



SHEMU

THE EGYPTIAN SOCIETY OF SOUTH AFRICA



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Khafre's causeway key to Khufu's pyramid

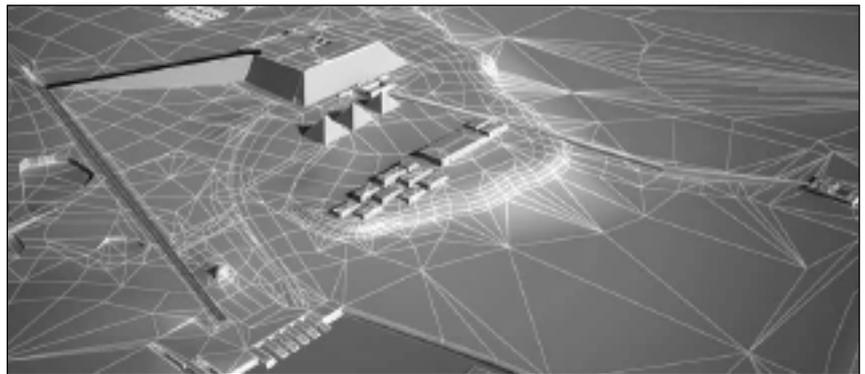
KEITH Payne a freelance writer whose focus is on Egyptology is in discussion with French architect Jean-Pierre Houdin.

Keith: Jean-Pierre, it seems that understanding the archaeology and engineering of Khafre's causeway, or more particularly, the "foundation" ramp beneath Khafre's causeway, is one of the keys to understanding how Khufu's pyramid was built, that the ramp beneath Khafre's causeway was actually a part of the network of ramps that helped build Khufu's pyramid. Can you explain how Khafre's ramp is connected to Khufu's pyramid?

Jean-Pierre Houdin: Keith, since the earliest time of my work on Khufu's pyramid, I have pointed out that in fact the construction can be divided into two projects:

1 – To build the main volume of the pyramid itself, for which I put forward two processes, an external ramp and an internal ramp on (or in) which small teams pulled blocks averaging two tons, and which resolved the construction problem quite easily thanks to the inside-out technique.

2 – To build the King's Chamber with granite coming from the Aswan quarries, 900km south of Giza, and limestone rafters coming from the Tura quarries, on the east bank of the Nile. The five relieving chambers above this funeral chamber already required no less than 43 huge granite monoliths weighing from 27 up to 63 tons, and 11 pairs of rafters



BIRD'S EYE VIEW: An artist's impression of the projected ramp.

PICTURE: JEAN-PIERRE HOUDIN/DASSAULT SYSTEMES.

weighing around 25 tons each, and many more heavy blocks for the walls. Most of these blocks couldn't be hauled just by human force and moreover, all these granite pieces were delivered over a period of many years because of the long extraction and dressing processes; thus they couldn't be delivered at the beginning of the construction. So, the architects and engineers had to find a technical solution to help tow these monoliths in order to reduce the number of men needed, mainly because of problems of space and coordination.

Now, you have to think that the port where all these heavy monoliths were delivered is at Nile level and that the base of the pyramid is 40m higher. Add to this the fact that the pyramid was rising while the granite was extracted, so the best timing to bring, all in once, the granite and Tura limestone pieces inside the perimeter

of the monument was around year 14. Around that year the base level plus 43m, the level of the King's Chamber, had been reached. But this timing had a consequence: the monoliths had to be hauled 43m higher than the base of the pyramid and, in order to keep a gentle slope of around 9% (per cent and not degrees), the length of the path from the port up to the pyramid delivery point had to be around 925m.

Taking advantage of the topography of the plateau, the architects chose a clever solution. The first external ramp, which runs for two thirds of the distance, is an almost natural ramp running westward from the port up to the base of the second external ramp. The second external ramp runs northward for the final third of the distance and reaches the pyramid in the south-western corner.

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**EGYPTIAN SOCIETY
PATRON: Keith Grenville**

DIARY

UNLESS otherwise stated, meetings are held at THE JENNY MALLET HALL at St George's Grammar School, Richmond Road, Mowbray, Cape Town, starting at 7.30pm. Entrance for members is free and is R20 for non-members.

