Further considerations on development at Giza before the 4th Dynasty

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6 figures

Abstract

Two previous papers produced by Vandecruys have been critical of the theories of erosion of the Sphinx by rainfall run–off, previously advanced by Reader. In a final response to Vandecruys' theory that the extant degradation can be attributed to shallow groundwater movement, Reader explains the limitations of Vandecruys' groundwater model and further discusses the case for development at Giza before the 4th Dynasty.

Key–words: Giza – Sphinx – Khafre – fourth dynasty – old kingdom – weathering – interflow – enclosure – temple – erosion

Contents:

1. Introduction

It is understood that this is to be the closing chapter (for the time being at least) in this debate, which has been hosted on www.PalArch.nl. Vandecruys' most recent contribution (Vandecruys, 2006b), covers some new ground but also reintroduces a number of issues that have previously been addressed. Some of these issues, for example Khufu's quarries and their relationship with the alignment of Khafre's causeway, will only be touched on briefly in the following paragraphs as there is little more to be added to the points already made (see Reader, 2002, 2006).

The essence of Vandecruys' papers is to demonstrate that rather than surface erosion processes, the coved degradation of the western walls of the Sphinx enclosure is the result of shallow groundwater movement (or 'interflow'). It is the current author's view that this thesis is untenable and in this paper, in addition to reiterating a number of previous arguments (including the lack of evidence for groundwater at sufficiently shallow depth to have influenced the Sphinx enclosure), new reasoning is introduced to support previous assertions that groundwater flow cannot be regarded as the principal agent responsible for the existing degradation morphology. Please note that the presence of limited shallow groundwater at certain times and under certain conditions is not ruled out. The important distinction to draw, however, is that groundwater cannot be regarded as the main agent of degradation as Vandecruys asserts. The current author continues to maintain that the processes responsible for the extant degradation of the Sphinx enclosure are episodes of rainfall run–off, separated by periods in which other processes such as chemical weathering and exfoliation were influential.

The other major issue that Vandecruys (2006a, b) has focused on in his papers is his view that the strong 4th Dynasty context of the site precludes the possibility of any pre–4th Dynasty development. Vandecruys' comments and objections to this matter, have in fact led to new areas of consideration that, as set out below, may actually strengthen the case for early activity at the site.

2. Identifying the deterioration of the rock

Throughout this debate (an involvement which dates from 1997) the current author has steadfastly refused to be drawn into discussions about 'rates' of weathering or erosion. Any claim that by combining estimated rates of degradation with estimates of the depth of degradation along a cut face (or some other measure of the amount of material that has been 'weathered' or 'eroded' away) will give us an indication of the age of a monument, is far too simplistic.

Vandecruys's (2006b: 2) statements that "Reader does not go into detail about the weathering process on the enclosure walls" and "it is crucial that he [Reader] also identifies the dominant weathering process" are difficult to reconcile with previous publications. In Reader (2002: 18) the following discussion of these issues was presented: "Having proposed an Early Dynastic date for the construction of the Sphinx, there is one other issue that needs to be addressed. Is the more intense degradation of the western Sphinx enclosure walls and the western part of the northern terrace consistent with an Early Dynastic date for the construction of the Sphinx? In other words, does this sequence of development provide sufficient time for the more intense degradation to have taken place? I believe the answer to this question is yes, for the following reasons. In the western part of the Sphinx enclosure, periodic erosion from run–off will have removed much of the weathered mantle – the result of chemical weathering which dominated conditions between rainfall events. This would have exposed comparatively unweathered strata from beneath. Given the increased soluble component of these newly exposed rocks, it follows that the effect of this seasonal [run–off] erosion will have been to promote renewed phases of chemical weathering and exfoliation, thereby accelerating the degradation process. Under these particularly aggressive conditions of weathering and repeated erosion, the more intense degradation of the western Sphinx exposures could quite easily have developed over a period of time which, in geological terms, was relatively short."

We can never reconstruct the detailed processes of degradation that the limestones exposed at the Sphinx will have undergone, but two important points were presented in the above text. The first is that the processes that have led to the degradation of the Sphinx have not operated in a linear fashion. For all areas within the Sphinx enclosure, the soluble component of newly–exposed limestones will have permitted an initially high (but now unknowable) rate of chemical weathering accompanied by erosion by exfoliation (please note that by definition, the process of *weathering* involves no removal of material). These initially high degradation rates will have reduced as the soluble component of the exposed face was leached away. The increasing insolubility of the exposed limestones will have been off–set to some degree by exfoliation, however, as this process acts only on thin, near–surface flakes of rock, its effect will have been limited.

The processes of chemical weathering and exfoliation of the limestones exposed by the excavation of the Sphinx have been the subject of a number of papers (*inter alia* Gauri & Holdren, 1981; Gauri, 1984; Gauri *et al*., 1995). As also discussed in Reader (2001), dew forming at night on the exposed limestone, removes soluble salts from the surface of the rock. Capillary forces draw this solution into the pores of the limestone matrix, where further salts are dissolved from the internal pore walls. As daytime temperatures rise, the solution begins to evaporate – precipitating salt crystals within the confined neck of the pores. The pressure that these crystals exert as they grow, leads to stress–induced exfoliation from the surface of the limestone. The 'chips' of limestone that are removed by exfoliation from the surface of the limestone are frequently coated on their lower surface with accumulations of halite and gypsum (Gauri *et al*, 1995: 124).

The processes of chemical weathering and exfoliation, therefore, progressively remove the soluble components from the surface of the *in situ* limestones. For those exposures which were not subject to erosion by rainfall run–off, chemical weathering and exfoliation will have gradually reduced the soluble content of the strata, leaving a residual mantle of less soluble weathered rock which was less susceptible to chemical weathering. Gauri (1984: 35) identified differences in the soluble content of the limestones between weathered and unweathered strata. For those exposures, however, that *were* subject to aggressive agents of erosion, such as run–off, erosion will have removed far more of the insoluble mantle than exfoliation alone, exposing further soluble material and, hence, renewing the process.

