cataract using ropes from both banks to control the course of the boat.

Other Nile hazards

While in the 19th century Willcocks, quoted above, observed that there were no navigational obstacles, except low water, on the Nile between the Mediterranean and the cataracts, medieval writers did not take quite the same view. In particular, they draw attention to the dangers around a mountain called Jabal al-Ṭaylamūn. Ibn Sa'īd writes:

> "To the east [of Asyūṭ] is Jabal al-Ṭaylamūn, which enters into the Nile. As a result, the water is disturbed greatly in the narrow. Boats are wary of it." (*Untitled*: 4.1.1084v)

A century earlier, al-Idrīsī writes of the problems of navigating the narrows created by the mountain:

> "This mountain presses tight from the western side and hinders the flow of the Nile. The water pours upon it with a torrential force, and exits from it with a force and pressure that prevents boats ascending from Miṣr to Aswan, among others, because the flow of the Nile and the force of its current there prevents ascent against it... To this day this place on the Nile is very difficult to pass, and is well-known." (*Nuzhat*: 1.127)

The toponym no longer exists today, and clearly Ibn Sa'īd and al-Idrīsī disagree as to which side of the river the mountain stood. However the relative locations they provide suggest Jabal Abū Fawdah (30°58' E, 27°22' N), a 195m-high escarpment on the east side of the river 30km downstream from Asyūṭ. Here the river narrows to 700m wide, and runs up against the valley-side cliffs and scree of the mountain for about 5km. Edwards recounts what happened when her southbound *dhahabiyyah* emerged from the wind shadow of the same mountain:

> "[The wind] now struck us full on the beam, and drove the boat to shore with such violence that all the steersman could do was just to run the *Philae's* nose into the bank, and steer clear of some ten or twelve native *canjas* that had been driven in before us ... Meanwhile once boat after another was hurled to shore, and before nightfall we numbered a fleet of some twenty odd craft." (Edwards 1878: 133)

Warburton, meanwhile, reports that his *dhahabiyyah* "almost sank" due to the winds around the mountain (Warburton 1845: 1.188-9).

The Delta branches had no such navigationally hazardous features beyond the Nile mouths. However, the more sinuous nature of the river channels in the Delta made for particular navigational difficulties. While the problem of sand and mud banks persisted,

the current around the bends was sometimes rapid, and the eddies created could be dangerous (Savary, *Lettres*: 353). The combination made for challenging navigation, and for that reason, navigators often shunned travelling at night (Belon, *Observations*: 100b)

4.6 Onward connections

The data presented in this section so far demonstrate, among other things, that navigation on the Nile was a highly seasonal enterprise: by a benign coincidence of factors, the wider flood period, from about late July to mid-November, was the optimal season for navigation. While vessels of the shallowest draught could sail year round, merchant and cargo vessels in the high season enjoyed the particular advantage of deeper water, a reduction in the presence of dangerous sandbanks, strong and predominant northerly winds, and a strong current to carry the vessel downstream. Within that prime season, it can be further observed that sailing upstream was easiest from August to October, when then north winds blew most frequently, and that downstream sailing would have been at its easiest from October to December, when the frequency of north winds had diminished. However, sailing in both directions was possible throughout this period –journeys did not *have* to be conducted at the optimal time.

We have also noted that it was also in the period starting in September that the seasonal canals of the Nile were opened, allowing, for example, waterborne travel to Alexandria through the Alexandria canal, and to al-Qulzum though the Nile-Red Sea canal. The duration of the navigability of these canals is not clear, but they cannot, as argued in the Seasonal Canals section above, have been passable much beyond December.

Sailing larger cargo vessels outside the wider flood season was fraught with difficulty. Winds were less dependable, and the proliferation of sand banks meant that navigators were exposed at best to delay and laborious progress, and at worst to irretrievable stranding and wrecking. Between March and June, navigating the Nile in a cargo vessel was close to impossible.

This new section asks how the clear seasonality of Nile navigation interfaced with the active seasons of the Mediterranean and Red Seas, and of the land caravans that connected to the Nile. The discussion is summarised in graphic form in Figure 4.12.

The Mediterranean sailing season

Sailing on the medieval Mediterranean, as on the Nile, was a highly seasonal activity, the result of the very distinct meteorological patterns encountered on the sea in winter and in summer. Essentially, the winter period is prone to sudden and violent storms, making for dangerous and unpredictable conditions: summer, in contrast, is dominated by stable

pressure systems that made for predictable and benign sailing (Admiralty 1937: 8-9; Braudel 1949: 1.246; Meteorological Office 1962: 3-5; Pryor 1988: 16-19).

The instability of winter is the result of low pressure over the sea relative to the land masses to its north and south (Admiralty 1937: 8). Mongolian highs dominate eastern and central Europe and central Asia, while highs hold sway over the Sahara. Atlantic depressions travel frequently along the entire west-east axis of the Mediterranean (Admiralty 1937: 8-9; Pryor 1988: 16-19) (See Figure 4.10.A). These depressions not only make wind direction highly variable, but also have gales and strong winds associated with them (Admiralty 1937: 9; Pryor 1988: 87). Hence sailing on the sea during this period – essentially November to mid-March – was a risky affair.

