The Nile on the move

The Nile, as a meandering river, has moved relative to habitation sites since antiquity, as attested in historic documents. Geologists Katy Ludley and Judith Bumbury combined maps and satellite images with a walk-about in the Cairo area to propose a map for its past movements. Their results suggest that environmental change has been topical since the Old Kingdom.

The Nile in antiquity has been a subject of much debate and questions have been raised by David Jeffreys, working at Memphis, as to whether the Delta head was further south in antiquity and how much the Nile channel has moved during the past 5,000 years.

Working with Angus Graham (University College London) and John Hillier (University of Cambridge) we have shown that, if migration rates from maps are calculated, the Nile may be moving laterally at rates of up to 9km every thousand years, although this rate includes channel jumps in the area of islands. The direction of motion depends on the curvature of the river; bends tend to move outwards and downstream except where constrained by the desert edge. The rates for the Giza area exceed the 2km per thousand years that we calculated for the Luxor area (EA 27 pp.17-19).

At Memphis, we already know from the intensive borehole survey (1983-2004) of David Jeffreys that the Nile has moved towards the east, abandoning the Roman waterfront (described by Joseph Hekokyan in the 1850s) and moving to the eastern boundary of the Nile valley in present times. Using this section as a baseline, we combined a range of techniques to produce a preliminary map of Nile paleo-channels.

From historic maps we calculated Nile migration rates for the past 250 years. We combined migration directions calculated from field boundary angles with these rates to suggest the geometry of former courses of the Nile. From digital elevation data from satellite images, broad swells in the topography around 2m high and 200m long were identified as former levees of the Nile channel. Chains of...
Koms, field and hod boundaries and patterns of topographic contours on maps further defined the locations of former levees and direction of migration of the river.

In collaboration with Mark Lehner and his team at Giza, we conducted a walking survey of koms, former levees and basin divides in the Giza area. The Bahr el-Libeiri and the Mansouriya canal seem to follow the patterns of the former levees, the most westerly of which is visible beneath the surface in Glen Dash's geophysical survey in Aragram (www.nara.org.au/aragram.asp). We also traced the feature above ground through the green of the second hole of the Mena House Golf Course at Giza and as far as the riding stables east of the 'Lost City of the Pyramids' (Grid reference: 29° 58'17.12" N, 31° 08'36.87" E).

These observations place constraints on the geometry of the movement of the Nile but they do not provide time constraints. Migration of the river destroys all the settlement on the erosional side of the river and preserves only sites on the depositional side. By linking the geometry to the ages of known sites within the Nile valley, we can determine the time before which the river last passed a certain point.

We combined these results to plot a map for Nile position over the past 5,000 years. In line with the results obtained by other researchers such as David Jeffreys, the migration geometry and rates suggest that the Delta head was further south in the past. A more southerly ancient Delta head, in the absence of tectonic uplift or sea-level fall with time, suggests that the Nile in antiquity had a higher flow rate which is supported by the suggestions of Bell (1975), Butzer (1976) and Hassan (2003, 2004) that the flow-rate and river plan-form were larger in antiquity.

Distributaries in a delta form in such a way that none of the river-beds has a base below sea-level. In the case of the Nile, a higher flow rate in antiquity ensured that the Delta head was further south and that there were more numerous distributaries. Historical sources such as Herodotus and Strabo support the view that there were many more distributaries in antiquity.

Our map suggests that an active Nile had an impact on the development of the site of the pyramids at Giza. We propose that a branch of the Nile was located to the far west of the valley prior to the building of these pyramids. By the time of the completion of the causeway to the Khufu pyramid (mapped by Mark Lehner), it must already have moved away from this extreme western location. It is interesting to speculate whether the blocks quarried for the Khufu pyramid created the embayment in the river-bank that was later used as a harbour as shown by the Giza project. That the river rapidly moved away from
this location was a product of its natural migration, but did waste from the pyramid builders' quarry enhance deposition and force the river eastwards?

Once the process of migration away from the site began, it seems to have continued. At what point there ceased to be more than one branch of the Nile at this latitude (one of the others passing by Heliopolis) has yet to be determined. The 'trapping' of the river by the revetment of the waterfront at Babylon and the limiting of migration by human activity have prevented more rapid migration back towards the west.

Thus, at Giza, Khufu had the advantage of a river adjacent to the plateau edge with a water connection through a more southerly Delta head to the quarries for the Tura limestone. By the time Menkaure began construction at his chosen site, he was struggling against the elements. His pyramid site was further west from the plateau edge and the river further east. The logistics of transport for the granite pyramid casing were complex and, due to natural processes of river migration, increasingly difficult with time. Is this why the pyramid remained unfinished at his demise?

Our results may also have some bearing on why the site of the capital of Egypt has moved so much between Memphis, Babylon, el-Fustat, Cairo, Heliopolis and other sites. With the river snaking across the valley and the Delta head migrating northwards and losing branches with time, some settlements, like that at Giza, were simply left high and dry. The pragmatic response to the environmental change was to found a new settlement that took advantage of the prevailing conditions.

[Map showing the detail of ancient loaves and monuments in the Giza area]

[Two silts deposits at the 'Lost City of the Pyramids'. The upper silt has much finer particles than the lower, suggestive of a greater distance to the river. The upper silt is 10-20cm thick. Photograph: Katy Lutley]

[River floodplain silt deposits that soil the site of the 'Lost City of the Pyramids'. Photograph: Angus Graham]

[Map showing the best fit estimate of ancient river positions from all sources of information]

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