The second important point to be drawn from the above–cited text is that a single agent of degradation may never have been dominant. Where Vandecruys (2006b) and the current author do appear to agree is that the current degraded state of the Sphinx can only be the result of a combination of agents, some of which (for example chemical weathering and exfoliation) will have acted fairly consistently, whilst others (such as run–off) will have been episodic.

The issue of the shallow erosion channel being associated with the sub–unit 1i of the Member II strata, was first raised by 'Solenhofen', on the Maat discussion website (http://www.hallofmaat.com/ profile.php?1,96). Contrary to Vandecruys' assertion, the current author has not presented the erosion channel as evidence of "large quantities of surface run–off" (Vandecruys, 2006b: 3). The reason for citing this feature is simply that this channel shows that run–off *has* been experienced within the enclosure, something that, whilst it may be acceptable to Vandecruys, is still rejected by many other commentators. The fact that the channel has been eroded into one of the least durable beds exposed across the floor of the enclosure is not in any way remarkable. It is only to be expected that running water will exploit the least durable strata.

It is unfortunate that, despite the issue being raised in previous papers (Reader, 2006), Vandecruys has still to respond to the principle objection to the interflow theory. This objection is the apparent absence of a body of water at Giza that was sufficiently shallow to have affected the walls of the Sphinx enclosure. As previously noted, the available data for Giza suggests that groundwater is some 5 m *below* the floor of the Sphinx enclosure. In order to present a case for the influence of groundwater flow on the degradation of the *walls* of the enclosure, Vandecruys needs to provide evidence for the presence of a shallow body of water at the site.

It has been argued previously (Reader, 2001) that surface flow from the higher areas of the plateau in the west, will have been prevented from reaching the area of the Sphinx by infiltration into the sand–filled 4th Dynasty quarries. The hydrological support for this assertion is given later in this paper. Shallow interflow (*i.e.* perched groundwater) flowing along the less permeable marly limestone beds at Giza, will be affected by quarrying in the same way as surface flow. If shallow perched water such as this is to be considered as the primary agent of degradation within the Sphinx enclosure then, given the influence of quarrying, this degradation must also have occurred before the 4th Dynasty quarrying at the site.

Without a clear hydrological model to support the presence of shallow interflow in the period after quarrying, discussions regarding the behaviour of shallow water in the vicinity of the Sphinx (such as those that follow) are largely academic. As discussed previously (Reader, 2006), flow nets are a widely used and robust tool for modelling groundwater movement, whether this movement is intergranular or through joints and other discontinuities in the strata. To substitute flow–nets with some other method of groundwater modelling, as Vandecruys (2006b) has done, requires that the proposed model is equally as robust as the well–attested flow net. Whatever method of assessment is proposed, however, it cannot disregard the influence that gravity will have on flow, influence that is reflected in the consideration of equipotentials.

Figure 1 presents a plan and schematic line of section through the limestones in the vicinity of the Sphinx and assumes the presence of a body of groundwater at shallow depth (despite there currently being no evidence to support this assumption). In Vandecruys' interflow model, water flows along the upper surface of the relatively impermeable and less durable marly sub–units of the Member II limestones (these marly sub–units are identified with the Roman numeral 'i' on figure 1, Reader, 2001), but actually discharges through the relatively durable coarser limestone beds (identified with a Roman numeral 'ii') that alternate with the marly horizons. Flow through the sub–unit ii strata is via two orthogonal sets of joints, which are well developed in the sub–unit ii strata (identified as joint set 1 and 2 on figure 1b, Vandecruys, 2006b).

On the plan presented in figure 1, Vandecruys' Joint Sets 1 and 2 are identified by the blue and green dotted lines respectively, with Joint Set 2 following the "approximate direction of the dip of the strata" (Vandecruys, 2006b: 3). Point A has been chosen so that it lies at one of the many points of intersection of Joint

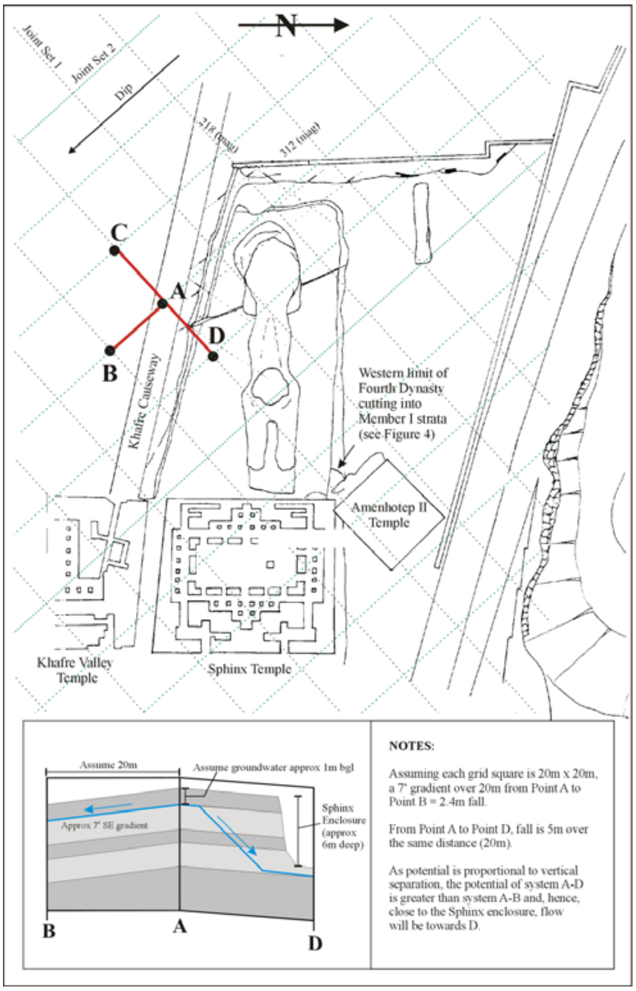

Figure 1. Plan of Sphinx enclosure and surrounding area with schematic section showing principles of hydrological potential. Drawing by the author.