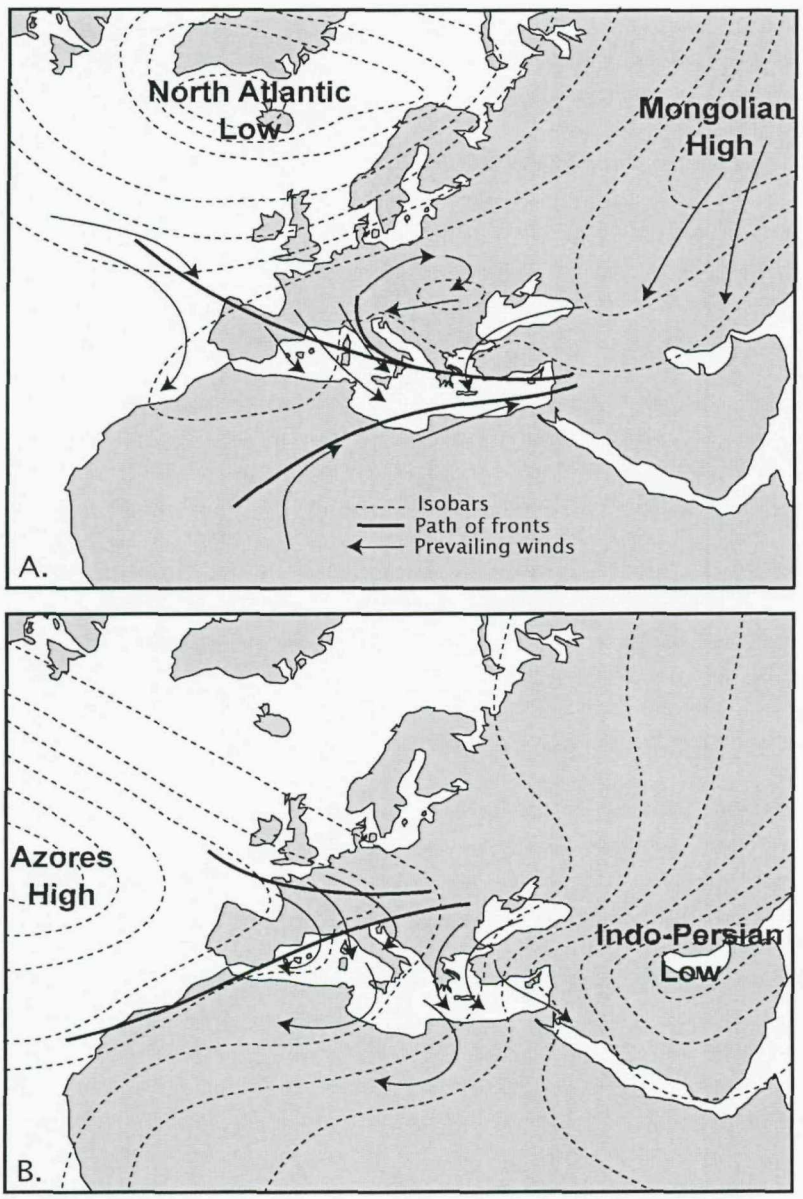

Figure 4.10: Prevailing meteorological conditions over the Mediterranean in winter (A) and summer (B). After Pryor (1988: 17).

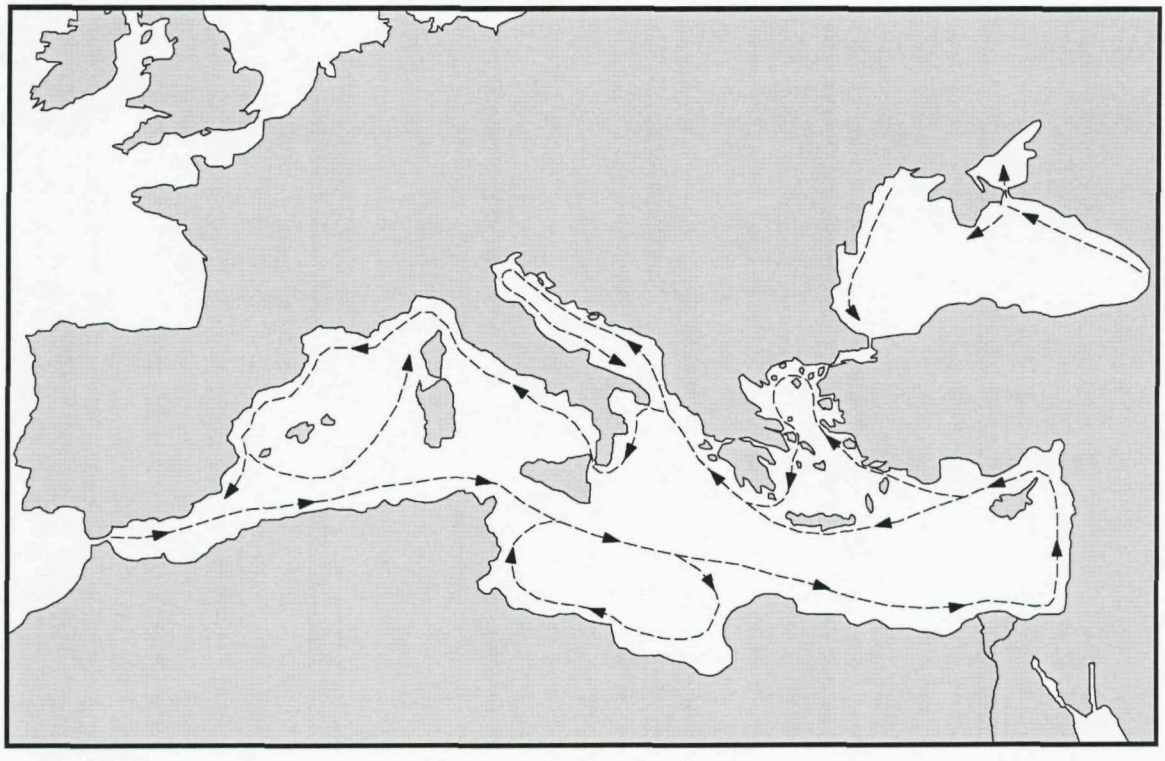

Figure 4.11: Main currents in the Mediterranean Sea, after Pryor (1988: 14).

In summer, by contrast, the central and eastern Mediterranean comes under the influence of depressions centred over Arabia and Iran, while tropical highs dominate the western sea. (Admiralty 1937: 8; Meteorological Office 1962: 4-5; Pryor 1988: 19) (see Figure 4.10.B). The convergence of these anti-cyclonic and cyclonic systems in the central and eastern Mediterranean makes for stable isobars, and with them the famed north or northwesterly winds know variously as the Meltemi or Etesian winds, which in antiquity carried Roman grain vessels to Egypt on a brisk Force 4 wind (Meteorological Office 1962: 20; Pryor 1988: 20, 87-88; Semple 1932: 94). Travelling depressions of the winter type are extremely rare in summer.

The spring transition – called in North Africa *al-Qāsim*, 'the divider' (Achard 1939: 231) – was a risky time to put to sea, since the impression of summer stability could be suddenly shattered. Northwest winds predominate, but the situation could still be interrupted by the occurrence of a late travelling depression (Admiralty 1937: 9). In late spring, depressions arising in North Africa and tracking east close to the Mediterranean coast give rise to the *khamsīn* season – the effect of which on Nile sailing has already been discussed – with frequent southerly winds (Admiralty 1937: 9; Pryor 1988: 20). The transition also sees the growth of easterly winds, offering the chance of westward sailing.

During the autumn transition, the eastern Mediterranean experiences frequent calms and light winds. It too sees the re-appearance of easterly winds, aiding the return journey of vessels to the northern and western Mediterranean at the end of the sailing season (Pryor

1988: 2-4). Ibn Jubayr called this easterly wind the *Ṣalībiyyah*. He says that the times for sailing west in the Mediterranean were in spring and autumn – that is, from Mid-April to May, and from the middle of October – when these easterly winds blew (*Riḥlah*: 311, 317).