Tuesday, January 28, at 7.30pm:
Professor Anthony Humphreys (two 45-minute lectures): *Partying in ancient Egypt and Caesar's Statue of Cleopatra.*

Tuesday, February 25, at 7.30pm:
Keith Grenville – *Royal crowns of ancient Egypt.*
Members' Platform by Keith Grenville: *Dendera Temple: Cleaned and Revealed.*

Tuesday, March 25, at 7.30pm:
Dr John Moore: *Making Wine in Ancient Egypt*
Members' Platform: Professor Anthony Humphreys: *Cheesemaking in Ancient Egypt.*

TAKE THE MEMBERS' PLATFORM

MEMBERS are invited to address the society on any Egypt-related subject at meetings. The time limit is 30 minutes. A slide, data and/or overhead projector can be made available. Contact the organising secretary or send details to The Egyptian Society of SA, PO Box 66, Table View, 7439.

**CORPORATE MEMBER
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SPECIALIST IN EGYPTIAN TRAVEL

**WE WELCOME
NEW MEMBER**
Hayes, Celia

BEHIND THE SCENES

WITHOUT the following people, monthly TESSA meetings wouldn't run quite as smoothly...
A very big THANK YOU to...
Colleen Cox – Librarian (021 797 3497)
Jackie Weitsz – Assistant Librarian
Mireille Farah – Press and Publicity

We have a new treasurer, Dianne Norman, but we also now have a new PO Box.

**MEMBERS PLEASE NOTE:
TESSA POSTAL ADDRESS CHANGE
WITH IMMEDIATE EFFECT –
THE EGYPTIAN SOCIETY
OF SOUTH AFRICA
PO Box 66,
Table View, 7439**

The society wishes to update its database of members' email addresses. Please forward your email address to the secretary at scarab@telkomsa.net or contact her on 021 557 5082.

SHEMU is the quarterly newsletter of The Egyptian Society of South Africa, issued in January, April, July and October. No part of this newsletter may be reproduced without prior permission. The opinions expressed herein may not necessarily represent the opinions of TESSA or the editor of SHEMU.
Shemu editor: Nerine Dorman
Email: nerinedorman@gmail.com
Shemu copy editor: Lila Komnick
Shemu content manager: Jean Smith

MONTHLY TALKS

THE Western Cape Branch of the SA Archaeological Society offers monthly talks on topics of archaeological interest on the second Tuesday of the month at 6pm at the Astronomical Observatory Auditorium. Guests are welcome, fee R10. See www.archaeologysa.co.za or call 021 689 5921 or 021 788 5620.

TESSA COMMITTEE
Anthony Humphreys – Chairman
Jean Smith – Vice-Chairman & Secretary
Dianne Norman – Treasurer
John Lombard – Organiser
Bill Weckesser – Coordinator
Elaine Weckesser – Catering

FROM THE TREASURER

When you pay money into the society bank account, please identify yourself by using your name in order to make matters simpler for the treasurer and the secretary.

**EGYPTIAN ODYSSEY
GROUP TOUR**

6-21 April 2014
Abu Simbel, Alexandria, Dendera, Abydos, Cairo, Luxor, Edfu, Aswan
5 star Nile Cruise
also

GLORY OF EGYPT
with Nile Cruise
10 days, depart any Thursday
Individual tour
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083 441 0003
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On top of that, the ramp from the port had another big advantage: it ran straight in the middle of the local quarries, providing all the limestone for the pyramid, except the Tura limestone for the facing and most of the internal works.

This ramp was built quite wide, around 23m (44 cubits), in order to allow a massive delivery cadence to the building site.

Keith Payne: One of the things that makes your work with Khufu's pyramid so comprehensive is that you are able to explain how the granite beams of the King's Chamber, some of which weighed in excess of 60 tons, were raised to the level of the King's Chamber and beyond by use of a counterweight system whose trench was housed in what we now call the Grand Gallery. Would there not have to be a corresponding trench and counterweight system at the top of the ramp under Khafre's causeway? Is there evidence for this?