Set 1 and Joint Set 2, with point B lying at a position that is down hydraulic gradient from point A. The hydraulic gradient between points A and B will be shallow (approximately 7^{o} to the southeast in accordance with the dip of the strata) and, because of the gentle gradient, the potential (energy) differences between points A and B will be comparatively small. Despite the relatively small difference in potential between points A and B, in the absence of any other influence, groundwater will flow along Joint Set 2, towards the southeast. This flow is represented by the southeast oriented arrows given in figure 2 of Vandecruys (2006b) and by the southeast trending flow lines towards the top left hand and right hand corners of figure 3 in Reader (2006).

Although not shown on the line of section, in the lower part of figure 1, point C is an arbitrarily selected point to the south of the Sphinx enclosure, located along Joint Set 1 from point A. The orientation of Joint Set 1 is such that these joints generally align with the strike of the limestone beds. Lines of strike are, by definition, horizontal and, hence, with no difference in potential between points A and C, there will be no flow in this direction. Contrary to Vandecruys' (2006b: 3–4, figure 2) suggestions, therefore, in the areas of the groundwater table beyond the influence of the excavation of the Sphinx, there will be no significant flow along Joint Set 1.

Point D also lies along Joint Set 1, but in this instance it lies to the northeast of point A, at a point on the floor of the Sphinx enclosure. The excavation of the Sphinx has lowered the 'base level' of this part of the hydraulic system and, as shown schematically on the section in figure 1, the potential between points A and D is much greater than that for the similarly spaced points A and B. The greater potential between A and D will result in groundwater movement towards point D – that is, towards the Sphinx enclosure.

On the basis of these considerations of potential, the most significant volume of any groundwater flow will be to the southeast along Joint Set 2. In the area around the Sphinx enclosure, however, an element of the total groundwater volume will flow to the northeast along Joint Set 1. Given the relative volumes of flow in each direction, it is not appropriate to represent the groundwater regime by arrows of equal length and number as

Vandecruys' has done on his figure 2. To represent the reduced volumes of flow to the northeast, these arrows (or vectors) should be shorter and reduced in number.

The other shortcoming of Vandecruys' figure 2, is that it does not combine the flow along Joint Set 1 with that along Joint Set 2 to illustrate the actual groundwater flux. Clearly at any point of intersection of the two principal fracture sets, it cannot be the case that one body of water will flow to the southeast, whilst a separate 'body' of water moves to the northeast, as Vandecruys has illustrated. At any one point the various components of flow will combine as a single flow vector in the manner shown on figure 3 of Reader (2006).

In conclusion, and as shown in figure 3 of Reader (2006), the general case for regional groundwater in the southeast of Giza (the area around the Sphinx) is the 'low–potential' flow along the southeastward (down dip) oriented Joint Set 2. As figure 3 of Reader (2006) shows, this general 'low potential' flow would influence the western walls of the Sphinx enclosure and, as such, the more intense coved degradation of the western enclosure walls may be seen as consistent with interflow. Only in the special case that groundwater is within influencing distance of the Sphinx enclosure, will differences in potential between the groundwater level and the reduced base level of the floor of the excavation, lead to a component of flow to the northeast, along Joint Set 1 and towards the excavation.

What Vandecruys' model does not illustrate, however, is that the volume of flow to the northeast, towards the southern Sphinx enclosure walls, will be less than the volume of flow to the southeast. To illustrate the reduced volume of flow to the northeast, flow line vectors along the southern Sphinx enclosure wall should be shown at greater spacings, as is the case on figure 3 of Reader (2006). The reduced intensity of groundwater flow in this region of the flow–net model would result in less intense degradation of the western sections of the southern Sphinx enclosure wall. As previously stated (Reader, 2006: 6) however: "The fact, then, that significant sections of the southern enclosure wall are as intensely degraded as the western enclosure wall, provides reason to question interflow as a dominant agent of degradation within the Sphinx enclosure."

The principles of equipotential should also be applied to the 4th Dynasty quarries up dip of the Sphinx and to the excavation that is Campbell's Tomb. Vandecruys (2006b) argues that these features, which are infilled with windblown or placed sand and, possibly in the case of the quarries, irregular blocks of stone that were unsuitable for construction, will have acted as 'interflow–' or 'water reservoirs'. There is, however, little to support this assertion.

As a consequence of the marly layers (sub–units 'i') that are present, the bedded limestones at Giza will have values of vertical permeability which are orders of magnitude less than either the horizontal permeability (that is the down dip flow through joints in the sub–unit 'ii' beds) or the general permeability of the loose sand infill.

If it were not for the marly beds, there would be no mechanism to maintain a shallow groundwater body at Giza and water would simply infiltrate to depth through the well jointed more durable beds. In areas of excavation, such as the quarries, the extraction of building stone has destroyed the natural interbedded sequence of limestones, replacing this sequence with a uniform body of sand and rubble fill. By quarrying away the less permeable beds, this activity has removed the conditions that would allow bodies of groundwater to remain perched near to ground level.

As a consequence of the difference in potential between the base of the excavations and either surface run–off or sub–surface interflow, water entering the infilled quarries from the higher ground in the west, will move vertically through the sand infill until either a marly bed is encountered at or below the base of the quarry, or standing groundwater is reached at depth. Upon reaching either of these 'aquitards', the infiltrating water will be free to move away from the quarry, down dip, through the open joints of any sub–unit 'ii' beds at depth.

As a result of vertical infiltration through the sand fill, therefore, water leaving the infilled quarry or Campbell's Tomb will be at a much lower topographic level than the water which entered the feature from the west. Using data supplied by Vyse (1840), which suggests that when excavated, the fosse surrounding Campbell's Tomb was dry and, therefore, *above* groundwater level, the base of the fosse is at an approximate level of 13.5 m amsl. This is substantially lower than the floor of the Sphinx enclosure, which is at approximately 19.5 m amsl. It is unclear how such low–lying groundwater can influence the walls of the Sphinx enclosure in the manner suggested by Vandecruys.

