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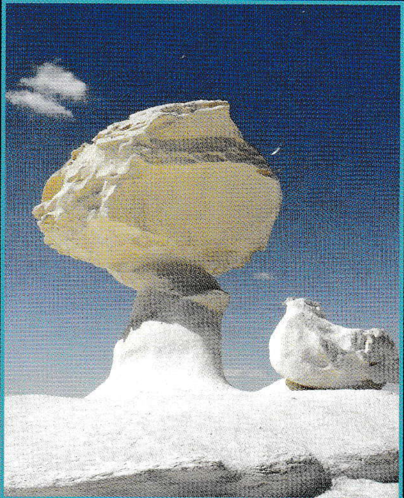
The History, People and Culture of the Nile Valley

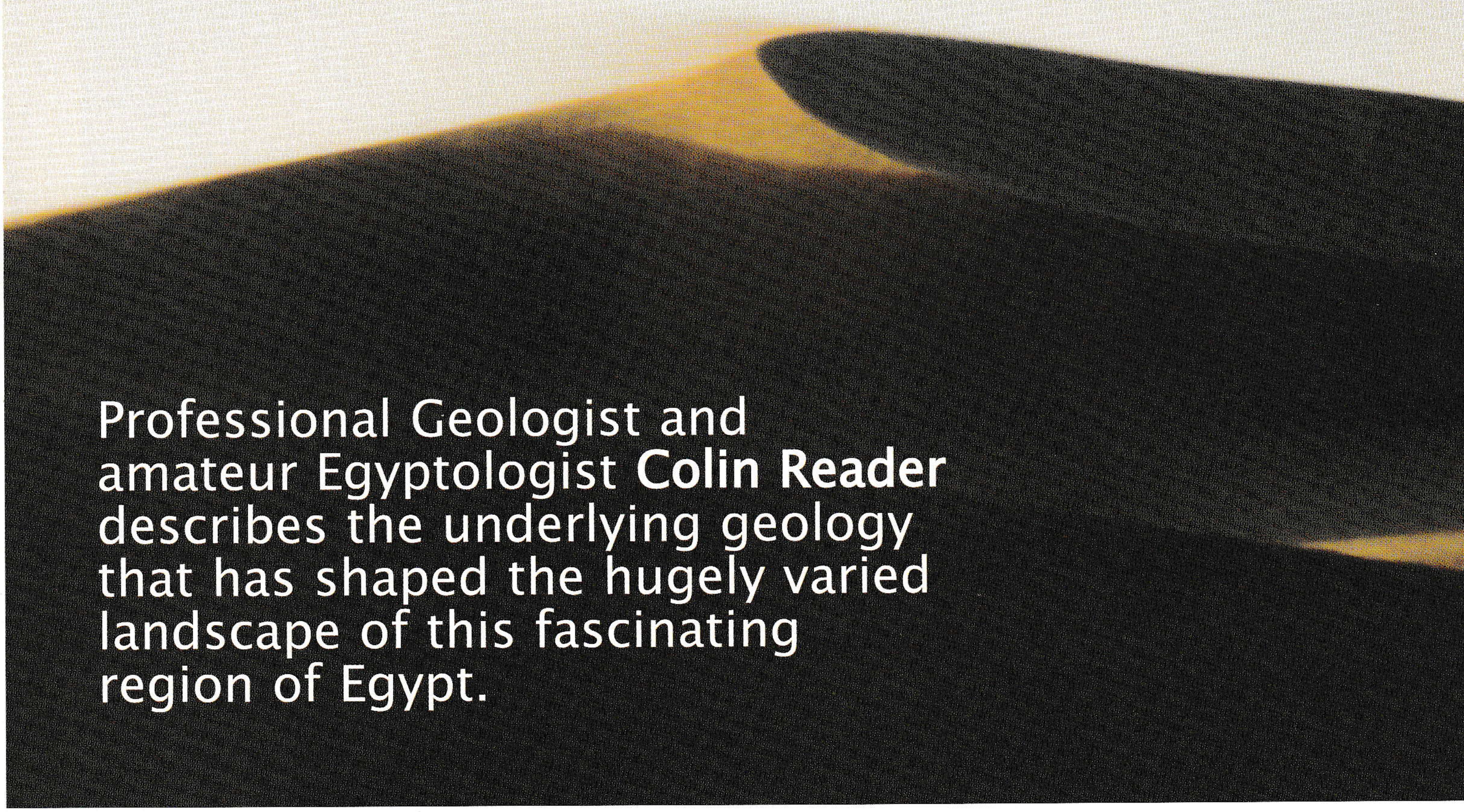


The Geology of the Western Desert

Grafton Elliot Smith

Nefertiti's 'New' Home

Egypt's Western Desert

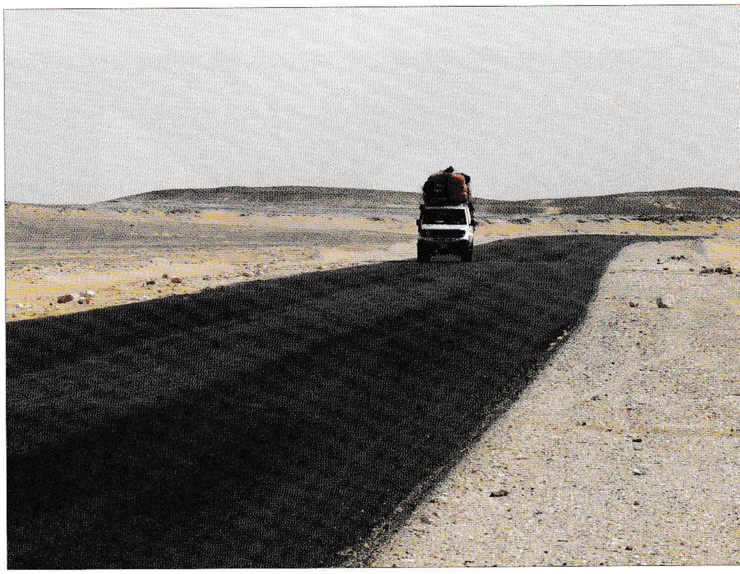


Professional Geologist and amateur Egyptologist Colin Reader describes the underlying geology that has shaped the hugely varied landscape of this fascinating region of Egypt.

Including the Sinai Peninsular, Egypt occupies some one million square kilometres in the north east corner of Africa. Of this landmass, the cultivated areas of the Nile Valley and Nile Delta represent only about 3·5%, the rest of Egypt being occupied by desert. I have yet to visit Sinai and my explorations of the Eastern Desert were recounted in Volume 10, Nos. 3 and 4 of ANCIENT EGYPT. In this article therefore, it is time to look at the Western Desert – the most extensive wilderness in Egypt.

The sand dune fields *(see above)* and rocky plateaux that extend across Egypt from the Nile Valley in the east to the border with Libya in the west are large enough to accommodate the entire British Isles, as well as significant areas of the surrounding coastal waters. In contrast to the cold and wet conditions of the North Atlantic however, the Western Desert is truly part of the Sahara – with only the famed oases to break up the vast sandy expanse. For those of you who have not visited the Western Desert, the mental images you will inevitably borrow from Hollywood or school geography books will give a fairly good general impression of the landscape – though such generalisations are not always reliable. For example, the Western Desert oases are sizeable agricultural regions that have little in common with the popular caricature of the small pool of water with its single attendant palm tree.

The desert starts abruptly in Egypt – almost as soon as you cross the western edge of the inundation and start climbing the escarpment that borders the Nile Valley. The highest point on the limestone plateau is reached relatively quickly via modern asphalt roads *(see below)* that tend to follow the beds of *wadis*. After climbing 400m



A modern asphalt road leading westward from the escarpment of the Nile Valley.