A futher environmental factor to consider in the navigation of the Mediterranean is sea current, which flows in an anti-clockwise fashion around the eastern Mediterranean basin. This cyclical flow is the result of the influx of water through the Straits of Gibraltar, which replaces of over 70 per cent of the water evaporating from this otherwise enclosed sea (Pryor 1988: 12-3; Semple 1932: 582; see Figure 4.11 in this thesis). The velocity of the resulting longshore current around the coast of Egypt and Palestine is about 0.5-1 knots (0.9-1.9 km/h; Sharaf el Din 1974: 187).

These navigational conditions made for concentrated sea routes in the eastern Mediterranean. Vessels sailing to Egypt from the north and west sailed across the open sea on the highly predictable Etesian winds. On the outward journey from Egypt, they rode the current around the coast, making use of diurnal and occasionally southerly and easterly winds to make progress around the Levantine shore. The westward journey followed the currents past Cyprus and Crete, taking advantage spring and autumn easterlies (Pryor 1988: 90).

As a result of the conditions outlined, winter was a closed season for navigation. In the Roman era, the Mediterranean merchant fleet was officially laid up between October and April, although in practice the period was from November to mid-March (Casson 1971: 270). The season was little different in the medieval period. In Egypt of the 11-12 centuries, the sea was closed from November to March (Goitein 1967: 316-7). Legislation drawn up in the Italian city-states between the 12th and 14th centuries banned sailing between St Andrew's Day (30 November) and the start of March. Until the 18th century, Levantine sailors would only put to sea between 5 May and 26 October (Braudel 1949: 1.248).

According to al-Maqrīzī, Egypt's military preparations for the onset of the sailing season took place in the Coptic month of Paremhat (10 March-8 April), at which time:

> "Itinerant vessels journey in the salt sea to Egyptian locations from the Maghrib and Rūm (Byzantium). In that month troops are detailed to the frontier-ports [Arabic: *thughūr*] such as Alexandria, Dumyāṭ, Rashīd and Tinnīs. There the (naval) fleets and transport ships were readied for the defence of the ports." (*Khiṭaṭ*: 1.735).

Sailing data from the 13th century shows that Provençal ships bound for the eastern Mediterranean departed mainly in late March or early April, with the eastward passage taking 4-6 weeks (Pryor 1981: 43, 69-72; 1988: 3). Hyde's investigation into European pilgrim accounts of the 14th and 15th centuries suggests that departure time for vessels bound for Egypt and the Levant varied from as early as April to as late as September (Hyde 1978: 523-4). In the 14th century, pilgrims leaving Venice usually did so on merchant vessels, while a century later, they normally journeyed on dedicated 'great galleys'. The relatively anecdotal evidence from accounts of journeys on those galleys suggests that April-May departures made for quicker journeys than those of June-July, and that returns made in May-to-July were quicker than returns made in August-to-October. Even in oared great galleys, the return journey typically took 75 per cent longer than the outward journey (Hyde 1978: 537).

Basing his assessment on travel times recorded in the Cairo Geniza, Udovitch (1978: 513) concludes that a journey across half the Mediterranean, between Alexandria and Sicily or Tunisia, took three to four weeks, and approximately twice that between Alexandria and Spain. These times meant that "*... the significant unit of time was the sailing season.*" (Udovitch 1978: 514, my italics). In other words, on long-haul voyages, the season only allowed for a single round trip to or from Egypt.

Returning to the Nile, it is apparent that, during the early part of the Mediterranean sailing season – until, say, early July – the river would have been at its lowest, and the movement of larger merchant vessels on it would have been difficult or impossible. Nile traffic would not have been in full swing until August, with the seasonal canals only opened in late August or September. Thus the period of overlap between the Nile and Mediterranean 'seasons' would have been a relatively short one, up to four months, between August and November. The Egyptian coastal ports could have been open throughout the Mediterranean sailing season. However, onward connections up the Nile would have been difficult or impossible for the first three months of that season, making land transportation the only alternative during that time. The optimal time for foreign merchants to arrive in Egypt, and for Egyptians to return home with cargoes, would therefore have been in time for or after August, by which time Nile activity would have been in full swing. By that time, too, Egyptian and Levantine merchants would have arrived back from their round trips to distant Mediterranean destinations. In the context of the Mediterranean sailing season, Udovitch (1978: 531-2) observes that:

"From mid-August to late September, the pace of maritime activity in Alexandria accelerated to the point where it dominated the activity and concerns of all the merchants

engaged in Mediterranean trade. For it was during this six week period that the approximately 50-100 ships which had set out from Alexandria in April and May returned to their Egyptian and Syrian home ports, and it was at this time that feverish preparations were under way for the last departures in mid- and late September of Italian and other merchant vessels returning to the western and northwestern Mediterranean laden with flax, spices, indigo and other eastern products."

The timing of this activity is not only a function of the cycles of the Mediterranean sailing season, however: it also represents the overlap of the Mediterranean sailing season with that of the Nile.

Finally, the conditions of the difficult Nile mouths at this time should also be considered. It was at this very time – the height of the flood, when maritime and fluvial activity was at its peak – that the Nile mouths were at their most dangerous. Moreover, with winds from the northerly quadrant most persistent during this season, this danger was also at its most predictable and unrelenting. Southerly winds, which could have flattened the waves and eased passage through the mouths, are particularly rare in the summer period. This highly localised problem therefore conveyed great importance on the existence and maintenance of those (safer) alternative routes already outlined in Section 3 – for example, to and from Alexandria by land, canal and through the lakes, and to and from Tinnīs along the Tinnīs branch. These will be discussed further in Section 5.