Given his assertions that the well jointed sub–unit 'ii' beds will freely promote the movement of groundwater at Giza, in order to support his theory that infilled quarries or other excavations would act as reservoirs, Vandecruys needs to demonstrate:

- a mechanism by which water entering the sand–filled excavations can overcome the influence of potential; and
- the means by which water would be contained within such a feature.

Until these points can be addressed in a satisfactory manner, the idea of storage reservoirs must be regarded as unsubstantiated.

One interesting new issue that Vandecruys introduces to the debate is the apparent absence of deep gullying along the near–horizontal limestone surface between the top of the southern Sphinx enclosure wall and Khafre's causeway. According to Vandecruys (2006b: 3–4), if the features of coved degradation along the walls of the Sphinx enclosure were the result of surface processes such as rainfall run–off, this sub–horizontal surface should be deeply eroded. Vandecruys takes the absence of such erosion features as support for the interflow theory.

The reason, however, for the absence (or apparent absence) of gullying along the top of the southern enclosure wall is that this surface has been re–cut. As figure 2 shows, the base of the masonry and restoration that marks the northern limit of Khafre's causeway, rises and falls over the remains of gullies (arrowed) and intervening ridges. As can be seen in figure 2 the original limestone surface between the top of the southern Sphinx enclosure wall and the causeway was excavated at some time in the past (although difficult to judge, given the lack of scale on figure 2, it is estimated that this excavation may have been up to 40 cm deep). It is also evident from the remains of the ridges and gullies that underlie the masonry of Khafre's causeway that, prior to this re–cutting, the surface of this part of the plateau showed features consistent with significant erosion.

Figure 2. The re–cut area between the top of the southern Sphinx enclosure wall and the Khafre causeway with possible former erosion gullies (arrowed). Inset, close–up of one area of re–cutting. Photograph by the author.

It is not clear when this re–cutting took place, but it is not unreasonable to assume that it was undertaken in the 4th Dynasty in connection with the construction of the walls and roof of Khafre's causeway, with which the re–cutting is clearly intimately associated. If this re–cutting *could* be securely dated to this 4th Dynasty activity, then these re–cut features would provide yet further evidence that the coved degradation in and around the Sphinx enclosure, pre–dated the 4th Dynasty. Furthermore, given that it was surface features that were removed by this shallow re–cutting, this may indicate that their origin lies in surface, rather than sub–surface, processes.

The variation in the intensity of the coved degradation that Vandecruys (2006b) observes in his figure 4 can be fully explained in terms of the run–off model. As the gullies that are exposed in section at the northern base of Khafre's causeway developed (see figure 2), they will have increasingly channelled run–off within the gullies themselves. Hence discharge of run–off over the enclosure walls will have become increasingly non–

uniform, leading to just the sort or variation in the intensity of degradation that has been observed by Vandecruys.

3. A structural analysis of Khafre's pyramid complex

Unfortunately, Vandecruys (2006b) has not engaged with the principle point raised by Reader (2006) regarding the alignment of Khafre's causeway. When considering this issue, it is vital that a distinction is made between the alignment of (*ibidem*: 8) "the unquarried ridge of limestone that was *later* used for Khafre's causeway" and the masonry structure of the 4th Dynasty causeway itself.

As previously stated (Reader, 2006), before any development at Giza, the natural topography of the site included two low hills – one from which the Sphinx was later carved in the east, and a second, on the western horizon, which was later the site of the proto–mortuary temple. As with any two points, these natural promontories can be joined with a straight line and it is this straight line (perhaps no more than a well used trackway before the 4th Dynasty) that is the focus of this discussion and, in the view of the current author, constrained Khufu's quarrying activity.

Under the conventional 4th Dynasty development of the site, there were no such constraints on Khufu's quarrying and, hence, no reason why he could not have extended his eastern quarry (marked D on Vandecruys, 2006b: figure 5) further south into the Central Field area, removing sections of the causeway alignment as he did so. Khufu appears, however, to have abandoned the eastern quarry for some reason and to have opened up a new quarry, further to the west within the Central Field. The reasons for this are unclear, however, as stated previously (Reader, 2006), under this conventional sequence of development, it is remarkable that, despite Khufu's apparent unplanned distribution of quarrying, Khafre was able to connect two naturally prominent points with a perfectly straight alignment for his causeway.

Vandecruys' arguments regarding the failure of the pre–4th Dynasty 'causeway' to connect with the Sphinx Temple, are rather circular, in that this relies on applying the principles of 4th Dynasty mortuary architecture in order to criticise a case for development that took place *before* the 4th Dynasty. There is no reason why the proposed early Dynastic development at Giza should adopt later Old Kingdom architectural conventions. There is no reason, therefore, why the feature along which Khafre later built his causeway (a feature that, I reiterate, is considered as no more than a well worn but possibly sacred, trackway), needed to make any connection with the Khafre valley temple, Sphinx Temple or, indeed any other feature in the east of the plateau. Furthermore, in his search for 'precedents' and other examples of cyclopean masonry in Egypt, Vandecruys appears to lose sight of the fact that the focus of this debate – the Great Sphinx– is unique and without any parallel in the entire Pharaonic period.