Jean-Pierre Houdin: Yes, the technical solution to raise the monoliths from the base of the second external ramp to the level of the King's Chamber took the form of a counterweight system, with the slide built in the body of the pyramid, aka the Grand Gallery, facing the external ramp. That said, another counterweight system was also needed for the pulling of the huge monoliths up the first external ramp, from the port to the base of the second external ramp and its slide was dug in the bedrock at the western end of the first ramp. This slide, a trench with a slope identical to that of the Grand Gallery, was thus dug into the plateau bedrock where Khafre's pyramid was later built.

And that is where things get interesting. After all, what kind of evidence could exist of a trench for a counterweight system for the ramp leading up from the harbor if it is now covered up by Khafre's pyramid?

If one draws a line in the axis of the



TRENCH: The section of masonry within the horizontal corridor of Khafre's Pyramid that corresponds with the location of a counterweight trench intersecting in the bedrock.

PICTURE: MATHIAS GLAD

ramp below Khafre's causeway and extends it through Khafre's pyramid, this line will cross the horizontal corridor of this pyramid almost in the middle of it. Knowing that the horizontal corridor is around 12m below ground level in this part of the plateau, this corridor should be simply cut through the rock for its entire length. But in reality, the corridor is divided in three sections; the first part, near the entrance, is cut through the stone; the second part, in the middle (around 8m long), is constructed of masonry (floor, walls and ceiling) and the last part, up to the funeral chamber, reverts back to a stone-cut passage. Amazingly, the masonry constructed part is straddling on the axis line.

Moreover, another detail is notable: the horizontal corridor is not on the north/south axis, as it should be, but is shifted 12m towards the east, the purpose of which could be

linked to the construction: to be closer to the upper part of the slide in order to reduce the height of the foundation for the masonry part of the corridor. This detail could well give a hint of the precise position of the original trench.

Another detail supports this idea: whereas the foundations of Khufu's and Menkaure's causeways have the same width as the causeways themselves, Khafre's causeway is built on a wider foundation, leaving a 6.5m wide sidewalk on both sides, with no apparent function related to its construction. One can reasonably conclude that Khafre's causeway was built on a former ramp which was used during the construction of Khufu's pyramid.

In conclusion, I would like to add that I originally suspected the above regarding the ramp beneath Khafre's Causeway based on my experience as an architect and knowledge of construction projects. It was only after I had these conclusions that I visited to site first hand to confirm the evidence. That has to be said.

Keith Payne: Would the ramp leading from the quay to the building site of Khafre's pyramid have remained in use during the building of that pyramid as well?

Jean-Pierre Houdin: Keith, there is something which should be put forward regarding Khafre's pyramid compared to Khufu's pyramid. First, we know that Djedefre ruled, shortly after his father Khufu's death, and began to build his own pyramid around 10 miles north of the Giza plateau, at Abu Rawash. Secondly, after Djedefre's death, Khafre, another son of Khufu, became the new king and ordered his architects and engineers to build a pyramid for him on the Giza plateau. For me, after having closely studied his pyramid, it became evident that some things had changed: the new king of Egypt no longer had the power and means to build a pyramid like his father Khufu.

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Chairman's annual report presented to the Annual General Meeting, November 26

PROF ANTHONY HUMPHREYS

ONCE again I extend a hearty welcome to all members and visitors to this the 17th Annual General Meeting of the Egyptian Society of South Africa. We have had yet another eventful and successful year. This is thanks to a team of highly committed committee members who filled the following portfolios: Jean Smith, vice-chairman and secretary; David Wolfaardt, treasurer; John Lombard, organiser; Bill Weckesser, co-ordinator; and Elaine Weckesser, catering. Their dedication is indicated by the fact that every monthly meeting was quorate. Our patron and founding chairman, Keith Grenville, continues to maintain his interest, support and wise council, for which we are always grateful.

Shemu is an integral part of the TESSA "package" (about which, more later) and our editor, Nerine Dorman, has maintained her usual exemplary standards. She is still ably assisted by Jean Smith as Shemu content manager and Lila Komnick as Shemu copy editor, who source material and often need to adapt it to conform to our particular house style. Jean commissions original lead articles especially for Shemu. Notable contributors this year include Anthony Cagle (with thanks to Dinah White who condensed the article), David Furlong, Keith Grenville, Joyce Filer and Jane Mulder, as well as the ever-regular Maria Nilsson and John Ward.