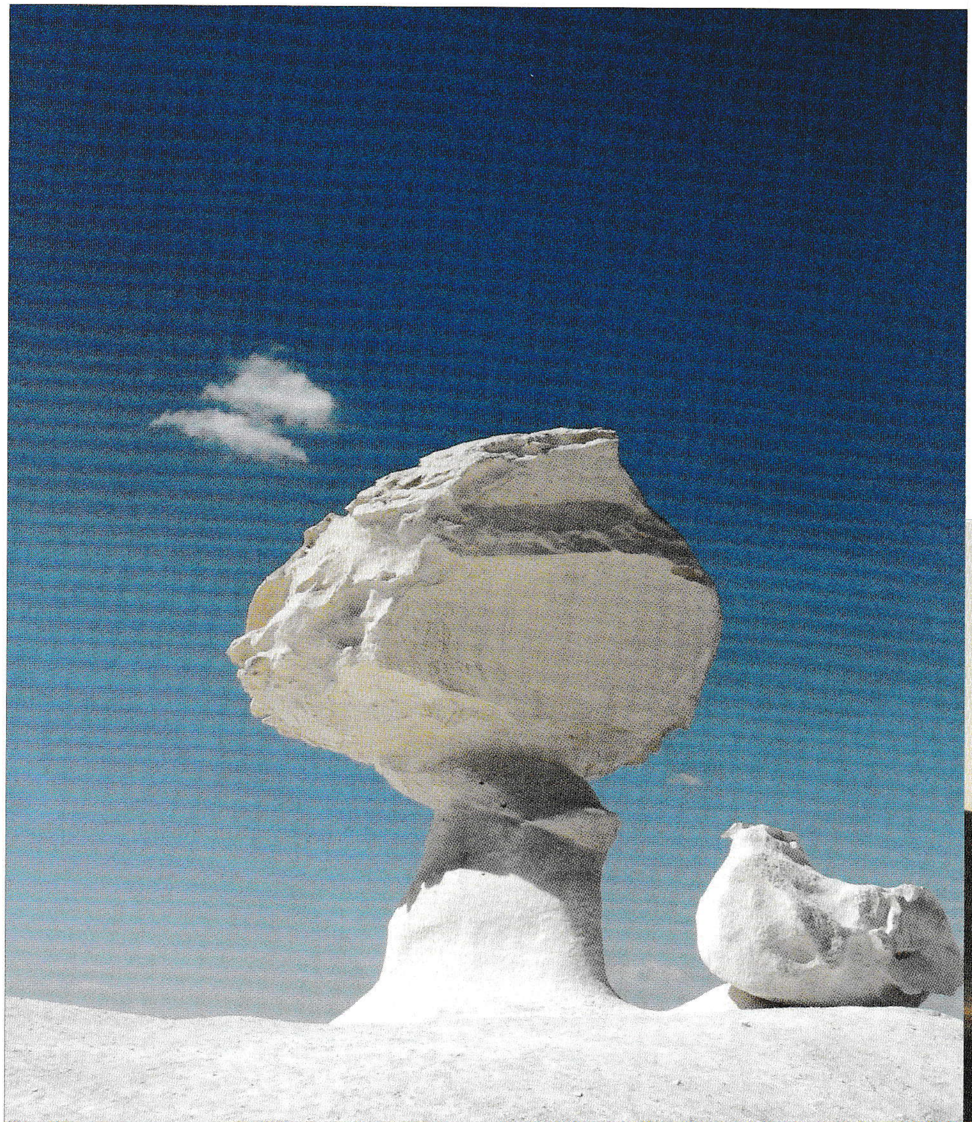
from the floor of the valley, the desert to the west opens up as a gently dipping limestone *peneplain* [an area of land worn almost flat by erosion], which extends for many miles before meeting the horizon in an indistinct blur of dust and haze. Travelling west across this limestone terrain, you slowly begin to descend across a series of low terraces as the landscape moulds itself to the bedded nature of the underlying limestones. This is not the classic sandy desert of the Sahara, which lies hundreds of miles further west; this is a barren rocky landscape that will be familiar to anyone who has visited the pyramid sites near Cairo – though in the desert, the scale is of a different order entirely. It requires several hours' travel by Landcruiser before this flat and generally uninspiring landscape gives way to something more dramatic.