Although from an authoritive publication, Wilkinson's (2000) comments on the 'many similarities' between the cyclopean section of Khafre's mortuary temple and the Khafre valley temple, that are referred to by Vandecruys (2006b: 7), are brief and cannot, therefore, be considered sufficient to challenge the detailed assessments of the other authors that have previously been cited (Reader, 2006: 9). Furthermore, Wilkinson's comments do not address the many *differences* in plan between the two structures. For example, the western section of the Khafre mortuary temple, with its open court and relatively small well squared masonry, has no equivalent in the valley temple. Furthermore, as discussed by Stadelmann (1997), whilst there is a striking similarity in the ground plans of the mortuary temples of Snofru at Dashur and Khufu and Menkaure at Giza, the Khafre mortuary temple (Stadelmann, 1997: 8) "seems to exhibit a quite different structure." He goes on to describe how Khafre's temple appears to combine the ground plan of the Snofru, Khufu and Menkaure temples with an additional eastern element, the cyclopean portion of the mortuary temple. Given these considerations, it is the western element of the Khafre mortuary temple, at the foot of the pyramid, that should be regarded as typical of the Old Kingdom, whilst the eastern, cyclopean section of the mortuary temple clearly does not conform with the established pattern of 4th Dynasty mortuary temple development.

Vandecruys' claim that the diagonals of both the Khufu and Khafre pyramids align is incorrect as figure 3 shows. The series of further 'near' alignments that Vandecruys cites may be significant if it were the case that the Giza Necropolis was developed under a unified ground plan for three successive pharaohs, rather than the development of the site being interrupted by construction at Abu Rawash (for Djedefre) and possibly elsewhere, for less well attested kings such as Bikheris (Schulz, 1998). It is the view of the current author that too much significance is often drawn from near–alignments such as these. For example what significance, if any, should we draw from the fact that the apex (*i.e.* the centre) of the Great Pyramid is aligned due north of the early Dynastic Covington's Tomb, located to the south of the site (Martin, 1997: 281)?

With respect to the age of the cutting in the Member I terrace to the north of the Sphinx, there are currently no grounds for this being made in the 18th Dynasty. Archaeological evidence presented for this cutting appears to indicate a secure 4th Dynasty date (Lehner & Hawass, 1994). Furthermore and as discussed below, Vandecruys' implication that the better preservation of the 4th Dynasty section of the Member I cutting can be attributed to being buried in sand ("more likely a difference in conditions and exposure" Vandecruys, 2006b: 8) does not explain the most significant feature of this cutting.

Figure 4 shows the westernmost end of the 4th Dynasty cutting that, as figure 1 shows, extends some distance west of the Sphinx Temple. It can be seen from figure 4, that at its western limit, the line of the Member I terrace has been cut back some 3 or 4 m to the north. If, as Vandecruys and others suggest, the better preservation of the durable Member I limestones in the 4th Dynasty cutting was the result perhaps of being buried in sand, we would not expect the better preserved face to be set back in the way shown on figure 4. Quite the contrary, it would be expected that the more highly degraded face further west would have receded from the general line of the cutting as a result of the more aggressive conditions of degradation that the western section of the Member I cutting had experienced.

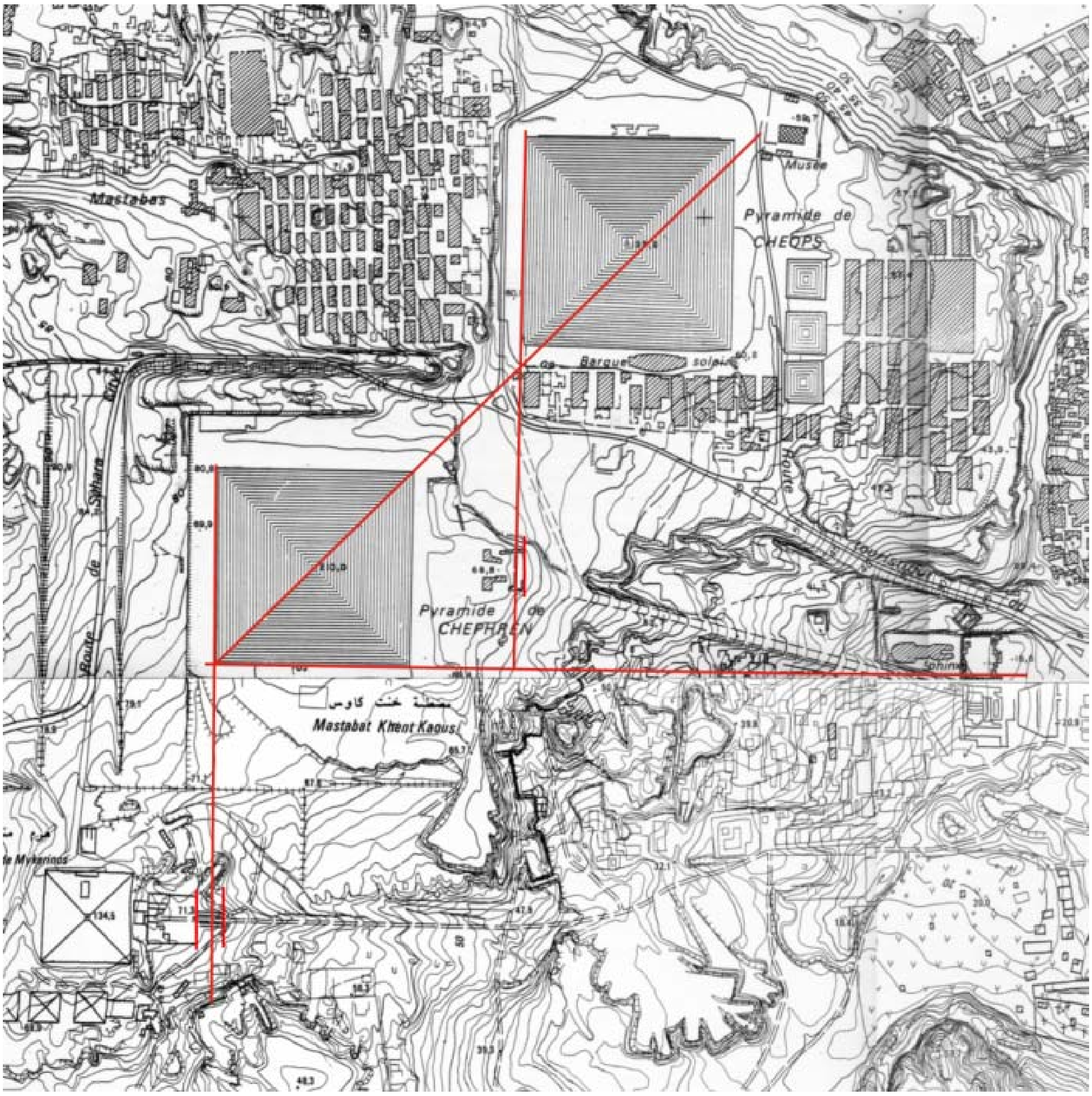

Figure 3. 'Alignments' at Giza suggested by Vandecruys. Drawing by the author, based on the Egyptian Ministry of Housing and Reconstruction (1978) Photogrammetric map, 1:5000 Scale. Sheet F17. Cairo.