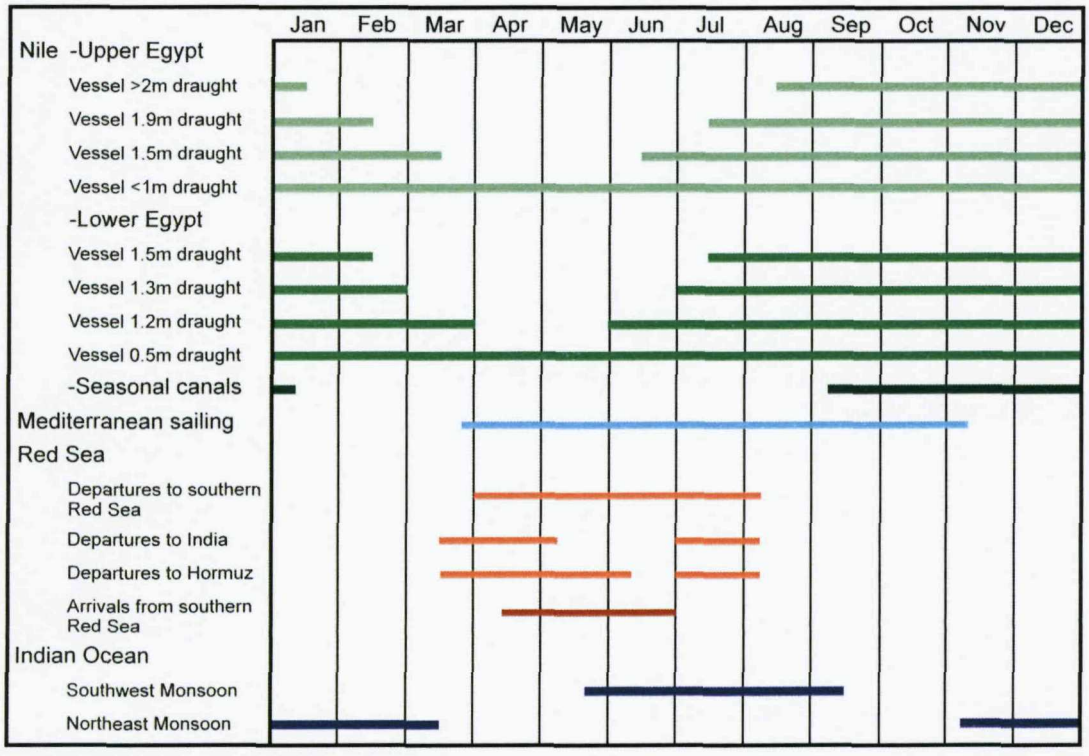

Figure 4.12: Comparitive table showing the sailing seasons of Nile vessels of various draught, the navigable period of the seasonal Nile canals, and the sailing seasons of the Mediterranean and Red Seas, and the Indian Ocean Monsoons.

The Red Sea

The Egyptian Nile's other major maritime interface was with the Red Sea. It was only for part of the seventh and eighth centuries that the two bodies of water were connected directly, by way of the Canal of the Commander of the Faithful. Nevertheless, whether by land or by canal, the traffic of people and goods took place between the two throughout the medieval period in one form or another, and so maritime connections between the two had to accommodate to the navigational seasons of each.

In order to understand the interaction of the navigational seasons of the Nile and the Red Sea, it is necessary to understand something of the various land journeys taken between the two. The quickest and easiest route was that between Cairo/al-Fusṭāṭ and al-Qulzum, at the top of the Gulf of Suez. The time for this journey is widely reported across several centuries as three days (al-Mas'ūdī, *Murūj*: 1.237-8; Ibn Ḥawqal, *Ṣūrat*: 9; Ibn Duqmāq, *Intiṣār*: 2.54; Rooke, *Travels*: 126). Al-Iṣṭakhrī (*Masālik*: 7) and al-Quḍā'ī (in al-Maqrizi, *Khiṭaṭ*: 1.40) give shorter times of a day and a night or two days, but these probably reflect post-horse speeds: three days appears to be the time taken with loaded camels. Al-Muqaddasī (*Aḥsan*: 212) says the journey took four days, but elsewhere that, via Bilbays, it took three (*Aḥsan*: 214-5). Meanwhile, the journey across the Isthmus of Suez between al-Qulzum and al-Faramā was also three days (al-Nuwayrī, *Nihāyah*: 231; Maqrīzī, *Khiṭaṭ*: 1.579).

Distances through the Eastern Desert between the Nile of Upper Egypt and the Red Sea ports of the south were considerably longer. Between the Qūs and al-Quṣayr, the journey time was seven days (Whitewright 2007: 85-86). The journey from Qūs to 'Aydhāb was considerably longer. Al-Idrīsī gives the journey time at less than 20 days (*Nuzhat*: 1.134). Nasir i Khusraw did it in 16 days (*Safarnama*: 64-5); Ibn Jubayr took 23 (*Riḥlah*: 57-65).

It was also possible to travel to 'Aydhāb from further upstream. Ibn Baṭūṭah, writing some time after the event, says he travelled there from Isnā in 15 days (*Riḥlah*: 1.109).

From Aswan, there was a choice of routes to the coast. One was via the gold mining centre of the Wadī al-'Allāqī. Abū al-Fidā (*Taqwīm*: 4.2.1183v) puts the journey to al-'Allāqī at 12 days, followed by eight to 'Aydhāb. Ibn Rustah says the journey to al-'Allāqī was ten days, followed by four to the coast (*al-A'lāk*: 183). Al-Idrīsī (*Nuzhat*: 1.40) puts the journey to the gold mines at 15 days, but does not provide the onward journey. Al-Muqaddasī (*Aḥsan*: 215) and al-Quḍā'ī (in al-Maqrīzī, *Khiṭaṭ*: 1.39) put the entire journey at 15 days. Finally, al-Bakrī (*Mamālik*: 3.3.730r) says the time taken via the mines or by the more northerly al-Waḍḥ route was 18 days. Again, these faster times may reflect post-

horse speeds rather than caravan speeds – there are no known accounts of actual journeys along between Aswan and al-'Allāqī. Quantifications of the times taken on these land routes are shown in Figure 4.7.

The Red Sea to which these roads led presented an entirely different navigational world from both Nile and Mediterranean. Its broadly north-south axis provided a useful maritime corridor to the Indian Ocean, while allowing ready navigation by the stars. However, it was in many other aspects a demanding environment. Its coastlines are fringed with reefs and shoals, and it has few natural harbours. The climate is extremely hot: the medieval coastline was sparsely populated, and had few water sources. It was, moreover, prone to sudden and vicious storms. In the north of the sea, relentless northerly winds made for a difficult northward passage. Summary current and wind charts for the Red Sea are shown in Figure 4.13, Figure 4.14, and Figure 4.15.

The meteorological year of the Red Sea can, like the Mediterranean, be divided into two distinct seasons, with transition periods occurring between the two (Admiralty 1892: 8-9; Morgan and Davies 2002: 27-28). Between June and September – when the southwest Monsoon is blowing in the Indian ocean – northerly winds of variable strength blow throughout the length of the sea with little interruption. Outside the Bāb al-Mandab, variable winds occur in the early part of the Monsoon, followed thereafter by more consistent westerlies (Admiralty 1892: 9). The northerlies are most persistent in the northern Red Sea, blowing for 94% of the time in the Gulf of Suez.