In much of Upper and Middle Egypt, after travelling about 200 km west of the Nile, the elevated limestone plateau suddenly falls away. The dramatic cliffs that wrap themselves around the north and east of Kharga Oasis for example, are some 300m high *(see above right)*. The face of this escarpment exposes layer upon layer of fossiliferous Eocene Limestones – all that remains of the floors of tropical seas and the life that teemed in the warm shallow waters some 30 million years ago. The White Desert, north of Farafra Oasis, marks the base of these thick limestone deposits. The extremely pure limestones *(see right)* that resemble chalk and contain some incredibly well-preserved fossils *(see overleaf)*, mark the end of the age of the dinosaurs – some 65 million years ago .

One of the most characteristic features of Egypt's Western Desert is the series of low-lying depressions that are scattered across the central and northern plateaux areas. The depressions in the central area have eroded through the full thickness of limestone strata to expose the underlying Nubian Sandstones – rocks that were deposited in coastal waters throughout the 170 million years of dinosaur evolution and contain some of the most remarkable dinosaur remains ever found. The groundwater in the Nubian Sandstones constitutes possibly the largest aquifer in the world and it is the presence of this water that has allowed the development of fertile oases at the base of these depressions – such as those at Siwa *(see overleaf)*, Dakhla, Farafra and Bahariya. Further north however, the depressions are dry. Although Qattara is one of the

ABOVE
The high cliffs that rise above Kharga Oasis.

BELOW
A wind-sculpted *inselberg* in the White Desert.



ABOVE
An intricately preserved echinoid fossil in the White Desert.

BELOW
The date palms and lakes of Siwa Oasis as viewed from the Temple of the Oracle.
Photo: JPP.

lowest-lying places on the surface of the Earth (at some 100 m below sea level) because the strata beneath Egypt dip to the north, the base of the Qattara Depression does not reach the water-bearing sandstone beds.

It is still not entirely clear how these depressions formed. It used to be thought that wind erosion 'scooped' them out of the arid desert surface, yet it is difficult to explain why the results of such a process would produce the series of relatively localised depressions that are scattered across the Western Desert. More recently, the depressions have been linked to sub-surface cave systems, which can form in soluble rocks such as limestones. If the rock layers above the caves become too thin, the roof may eventually collapse leading to the formation of a depression at the surface. Although the action of underground rivers is believed to have played an important role in the formation of the depressions, it is generally felt that another process must also have been involved. Surprisingly, given that we are talking about the eastern fringes of the Sahara Desert, this additional process is thought to have been the action of rivers. A surface river will constantly erode along its bed, deepening its valley in the process. Where deepened valleys crossed underlying cave systems, the thin intervening rock layers became

increasingly vulnerable to collapse, leading to the scattering of depressions that exist across the Western Desert.

Although the idea of extensive surface rivers in the Western Desert may at first appear to be a little odd, evidence for the presence of large river systems in the area has been available for some time. The presence of coarse, water-worn gravels in the area north of Bahariya clearly indicates the existence of an ancient delta some 30 million years old – a delta which dwarfed the current Nile Delta. Within these gravels are extensive deposits of fossilised wood (including tree trunks up to 20 m long) which attest not only to the heavily vegetated environment that existed in North Africa at that geologically recent time, but also to the presence of a large river that fed into the delta. But where were the remains of this river?