We are greatly indebted to John Lombard, who always makes his own personal laptop available at meetings. We are still grappling with our erratic sound system. The acquisition a microphone which attaches to the speaker's head has gone some way towards solving this problem. Many

thanks, John, for your on-going technical input and experimentation.

Our society website – www.egyptiansociety.co.za – has continued to be a great success in making our existence known to the outside world. We had 9 413 unique visitors – 2 400 more than last year. Our Facebook page is also active with, to the end of October, 377 members from all over the world. Do think of joining in as you are missing a valuable resource.

Membership

Economic pressures have forced us to increase our subscription rates to R85 for ordinary members, though we have kept the rate at R45 for distance and student members. We managed to hold the rate at R80 for ordinary members from 2004 until now – no less than 10 years. Despite this small increase, I believe that TESSA is still one of the best value-for-money societies in the country. We offer 10 lectures a year; the Annual Day School, with its three lectures and traditional Egyptian-style buffet lunch, where members pay the basic cost-per-person rate (non-members being required to pay slightly more); four issues of Shemu; free access to our ever-expanding lending library now consisting not only of books but a solid collection of DVDs; and, of course, Jean Smith's electronic TESSA Bulletins with updates on developments relating to finds and events in Egypt. Our membership remains fairly constant at about 200, though it is impossible to quote precise figures. We are now in the midst of the annual renewal of subscriptions and new members are always replacing those who fall away for whatever reason. New members are reflected in each issue of Shemu for existing members' information

and by way of a welcome.

It is with great sadness that I have to record the passing of two stalwart members of TESSA. The first is Clive Oosthuizen, who was a member for 14 years and regularly participated in our activities, along with his wife Heletia. The second is founder member Doreen Davis, who was an equally enthusiastic supporter, as was to be expected. Appropriate messages of condolence were conveyed to the respective families on behalf of TESSA.

Lectures

An exceptional highlight this year was a lecture by Prof Salima Ikram, Professor of Egyptology at the American University in Cairo. As a result of a happy set of circumstances, Ikram was in the country at the end of April to engage in a research project with Prof Sakkie Cornelius of the Department of Ancient Studies at Stellenbosch. TESSA contributed financially to making the visit possible, thereby subsidising valuable research into an intriguing aspect of ancient Egypt. A fuller report and some photographs taken at the meeting can be seen on our website.

John Lombard, our organiser, continues his sterling work in seeking out speakers. Thanks to his dedication we were able to enjoy the following presentations:

January: *The Last Cleopatra – The Life and Times of Cleopatra Selene II* and *The Nefertiti Centenary* by Anthony Humphreys;

February: *Mummifying Alan: Egypt's Last Secret* – A DVD version of the award-winning TV documentary by Joann Fletcher and Stephen Buckley;

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March: *Ancient Egypt in Victorian Art* by Keith Grenville;

April: *Mummies in Ancient Egypt* by Salima Ikram;

May: *Journeying through the Faiyum* by Lambert Vorster;

June: *The Scourge of the Sea Peoples* by Patricia Weckesser;

August: *Ancient Egypt – What Happened Before the Pharaohs?* by Alexandra Sumner;

September: (double lecture) *Uncovering a Graeco-Roman City in the Delta – The Excavation at Ancient Thmuis (Tel Timai)* by Jessica Nitschke;

October: *Unite or Die: What Happened to the Royal House of Nekhen* by Gillian Russell-Johansen;

November: After the AGM formalities, John Lombard brought us up to date with *More Breaking News in Egypt 2013*.

Members' Platforms

The Members' Platforms were similarly varied and consisted of the following:

March: *Ancient Egyptian Shabtis* by Jean Smith;

May: *More of the Western Desert* by Lambert Vorster;

June: *Breaking News 2013* by John Lombard;

August: *Helen of Troy – An Egyptian Connection?* by Anthony Humphreys;

October: *Rise of the Rebels, and a 2nd Unification: it didn't take long for the dream to fade ...* by Gillian Russell-Johansen.