From November to March, a quite different configuration prevails in the Red Sea, this time under the influence of the northeast Monsoon. Winds from the northerly quadrant again prevail down the axis of the sea as far south as 23°N – just north of 'Aydhāb and Jiddah – and as the dominant wind to about 19°N – that is, about Suwākin. Typical winds are Force 4-5 (21-38km/h). Between December and March, winds are sometimes violent, and there are few calms (Admiralty 1892: 11; Morgan and Davies 2002: 26-7). Further south, winds from the south-southeast blow up the axis of the sea. During the height of the Monsoon, these can achieve moderate gale force. Between the northern and southern sectors, a relatively calm convergence zone traverses the sea from east to west, oscillating north-south (Admiralty 1892: 8; Findlay 1882: 37; Morgan and Davies 2002: 27; see Figure 4.15).

Between the two major Monsoon seasons, transition periods occur during which northerly winds continue to dominate the northern sea, but during which the pattern of winds in the southern sector is more variable, with winds alternating between blowing up, and blowing down the axis of the sea (Morgan and Davies 2002: 26-8).

Local winds also occur. In fine weather, land and sea breezes are common on all coasts. These blow with particular strength in the southern Red Sea, and in the north along the Arabian coast (Admiralty 1892: 11, 20). While southerly winds are rare in the northern Red Sea, they are not absent. These southerlies equate to the *khamsīn*, in that they are caused by anti-cyclonic depressions tracking east along the Mediterranean. They are most common between February and May (Morgan and Davies 2002: 28, see also Appendix 4, Tables 11A and 12A), and make for a rare and easy northward passage for sailing ships.

For mariners venturing outside the Bāb al-Mandab, the key winds are those of the Monsoon. The southwest Monsoon blows in the northern Indian Ocean from mid-May until the end of September, peaking in June-August with heavy swell and stormy and rainy conditions on the coasts of Sind and Gujerat. The northeast Monsoon begins in mid-October and prevails until early March, when the transition to the southwest Monsoon begins (Admiralty 1892: 10; Findlay 1882: 29, 169-164; Morgan and Davies 2002: 25-6).

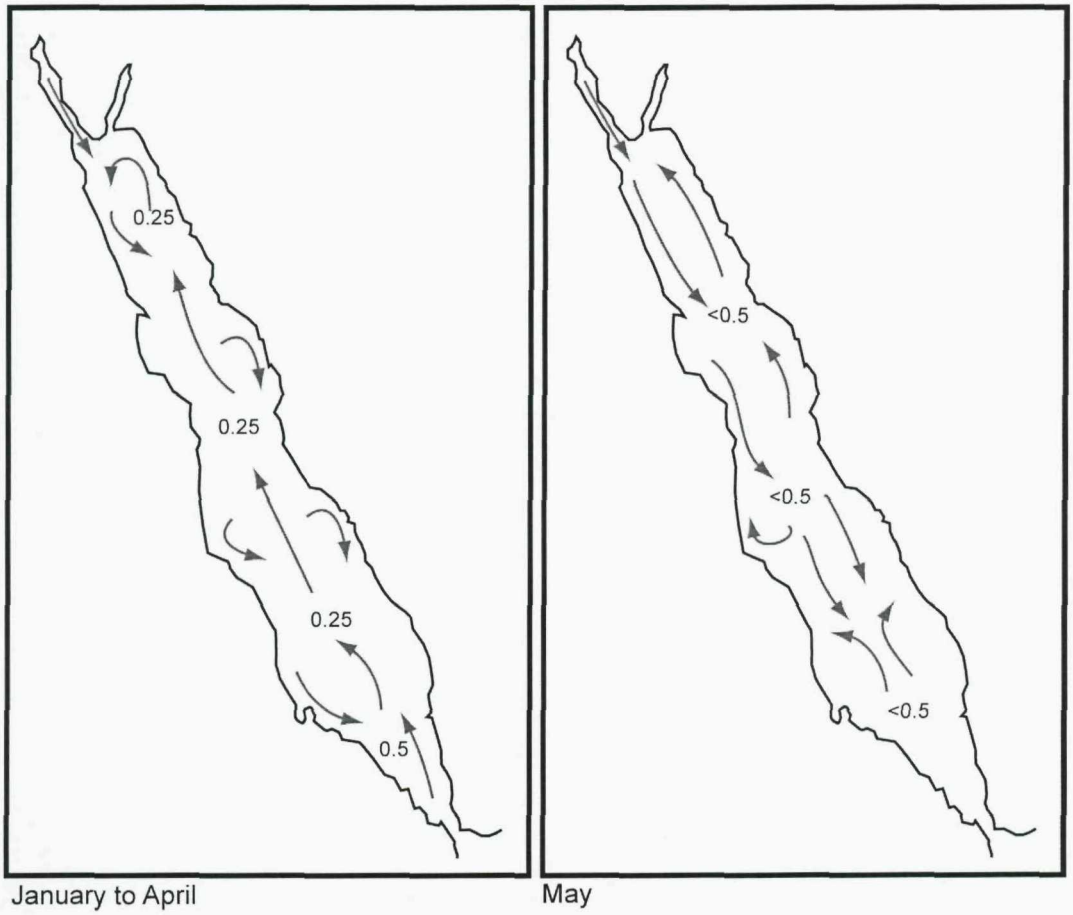

Figure 4.13: Major currents of the Red Sea, January to May, after Morgan and Davies (2002: 39)