The feature shown in figure 4 is clearly a later excavation into an existing exposed terrace. Vandecruys' suggestion that the two phases of Sphinx Temple construction may both be attributed to the 4th Dynasty, does not provide sufficient timescale for the clear contrast in the condition of the two sections of the Member I cutting illustrated in figure 4 to develop. As the later excavation has been dated to the 4th Dynasty, the more degraded face beyond can only be regarded as a substantially earlier feature. Clearly these two cut faces were separated by a significant period of time during which the durable Member I strata in the west of the Sphinx enclosure underwent substantial degradation.

The shallow trench that marks the possible position of a northern enclosure wall of the Khafre valley temple (see Vandecruys, 2006b) is something that has been in the published domain for a number of years (Lehner, 2002). There are numerous cuttings and other features that lie both inside and outside the Sphinx Temple and, as such, this evidence needs to be treated with a great deal of caution, requiring further investigation including difficult–to–obtain access to the interior of the Sphinx Temple.

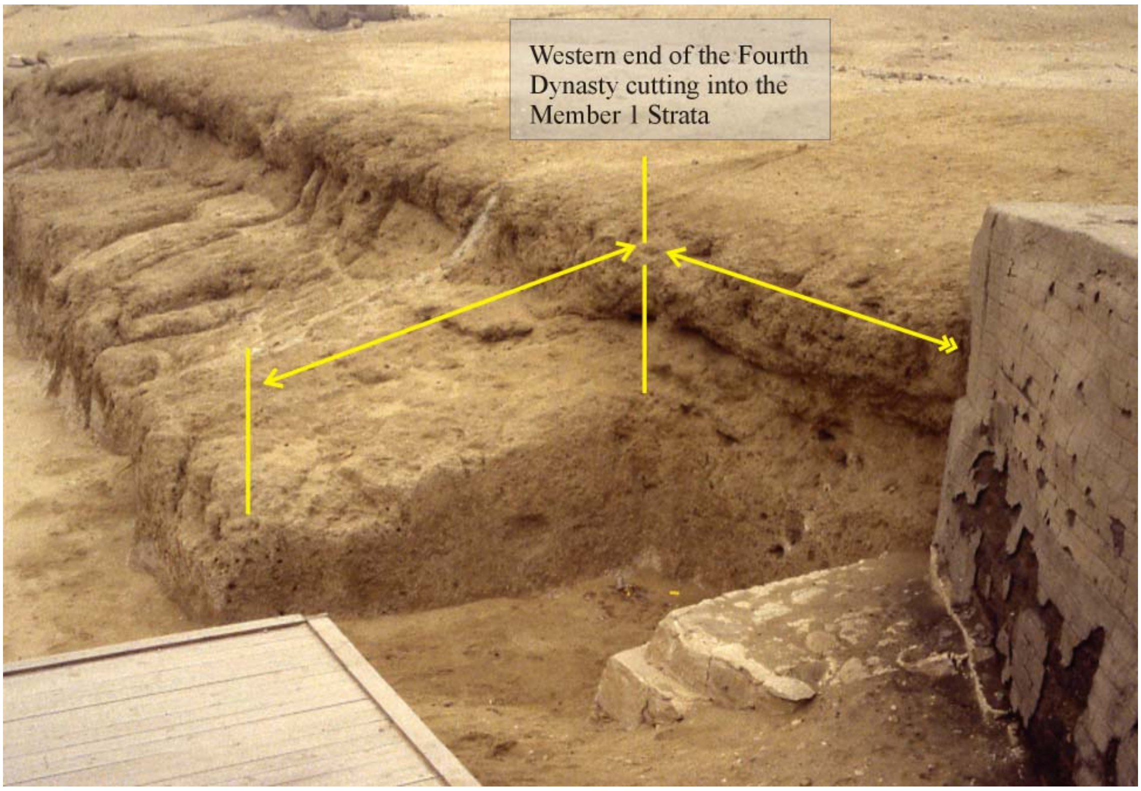

Figure 4. The western limit of the 4th Dynasty cutting in the Member I strata north of the Sphinx. Photograph by the author.

As shown in figure 5, the shallow trench referred to by Vandecruys, meets the outer façade of the Sphinx Temple close to its southeastern corner but, significantly perhaps, also close to the boundary between Ricke's first and second phases of Sphinx Temple construction. The trench, if this is indeed what this feature is, has two elements: the main deeper section (with spot heights of 7.26 and 7.56 m – shown in darker grey in figure 5) and a shallow 'shoulder', which is only some 20 mm deep (spot height = 7.61 m – shown in lighter grey in figure 5). There is also an abrupt step in the trench close to the eastern wall of the Sphinx Temple (marked A – A' in figure 5), with the red–shaded area between the step and the temple itself, being cut less deeply than the sections that are shaded in grey.

A number of questions arise in relation to this feature, for which, currently, no answers can be obtained from published data. These include:

- whether this feature does indeed pass beneath the masonry of the Sphinx Temple – the evidence presented in figure 5 suggests it becomes increasingly shallow as it approaches the eastern face of the temple**;**
- if the feature does pass beneath the masonry, whether this masonry belongs to the first or second phase of the temple construction**;**
- whether any features within the Sphinx Temple, such as the shallow depression shown in green in figure 5, are associated with this trench**;** and
- how this trench relates to a second trench, shown in orange in figure 5.