Mireille Farah continues her vital job of ensuring that our meetings are always advertised timeously in the various media. Thank you, as ever, Mireille, for your consistent behind-the-scenes reliability. Anthony Humphreys and Jean Smith were also interviewed on local radio stations – FMR and Voice of the Cape – to promote particular lectures and, of

course, TESSA itself.

Annual Day School

The Annual Day School, which remains a high point of our year, was held on July 27, this time at a new venue, Kelvin Grove Club. This year's theme was *Female Pharaohs of Ancient Egypt* and consisted of the following three lectures: *Hatsepsut – Betrayal or a Royal Cover-up?* by Keith Grenville, *Tausret – The Unknown Pharaoh* by Jean Smith, and *Arsinoe II – A Valid Pharaoh?* by Anthony Humphreys. A full report on the highly successful day is available on our website. Particular thanks are due to Andre Bakkes of the TygerBurger for pre-Day School publicity and for a comprehensive report on the event in the paper, as well as a video feature on their website. This is all still available on our website – click on the TygerBurger website address just above my report on the Day School.

Library

Our library continues to be run smoothly as ever by Colleen Cox and Jackie Weitsz. These two ladies put an enormous amount of work into the library – and have done so for the past 13 years – and we are extremely grateful for their sustained and dedicated services. They maintain a fundamental part of our offerings to members. Our librarians report as follows:

Thanks are due to Lila Komnick, Jean Smith, Ria Robinson and Graham Rodgers for press cuttings, pamphlets and articles of historical interest, which they donated to the library for the society's scrapbook. Thanks also to Jane Mulder for donating a large packet filled with Egypt-related articles and cuttings from the estate of her late friend Richard Boberg. A large poster portraying Queen Nefertari was kindly donated by Wendy Cranston.

We are also grateful to the

Egyptian Embassy for donating a dozen miscellaneous items and two books to the society, which have been incorporated into the library.

Two VHS videos were anonymously given to the library earlier this year. They are the last as we no longer possess a VHS video library. Owing to the progression of technology, last year we upgraded to a new DVD library instead. It gave us great pleasure to present the contents of our former VHS video library to our oldest TESSA member, Graham McPetrie, who is almost 95 years old, and unfortunately no longer able to attend our monthly meetings. All of us at TESSA wish him well for the future, and trust he that will have many hours of viewing pleasure ahead.

An anonymous donation of R20 was made to the library's sundries account this year, in the form of a money note discovered lying under the library desk. A book was also donated to the library by an anonymous gentleman.

The Society received one Journal of Egyptian Archaeology (along with a newsletter and flyers), and one Egyptian Archaeology Bulletin from the London-based Egypt Exploration Society, through TESSA's membership of the EES.

Thirty-eight books were donated to the library this year. Of these, the TESSA committee purchased three. They were: *Cleopatra the Great* by Joann Fletcher, *The Great Pharaohs* by TGH James, and *The Encyclopaedia of Ancient Egypt* edited by Helen Strudwick.

Other book donations came from Keith Grenville, Wendy Cranston, Soretha Smithers, Karen Douglas-Elliott, and Joan Engelbrecht.

At the end of last year 781 books were registered in the library. The grand total is now 817 books. Warm thanks are due to all who contributed to the expansion of our library.

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General thanks

Over and above the people mentioned above, the committee is also indebted to the following: corporate member Egypt Today CC for its continued support; our auditor, Ralph Pond; the St George's

Grammar School people – headmaster Julian Cameron, liaison person Stephen Bornman and estate manager Ivan Smith. Master photographer Gunther Komnick provides photographic and technical advice when required.

Most importantly, thanks are due to the various speakers for sharing their knowledge with us and for the effort involved in researching their

topics.

Finally, of course, thanks are due to you, our loyal members, for your continuing support, which makes TESSA the vibrant society that it is.

May I conclude by wishing everyone a happy and safe holiday period until we foregather for the beginning of our 18th year next January to resume our exploration of "things Egyptian".