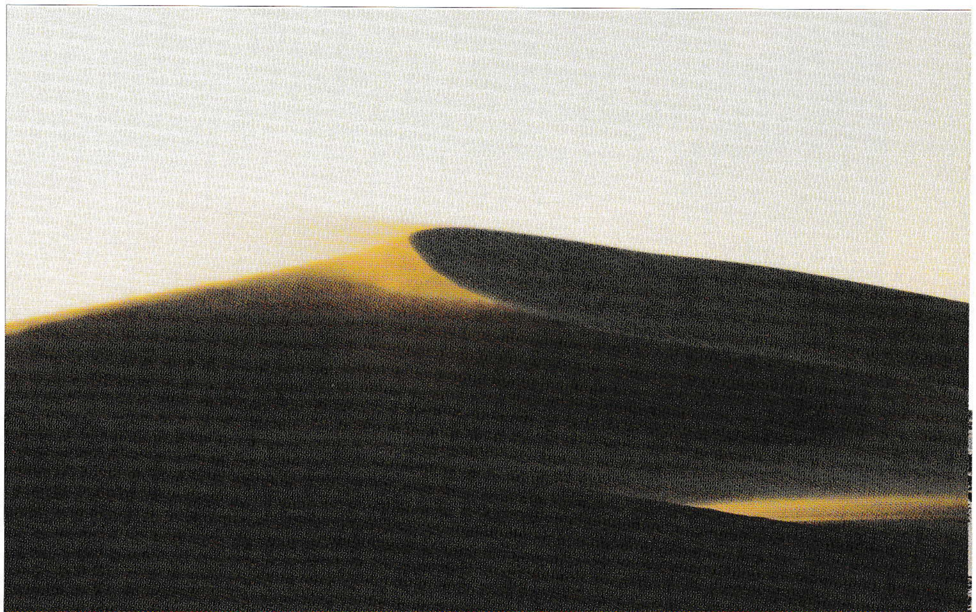
The answer came – rather unexpectedly – from space. As part of NASA's Space Shuttle missions, large parts of the Earth's surface were mapped by space-borne radar. What distinguishes radar mapping from satellite photography is that radar energy can penetrate loose surface material such as sand or soil – allowing the underlying bedrock profile to be accurately mapped. In the Western Desert, the Shuttle's radar identified a network of hills, ridges and valleys lying beneath the huge thicknesses of sand we refer to as the Great Sand Sea – a river system that terminated at the ancient delta. Not only did the Shuttle's radar data allow the source of the delta deposits to be identified, it also confirmed the huge size of this river. Now referred to as the Gilf River (because some of its headwaters rose on the Gilf Kebir, a fascinating area of the Western Desert we will look at shortly) the valley that was eroded by this river and its tributaries extended from Libya in the west, across to Dahkla and Kharga Oases in the east. The cliffs that were discussed earlier and provide the dramatic backdrop to the Kharga Oasis are cliffs that once lined the valleys of the Gilf River system.

Another long-standing question could now also be resolved – where had all the sand in the Great Sand Sea *(see above left)* come from? Having identified the presence of the former Gilf River, it was recognised that over millions of years this huge river system had ground out vast quantities of sand from the Eocene limestones and the Nubian Sandstones. This sand had originally been carried north by the flowing river to be deposited into the Tethys sea. As the climate dried out and the coast moved further north to align with what today is the Mediterranean, countless individual sand grains were driven south from the ancient coast by the prevailing north winds *(see below)*. It is this mass blanket of sand that we call the Great Sand Sea.

In one relatively small area in the south of the Great Sand Sea, the shifting sands have revealed yet another mystery of the Western Desert. Translucent green in colour and with an unusual soapy texture, fragments of 'silica glass' litter the surface of the desert between the high dunes. Debate continues regarding the origin and formation of the silica glass. Although it is generally considered to be the result of an

ABOVE
Preparing to cross the Great Sand Sea.

BELOW
The northern wind carrying sand grains from the crest of a dune.