Until these questions can be resolved, the issue of this trench and what it actually tells us in terms of the sequence of construction of the Khafre valley temple and the two building phases of the Sphinx Temple must remain open to question.

Interestingly, as Vandecruys (2006b) points out, whilst Ricke (1970: 6) does seem unclear about the phasing of the Khafre valley temple and phases of Sphinx Temple construction, he seemed in little doubt that development of the Sphinx Temple terrace had occurred before the 4th Dynasty.

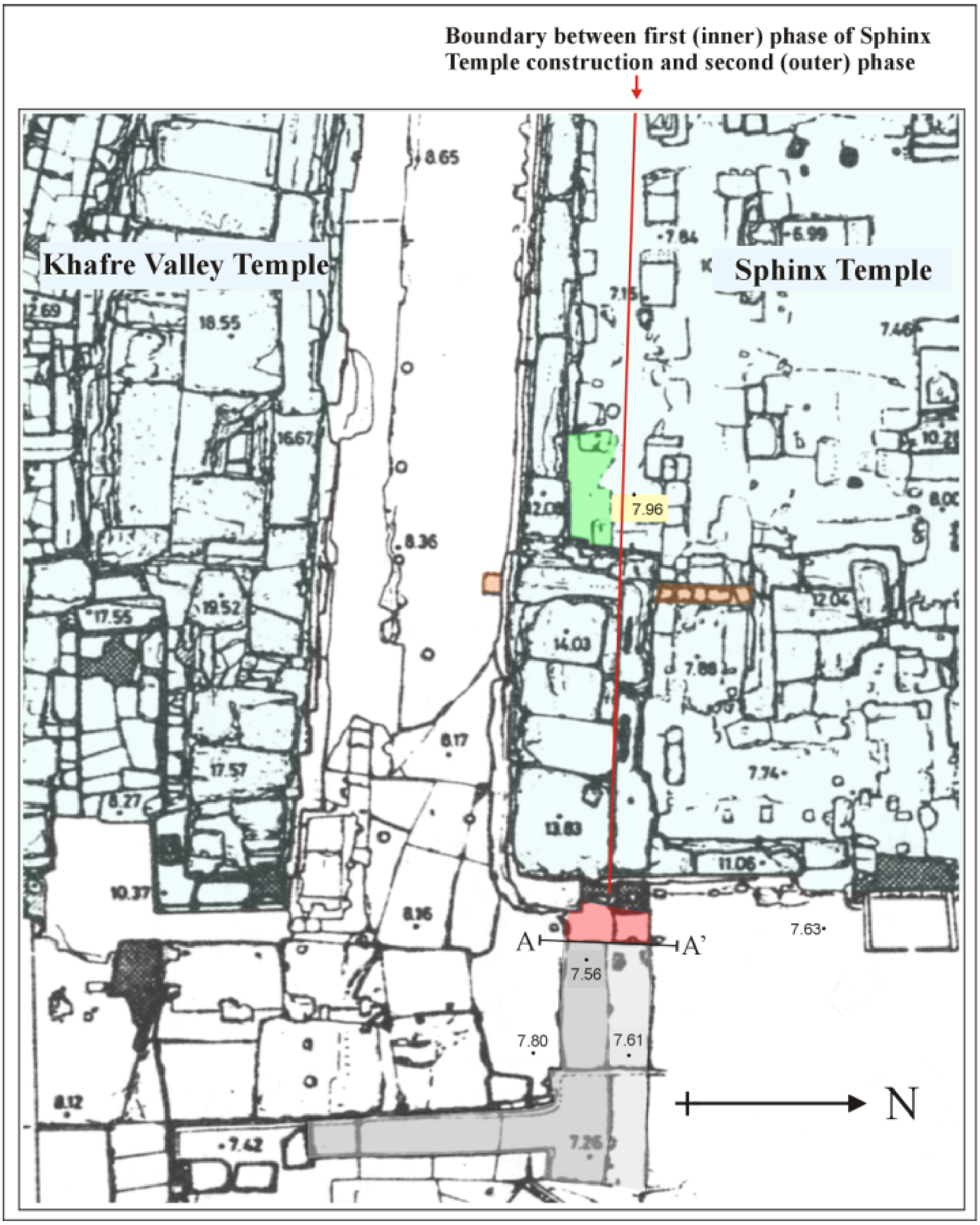

Figure 5. Details of the southeast corner of the Sphinx Temple (after Lehner, 1992).

4. Kai and Khentkawes. Interpreting the niches

When discussing the tomb of Khentkawes and Kai (though it is noticeable that the better preserved and certainly more diagnostic features of the Kai tomb do not feature significantly in Vandecruys' (2006b) criticism), Vandecruys makes a number of incorrect statements. Firstly and, perhaps, most significantly, he appears to be of the understanding that these two tombs are 'inside' the 4th Dynasty central field quarry. As figure 6a and b show, this is not the case. Khentkawes is bounded to the south by the main wadi and Kai lies close to the southeast limit of the central field quarry, with the main wadi to the south and the slopes of the Giza Plateau leading to the Nile valley in the east. There are no rock cut features to the south of Khentkawes and Kai, nor in the same limestone beds to the east of Kai. As figure 6b shows, the only rock–cut tombs to the east of Kai, have been cut from lower–lying beds of the Member 2 limestones.

Figure 6. The tombs of Khentkawes (figure 6a, top) and Kai (figure 6b, bottom) near the southern limit of the Giza Plateau, viewed from the south. Photograph by the author.