Mealtimes in ancient Egypt

ARCHAEOLOGICAL discoveries have told us much about how ancient Egyptians worshipped, celebrated and mourned. But these scientific finds have also provided tantalising clues about how, and what, this complex civilisation ate.

Bread and beer were the two staples of the Egyptian diet. Everyone from the highest priest to the lowliest labourer would eat these two foods every day, although the quality of the foods for the priest would undoubtedly be higher. The main grain cultivated in Egypt was emmer. Better known today as farro, emmer happens to be a fairly well-balanced source of nutrition. It's higher in minerals and fibre than similar grains. Breads and porridge were made from the grain, as well as a specially devised food product that modern-day archaeologists call "beer bread".

Beer bread was made from dough that used more yeast than normal breads, and it was baked at a temperature that didn't kill off the yeast cultures. Brewers crumbled the bread into vats and let it ferment naturally in water. This yielded a thick and cloudy brew that would probably disgust our modern palates. But it was also nourishing and healthy, and filled in many nutritive deficiencies of the lower-class diet.

But ancient Egyptians did not survive on carbohydrates alone: hunters could capture a variety of wild



ANCIENT FOOD: Detail from a New Kingdom tomb.

PICTURE: KMT MAGAZINE VOL 13 NO 4.

game, including hippos, gazelles, cranes as well as smaller species such as hedgehogs. Fish were caught, then salted and preserved. In fact fish curing was so important to Egyptians that only temple officials were allowed to do it. Honey was prized as a sweetener, as were dates, raisins, and other dried fruits. Wild vegetables abounded, such as celery, papyrus stalks and onions.

Although no recipes from the times remain, we have a fair idea of how the Egyptians prepared their food, thanks to wall paintings in tombs and objects placed therein to accompany the deceased to the afterlife.

Labourers ate two meals a day: a morning meal of bread, beer and often onions, and a more hearty dinner with boiled vegetables, meat and more bread and beer. Nobles ate well, with vegetables, meat and grains at every meal, plus wine and dairy products like butter and cheese. Priests and royalty ate even better. Tombs detail meals of honey-roasted wild gazelle, spit-roasted ducks, pomegranates and a berry-like fruit called jujubes, with honey cakes for dessert. To top it all off, servant girls would circulate with jugs of wine to refill empty glasses: the perfect end to an Egyptian banquet. – www.history.com/news/hungry-history

LETTERS FROM SILSILA –

Ancient quarries and predynastic rock art



**DRS MARIA NILSSON
AND JOHN WARD**

THIS autumn the Gebel el Silsila survey team returned to the Mountain of Chain for another six weeks of exciting exploration and documentation. This letter is written as a brief, personal field report with the aim to share with you, dear Shemu readers, some of our amazing discoveries.

First and foremost, this season has proved more than ever that Gebel El Silsila has more to offer than just its monumental pharaonic structures, and that its preserved material stretches far, far back into Egypt's vast history.

When we returned to the site in September we picked up where we left off in May. We continued to record and document the quarries of the east bank and paid particular

attention to Ramses' surface quarries. These lay elevated high above the River Nile, next to the now fallen stele of Ramses II, which we described in a previous letter.

For the general masses it may sound boring and even a waste of time, but for us it was an exciting moment when we found and investigated an area that presented a perfectly preserved single semi-dressed block.

Still attached to the bedrock, it sat complete with trenches to three sides and with lower pecking holes, which, if finished, would have fractured the block from its solid foundation – a technique that evolved during the 18th Dynasty.

The area further retained evidence of already extracted blocks and provided us with a perfect example of the techniques involved in extracting blocks in a logical sequence. An

interesting marking system was recorded on the block surface, which outlined the continued sequence of extraction. Given the approximate depth at which the area now stood, we estimated that some 36 blocks had been removed from a 6m² area; quite a feat of engineering, not to mention thought provoking when one imagines how many blocks in total had been removed from the site. Consequently this small block area gave us a better understanding of the techniques employed by the ancient quarrymen, and helped us to understand the various types of tools that were used in the space-restrained fist-sized trenches, which not only created the required block size, but also functioned within the overall sequence of removing the required blocks.