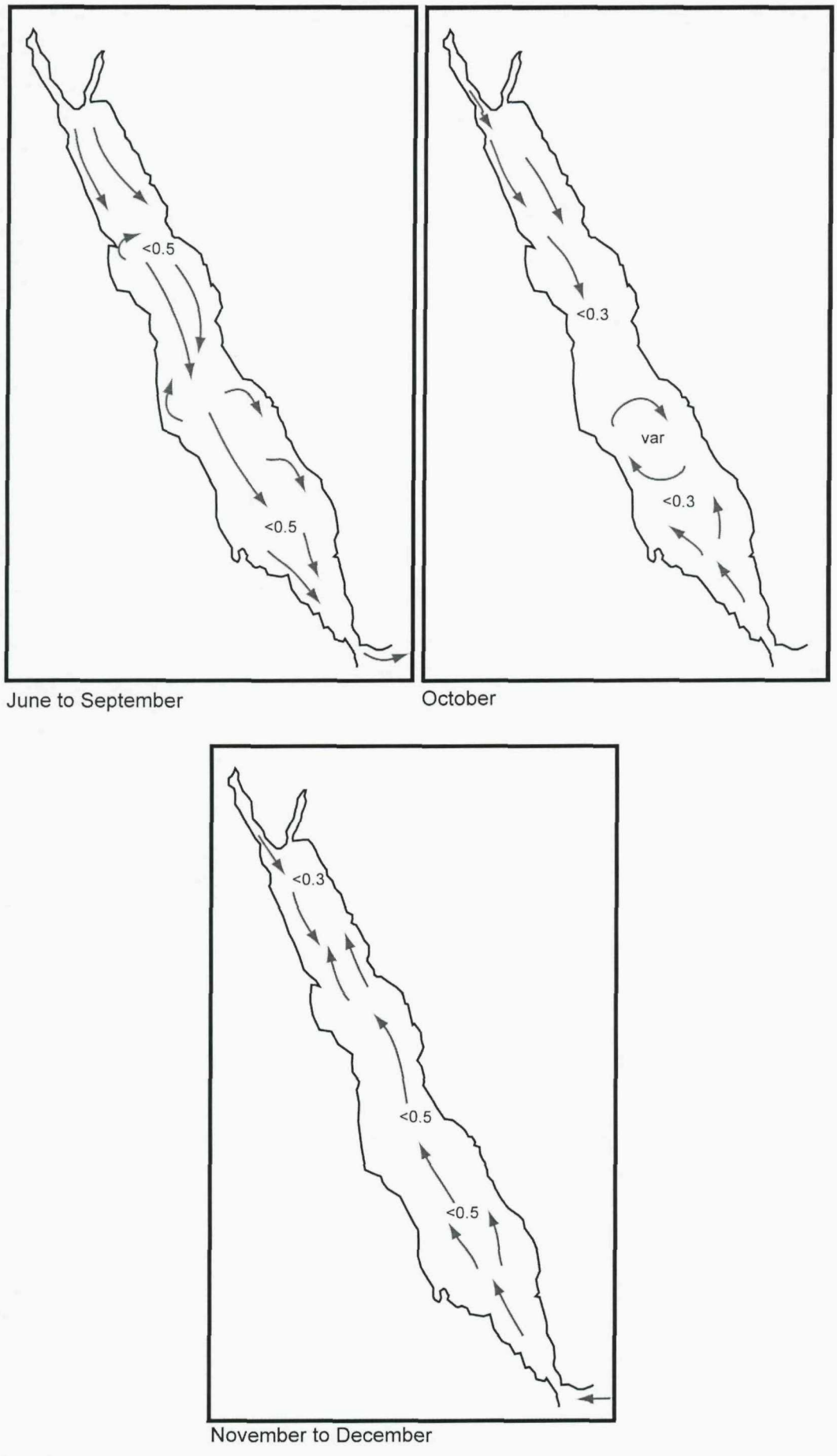

Figure 4.14: Major currents of the Red Sea, June to December, after Morgan and Davies (2002: 39-40)

Sea currents in the Red Sea are generally mild, but are nevertheless a salient factor in navigating northwards in particular (Whitewright 2007: 84-5). Like the Mediterranean, the Red Sea is virtually landlocked, and draws water through the Bāb al-Mandab – today also the Suez Canal – to replace that lost through evaporation (see Figure 4.13). The Monsoon winds also set up seasonal currents. In winter, during the northeast Monsoon, the drift is north-northwest up the axis of the sea. This nowhere exceeds one knot (1.9 km/h). Above al-Quṣayr, the current starts to circulate anti-clockwise. During the height of the southwest Monsoon, currents are less than 0.5 knots in the opposite direction (Admiralty 1892: 20; Findlay 1882: 105-6; Morgan and Davies 2002: 34-40). Transition periods in May and September-October make for more complex current patterns.

Irregular local currents also flow. Northward currents are prone to flow rapidly after an extended period of northerly winds, particularly on the east coast between Jiddah and Ras Muḥammad (Admiralty 1892: 20; Findlay 1882: 105-6). Moresby (Admiralty 1892: 301) recommends using these currents, together with the land breezes of the Arabian coast north of Jiddah, to make the passage northward through the sea – although he acknowledges that 'old navigators' preferred the Egyptian side because of the fewer shoals.