The geomorphological evidence indicates, therefore, that the niched façades of these two tombs are close to what may have originally been part of the natural banks of these two watercourses. The significance of watercourses or areas of vegetation for early Dynastic architectural features has been discussed elsewhere (Reader, 2004) and also appears to have influenced the decoration of the walls of the 2nd Dynasty Shunet ez–Zebib at Abydos (Kemp, 1991). Although built in mudbrick with a niched façade on all four sides, like the decorated façades of the tombs of Khentkawes and Kai, the walls of the Shunet ez–Zebib that face the cultivation are decorated with three plain niches with, according to Kemp (1991: 53, figure 18a) "the insertion at regular intervals of an inner, deeper niche".

That the niches of the southern face of the Khentkawes tomb are 'shallow indentations' that extend no more than 1.5 m in height and are irregular in distribution and position, can be explained by the lower lying sections having been protected by burial in sand and the upper exposed sections having been lost to degradation (see D'Hooghe & Bruwier, 1996: 40). The irregularity of the panels is likely to be the result of the re–working of the weathered niched façade for the placing of Tura–quality limestone casing for the later burial of Khentkawes.

None of Vandecruys' criticism of the niched façade of Khentkawes can be levelled, however, against the façade of the tomb of Kai. Although unremarked upon by Vandecruys, the niched panels along Kai are regular, evenly spaced and extend a considerable distance up the façade. Furthermore, as the Old Kingdom burial of Kai did not include Tura casing to the external faces of the tomb, the niched panels have not been re–cut in the same way as those on the Khentkawes façade. As the niched façades to Khentkawes and Kai are external features, any comparison with internal elements of tombs, pyramid chambers or sarcophagi is not considered relevant.

The tombs of Kai, Khentkawes and Nisutpunetjer were excavated in the early part of the 20th century and it was never the current author's intention to suggest that, by merely referring to the Giza Archives website, some extraordinary case for dating any of these monuments could be made (Vandecruys, 2006b). Vandecruys has missed the important point presented by this evidence, however, that the sequence of construction made evident by the distinctive weathering of the niched façade of Kai, clearly indicates a period of time elapsed between the excavation of the rock cut façade and the building of the masonry walls of Nisutpunetjer.

Whilst the attribution of the masonry tomb of Nisutpunetjer to the early 5th Dynasty is not disputed, the geomorphological evidence that the features of weathering present is not in any way consistent with the excavation of the tomb of Kai in the early to mid–5th Dynasty. Put simply, the distribution of weathering, particularly the extent of the darker patina on the niched façade of the rock cut tomb that was later used for the burial of Kai, shows that the niched panels were cut and exposed to degradation for a substantial period of time, before the early 5th Dynasty tomb of Nisutpunetjer was constructed against it. As the burial of Kai is attributed by the Giza Archives website to the early to mid–5th Dynasty (that is contemporaneous with or later than the burial of Nisutpunetjer), the burial of Kai must constitute a secondary use for the decorated rock cut monument.

5. Conclusions

By disregarding the principles of equipotential and the effects that the excavation of the Sphinx enclosure, the 4th Dynasty quarries and other excavations such as Campbell's Tomb will have had on the local groundwater regime, Vandecruys' hydrological model for Giza is fundamentally flawed. Furthermore, Vandecruys has still not provided any evidence for the presence of a body of groundwater at sufficiently shallow depth to substantiate his interflow model.

Vandecruys' claims that the infilled quarries at Giza and the sandfilled Campbell's Tomb would act as reservoirs for interflow contradict other aspects of his theories. If interflow moves so readily through the well developed joints of the coarser limestones (the sub–unit 'ii' strata), by what mechanism would water be contained in these 'reservoirs' given that their walls are also cut into the same beds? Vandecruys also fails to explain how interflow along the marly beds (sub–units 'i') would be sustained across features that were formed by excavating through these very beds. The bedded nature of the strata, which provides the only mechanism by which shallow groundwater movement could be sustained, would have been destroyed by this quarrying activity.

Further failures of the interflow theory can be identified in Vandecruys' reference to the lack of surface erosion across the flat area between the southern Sphinx enclosure wall and Khafre's causeway. His claims that this overturns the influence of surface erosion in favour of sub–surface processes, is easily countered by the fact that this area has been re–cut.

As for Vandecruys' calls for a precedent for the early Dynastic development at Giza that has been proposed, the remains of the niched façades of the tombs of Khentkawes and Kai share many features with the niched façade of the 2nd Dynasty Shunet ez–Zebib at Abydos: further strengthening the early Dynastic date for the decoration at Giza. Whilst the fact that the Shunet ez–Zebib is built in mudbrick provides a major difference between these monuments, the comments of Dodson (1991: 11) prove of some relevance: "In areas less suited to mastaba building these offering places came to be cut into cliff faces, overlooking the cultivated land bordering the Nile." Although this text appears to be making reference to Old Kingdom rock cut tombs at Giza, such as those in the escarpment east of the Great Pyramid, the principle that such tombs were modelled on earlier precedents cannot be ruled out. Perhaps, with these considerations in mind, we can begin to reveal the original purpose and date of the niched decoration in the south and east of the central field cemetery.

As to Vandecruys' claims that the use of cyclopean masonry at Giza is diagnostic only of 4th Dynasty construction, two final points are worthy of mention. Contrary to Vandecruys' (2006b: 8) comment that "carving in massive stone was not common in the first dynasties", evidence from Helwan makes it clear that even as early as the 1st Dynasty, large scale limestone masonry (up to four metres along the greatest dimension) was being used (Saad, 1969: 29, plates 18, 19). Furthermore, it is only the western section of the Khafre mortuary temple, with its comparatively small well squared masonry, open court and other features that so closely fits the established sequence of 4th Dynasty mortuary temple development. The eastern cyclopean part of the temple is particularly uncharacteristic of mortuary temples from this period.

We must be careful that the use of context does not prevent us from assessing all the available data in a fair and open–minded manner. The 4th Dynasty context of Giza that Vandecruys so clearly espouses, has already led to mistakes being made. Take the four jars that were found near the base of the Great Pyramid in the late 1800's and were dated, on the basis of context, to the 4th Dynasty. When properly assessed almost a century later these jars were found to be late Predynastic Maadi ware (Mortensen, 1985).

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