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Only a few days into our season the work plan changed as our focus was turned to the very south of the east bank due to a dispute between local farmers and the guardians over agricultural encroachments. The dispute was settled but we still decided to survey the area and document it properly.

And what a joy it was to do so, because there, where this undulating, weatherworn rocky landscape meets agricultural land (once a Nile canal) is a series of the most magnificent preserved Epipalaeolithic rock drawings very much comparable with the so-called "Masterpiece" as reported from el Hosh by Dr Dirk Huyge and Per Storemyr not that long ago.

Indeed, the focus of this season's work had changed as we were now working with material that was almost 10 000 year old.

Dr Huyge, who visited the site in 2008, kindly brought to our attention a few endangered rock art sites also on the west bank. Our recording of these sites, combined with many more, provided us with an enormous wealth of material, ranging from Epipalaeolithic rock art to Middle Kingdom inscriptions describing quarry expeditions to the site. Predynastic rock art literally drew us a vivid picture of the Ethiopian fauna, especially the bushy-tailed giraffes, known to roam in the area during Naqqada I (4000 to 3600 BCE).

In addition to the epigraphic material we recorded flint and other lithic workshops; we followed early dynastic transportation routes, and learnt more about the use of the southern quarter of Silsila West as a place of not only habitation and security, but also a strategic location for the local indigenous tribes during the annual floods.

Among the more interesting finds

this season were a round-topped stele that depict a vizier presenting offerings to Amun-Ra and Thoth, and a wooden hand, which was likely to have belonged to a sarcophagus. Indeed, the archaeological material discovered this season showed the diversity of the site.

We now look forward to continuing the survey over the coming years, learning more as we delve deeper into "Madam Silsila's" past, exploring her valleys, stony hills and vast quarries.

Gradually we decipher her incredible amount of archaeological material that spans thousands of years; left by the pre-historical man who escaped the Holocene plains to the higher grounds of Gebel el Silsila, to the last caravan trader who travelled the area before the modern world took over. The autumn season of 2013 has certainly shown us that Gebel el Silsila has more to offer than we could ever have wished for.

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That said, his architects and engineers, amazingly clever, designed a project as impressive as that of his father, although cheaper to build. The base is a little shorter, the slope of the faces is a little steeper, the height is just a few metres lower, while the pyramid is based almost 10m higher on the plateau, the whole resulting in the feeling, when one is on the Giza plateau, that both pyramids are equals, which is not the case at all. Khafre's pyramid is near 370 000m³ smaller and, more importantly, much easier to build because the funeral apartments are below ground level, dug in the bedrock, thus avoiding the need for structures such as the Grand Gallery and a counterweight system in its body.

Furthermore, the architects and engineers were able to take advantage of the terrain itself as well as the already-existing ramp from the harbour.

The pyramid itself was built in a large quarry and the remolded topography of the plateau was closely integrated into the project. Only a small number of blocks of granite had to be brought in from elsewhere for the lower layers. Instead of creating a new path for the construction of the causeway, the former ramp from the port from Khufu's time was recycled as the foundation of the Royal causeway.

And as this former ramp was much larger than needed for the causeway, this ramp was used for transportation before and after the construction of Khafre's causeway, the large sidewalks on both sides being used to haul the blocks of granite used to make the facing of the few first layers.

As a conclusion, I would say that Khafre's pyramid is the last true large smooth pyramid built in ancient Egypt and rings the bell of the end of an era. After this pyramid, all the pyramids built until the 13th Dynasty would be smaller and much easier to

build, but that didn't end the fact that the following pyramids were also built inside-out, a technique which is still in use in modern Egypt in some similar temporary constructions.

Biographies

Jean-Pierre Houdin is an architect from Paris, France, whose father, an engineer, had an intuition in 1999 that the pyramids could have been built from the inside. Jean-Pierre has expanded and continued his father's work with his theory that an internal ramp was used to build the Great Pyramid.

Keith Payne is a freelance writer on the subject of Egyptology and is the webmaster of the site www.emhotep.net. By day he is an educator at the Community Montessori School in New Albany, Indiana, USA.