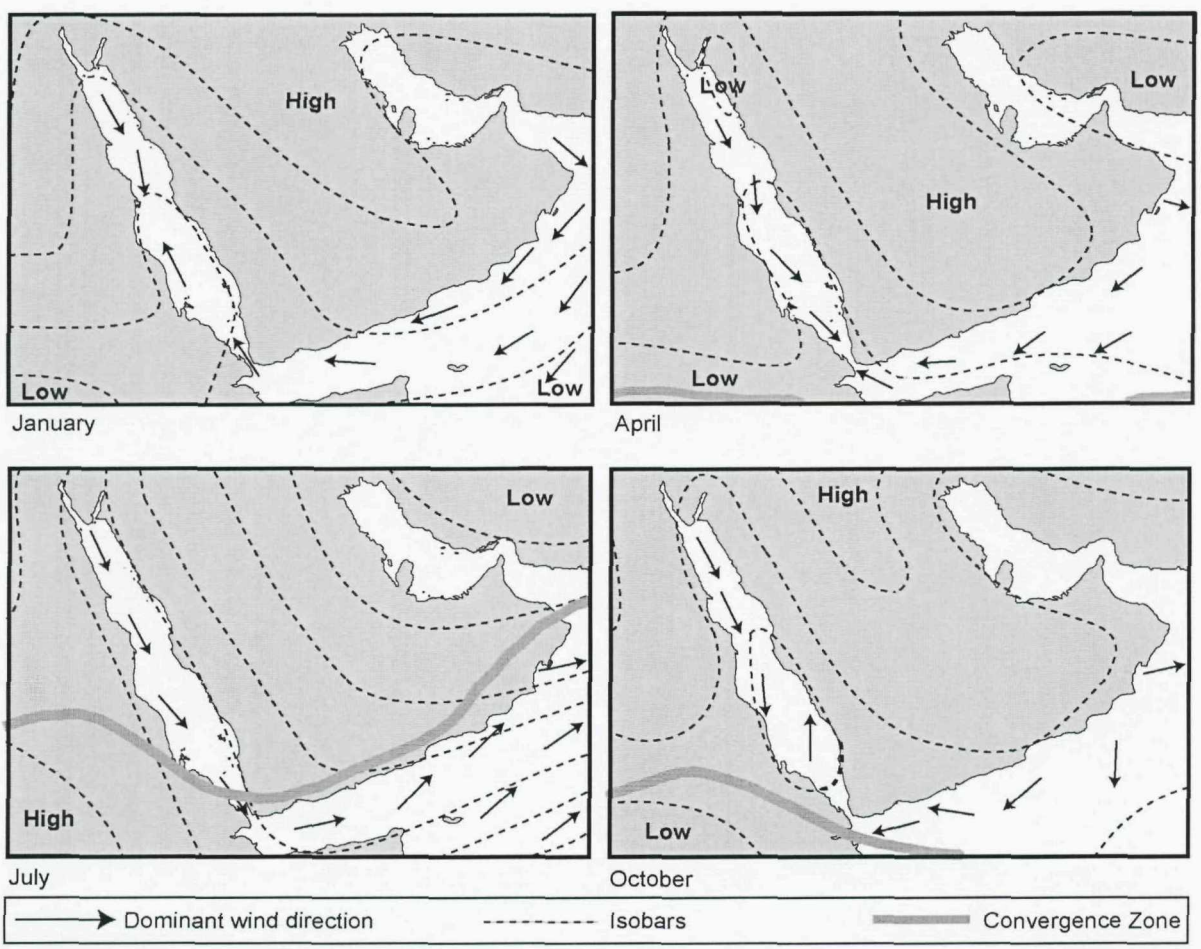

Figure 4.15: Prevailing meteorological conditions in the Red Sea in four indicative months, after Facey (2004: 8, 10-11)

For those sailing from Egypt to the southern part of the Red Sea and beyond, the departure season was from April to early August. By late March, the northwest Monsoon had abated, and with it the prevailing southerly winds of the southern sector of the sea diminished, giving way after the transition period to prevalent northerlies by June. Modern pilots put the earliest time for passing out of the Bāb al-Mandab at between April (Findlay 1882: 175) and June (Admiralty 1892: 43), with the latest date in September. For those aiming for India and the southern Arabian coast, Ibn Mājid counsels two periods during which departures from the southern Red Sea to India and the southern coast of Arabia could be made. The first lasted from the late-March/early-April until 7 May if going to India, and until 10 June if going no further than Hormūz (*Fāwa'id*: 225-6). The second ran between early July and early August (*Fāwa'id*: 243-4). The hiatus between the two was due to the ports of the southern Arabian coast being closed in July and August due to adverse wind conditions, and those in Gujerat and Sind closed in June and July because of the swell at the height of the southwest Monsoon (Ibn Mājid, *Fāwa'id*: 163; Tibbetts 1971: 367). Although Ibn Mājid does not address Red Sea locations north of Jiddah, it can be inferred that the timing of departure from the Egyptian port of 'Aydhāb, 80km north of Jiddah must have been similar, with a somewhat earlier departure from al-Quṣayr, and especially al-Qulzum, which was much further north.

As for the return journey, Ibn Mājid reports that the time to leave India for Arabia was mid-October, with the start of the northeast Monsoon (*Fawā'id*: 228-9). In general, the season was open continuously until the April-May transition (Tibbetts 1971: 375). However, Ibn Mājid says that those bound for Jiddah were best off leaving on 2 March, and no later than 11 April. Leaving on the northeast Monsoon earlier than that was not advisable because the southerly winds of the Red Sea blew too strong, "especially with a large ship" (*Fawā'id*: 230-1). Any later, and the southerly winds prevailing in the Red Sea would have given way to northerlies by the time vessels reached there. Mariners following that advice could expect to arrive in Jiddah in July (*Fawā'id*: 230-2). The implication is that the best time to sail up the southern Red Sea was at the very end of the northeast Monsoon season, and into the transition period, but before the southwest Monsoon took hold. Ovington, in the late 17th century, notes that ships leaving Surāt in Persia for the Red Sea did so "...generally about March, and arrive at Mocha towards the latter end of April, or before the 20th of May..." (*Voyage*: 450). In the 19th century, Findlay (1882: 170) offers similar advice to sailors.

Thus, when Ibn Jubayr, travelling in May 1183, found the Eastern Desert route between Qūṣ and 'Aydhāb teaming with caravan activity (*Riḥlah*: 67-8), it was probably because this was high season for vessels arriving at the port.

With luck, mariners bound northward for 'Aydhāb, al-Quṣayr and al-Qulzum would find the convergence zone displaced north, and southerly winds would carry them further north than Jiddah (Admiralty 1892: 43). If not, then the long haul up the northern reaches of the sea would begin. The technical capacity of ancient and medieval navigators to sail north against the northerly winds of the northern Red Sea has been examined, *inter alia*, by Tibbetts (1971: 310) Casson (1980), Sidebotham (1989) Facey (2004) and Whitewright (2007). That medieval vessels could indeed make ground against the northerly wind is indicated by Ibn Mājid himself, who says that navigators used a technique called *takiyah* – presumably a form a tacking – to sail windward (*Fāwa'id*: 256). In any case, the very existence of major Red Sea ports as far north as al-Qulzum suggests that, no matter how laborious the process, sailing north along the length of Red Sea was entirely within the capabilities of medieval mariners.

For navigators departing from Egypt and aiming for East Africa, the medieval accounts have little or nothing to say. However the aim in the outbound journey would presumably have been to leave in the late summer at the end of the southwest Monsoon – that is, with the second wave of vessels bound for India and south Arabia. In doing so mariners and cargoes would be in the Gulf of Aden in time to anticipate the northeast Monsoon, which would from August carry them down the African coast. On the return journey, mariners could sail north on the end of the southwest Monsoon – around September – and wait in Aden until October for the onset of the northeast Monsoon, whose related southerly winds in the southern Red Sea would carry them north.

Sailing in the northern Red Sea – that is, between and along the coasts of Egypt and northern Arabia – kept mariners within that zone of the sea dominated by perennial northerly winds all year round. Provided those winds were not too strong, the journey south within the northern Red Sea was, beyond generalised risks such as reefs, shoals and cross currents, a relative straightforward enterprise. Also challenging was the east-west journey between the Egyptian and Arabian coasts, with the wind broadly on the beam in both directions. The crossing between 'Aydhāb and Jiddah – a pilgrim route in the Fatimid and Ayyubid periods – was of this type (see Section 5.4). It was not without its hazards. Ibn Jubayr relates that:

> "... the winds cast most of [the pilgrims returning from Jiddah] into anchorages in the desert far to the south [of 'Aydhāb]. There the Bujah people, a type of

Sudanese people living in the mountains, hire them camels and lead them on a waterless route [up to 'Aydhāb]."

If sailing across the width of the northern Red Sea was tough, then altogether more difficult was the northward journey to al-Qulzum, al-Quṣayr and other northerly locations. Mariners must have made use of land breezes, currents, the oar, and the occasional assistance of the *khamsīn* to make the journey against the northerly winds. However difficult, the journey *was made*, as is demonstrated by the very existence of al-Qulzum, and its rôle in trade with the Hijāz, Yemen, India and East Africa, discussed in Section 5.4.

With the data for the sailing seasons of both the Nile and Red Sea now set out, the nature of the interface between the two can now be considered. It has been shown that departures from Egypt for destinations in the southern Red Sea must have been made in anticipation of meeting northerly winds blowing in the southern Red Sea – which they did between April and October, and particularly during the height of the south-eastern Monsoon between June and September. Given the low level of the Nile in the early summer, large cargoes could only have started moving in July at the earliest – and only from September if the route involved a seasonal canal like that of Alexandria or the Nile-Red Sea canal. Merchandise travelling by land to al-Qulzum from al-Fusṭāṭ or across the Isthmus of Suez from the Mediterranean port of al-Faramā was not constrained by conditions on the Nile. Both routes involved a land transfer of just three days. Goods could be embarked at al-Qulzum in good time to catch the period of northerly winds in the southern Red Sea – that is, at *any* time for goods coming by land from al-Fusṭāṭ, and during the early Mediterranean sailing season for goods arriving from al-Faramā. Vessels leaving from al-Qulzum carrying cargoes from al-Fusṭāṭ could have caught the early (late-March to early May) season for departures for India identified by Ibn Mājid, and his season, ending 10 June, for departures to Hormūz. Cargoes arriving across the Mediterranean at al-Faramā in the early sailing season of that sea would probably have arrived a al-Qulzum too late to make the early India departure window, but they may well have made the second. From the southern Red Sea this was from early August to early September: from al-Qulzum, it must have been a little earlier.

In contrast, cargo vessels moving on the Nile even at the very onset of the flood in late June or early July would have struggled to catch this outward sailing season. From the data presented in Figure 4.7, Figure 4.8 and

Table 4.3, it appears that goods originating at the Delta coastal ports were still some 24-34 days from al-Quṣayr by Nile, and 39-49 days from 'Aydhāb – remembering that the faster end of these time ranges represents times for faster, non-merchant vessels. Cargoes

originating at al-Fusṭāṭ/Cairo were only 3-5 days closer. Merchants would have found it extremely difficult to ship bulk items up the Nile from Lower Egypt in time to catch the southbound sailing season of the Red Sea. Certainly, by the time the Nile sailing season was in full swing in September, the window for southbound departures from al-Quṣayr and 'Aydhāb would have been closed. Therefore, in order to catch the outbound sailing season, merchants may have had to ensure that goods travelling on large vessels had completed the Nile leg of the journey *before* the Nile fell to un-navigable levels– that is, by the end of January at the latest for larger cargo vessels, and by end-March for medium-sized craft (see Table 4.2).

On the return journey, Red Sea merchant vessels arriving at 'Aydhāb, al-Quṣayr or al-Qulzum would have made their journey up the southern Red Sea either early or late in the northwest Monsoon season – thereby avoiding the stormiest weather of the mid-Monsoon period. That northbound journey must therefore have taken place between late-September and early December if coming from Yemen and East Africa, and from late-April to July for vessels arriving again from those destinations or from India. In both cases, these inbound Red Sea sailing seasons fit better with the Nile flood cycle. Goods arriving at 'Aydhāb and al-Quṣayr in the early northeast Monsoon would have found transportation on a river with ample water levels. The earliest arrivals in the second inbound season would have been a little early for the flood, but they faced a land journey of about three weeks until they reached the Nile, by which time the flood was only a month or so away. Later arrivals arrived in good time for the start of the flood.

The alternative for inbound vessels on the Red Sea, assuming no other constraints, would have been to shun the southern ports and beat northward to al-Qulzum. Whether the final destination was al-Fusṭāṭ/Cairo or the Mediterranean, this was, in purely logistical terms an entirely viable option. The journey up the Red Sea would have been labour-intensive, but once at al-Qulzum, merchandise was only three days journey from either the Nile or the Mediterranean. Meanwhile, goods unloaded at 'Aydhāb had ahead of them a land journey of around three weeks to Qūṣ, followed by perhaps three weeks on the Nile – or a similar three weeks by land to Aswan, followed by a journey of up to a month to Cairo. Vessels arriving at al-Quṣayr were, equally, still a week's land journey from the Nile, followed by a three-week journey downstream. In both cases, these times assumes no delay due to low Nile.

In addition, given the consideration above of the hazards of sailing on the Nile, the idea of the river route as a safe option compared to the sea does not stand scrutiny. Thus, in purely practical terms, the option of continuing an inbound journey on the Red Sea up to

the northern extreme of the Red Sea does not seem – from a logistical and mercantile point of view – to be an unattractive option.

4.7 Conclusion

This section has explored the environmental conditions influencing navigation on the Egyptian Nile, and the implications of those conditions for movement on it. It has also examined the implications of the Nile cycle for navigation on the river, and has established that there were seasons of optimal navigation, and others during which traffic was impossible for large vessels. It has proposed as season of navigability for the major seasonal canals of the Nile, such as the Alexandria canal and the Nile-Red Sea canal. It has also identified the particularly difficulties to navigation presented by the mouths of the Rashīd and Dumyāṭ branches. The section has also established representative journey times for the major trans-Egyptian routes, and has examined the interaction of these Nile seasons with the navigation seasons of the Mediterranean and Red Seas, as summarised in Figure 4.12.

The findings of this chapter suggest a quotidian reality of navigation on the Egyptian Nile that is far from the cosy characterisation of some authors on the subject. The wind did not simply waft Nile vessels upstream, nor did the current gently carry them downstream. Navigation required intimate, extensive and often highly localised knowledge of wind, flood pattern, and water depth, and of the navigable course along a river whose bed could change radically from season to season. It required mastery of technique in sailing, in pre-empting gusts that could capsize a vessel or drive it into the banks, in effective towing and rowing, in avoiding sandbanks, in freeing grounded vessels, and in safely particular obstacles. All these were skills that required a degree of knowledge, initiative and physicality that goes far beyond the characterisations of the Nile as an 'easy' water considered at the beginning of this section.