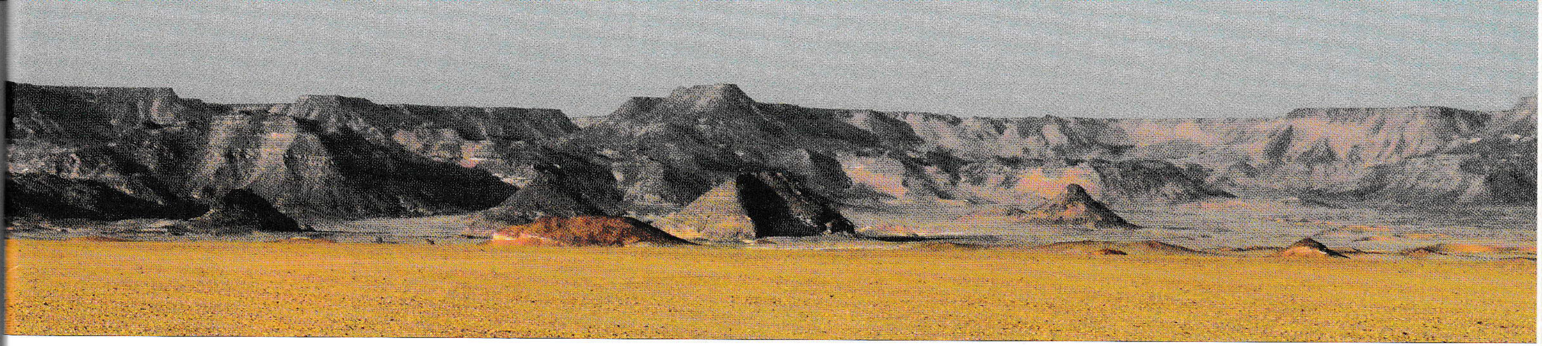
RIGHT
Egyptian silica glass.

BELOW
Tutankhamun's pectoral with a central scarab carved from silica glass from the Western Desert
Photo: RBP.

impact of a meteorite or other natural extraterrestrial body, there are some features of the Egyptian silica glass that may not support this interpretation. For example the silica glass in Egypt is generally 98% silica – a far higher purity than other impact products that have been found around the world *(see above)*.

Despite the uncertainty however, it has been possible to establish some facts. The age of the silica glass is a little short of 30 million years. At that time, the Tethys Sea was retreating north across Egypt leaving Nubian Sandstones overlain by beds of limestone. The meteor (if that is what it was) did not impact the sand that covers the desert today but fell onto a very different landscape characterised, as we have seen, by flowing rivers and dense forests. It is because the meteor impact crater is now likely to have been lost to erosion that it has proved difficult to establish clearly the origins of the Egyptian silica glass.

Perhaps the biggest surprise of recent years, however, was the realisation that the Ancient Egyptians not only knew of the silica glass, but also perhaps valued it. A large piece of rounded and polished silica glass, worked into the shape of a scarab, forms the centre-piece of a pectoral discovered in the burial of Tutankhamun. The pectoral was an important element of the burial regalia and was laid on the chest of the pharaoh's mummy. For many years the strange green stone at the heart of this piece had been identified as chalcedony, a relatively common stone far less valu-



able than the gold into which the scarab had been set. The recent re-identification of this scarab as a specimen of worked silica glass clearly indicates that the Ancient Egyptians were familiar with the Western Desert and its resources. Whether they could have known how unusual and rare the silica glass is, however, seems unlikely.

Nowhere is the name 'The Great Sand Sea' more appropriate than at its southern 'shore' where it meets the impregnable Gilf Kebir. 'Gilf Kebir' can be translated as 'The Great Barrier' and it's clear why this incredible landscape feature was given that name. To the east, west and south, the cliff-like walls of the Gilf tower some 400 m above the surrounding desert *(see above)*. In the north however, the cliffs of the Gilf are slowly being 'drowned' by vast waves of sand – the relentlessly advancing dunes of the Great Sand Sea.

The rocks of the Gilf are a remnant – an uplifted body of durable sandstones and siltstones formed in the early part of the dinosaur age, some two hundred million years ago. Time and nature have been unable to erode these rocks as efficiently as the surrounding limestones and Nubian Sandstones. As the Western Desert area became more and more arid, the upland Gilf plateau was probably one of the last remaining places with rain and flowing rivers: even today dry river channels can be seen running westward from the flanks of the Gilf and into Libya *(see below)*. For the traveller, these *wadis* represent the few places where the rocky battlements of the Gilf can be breached – but even in modern four-by-fours, the ascent to the top can be treacherous. The difficulty in reaching the top of the Gilf may be one of the reasons why the *wadis* in the area were so well explored in the early twentieth century. It was during these explorations that perhaps the Desert's best kept secrets were revealed to the modern world. The Cave of the Swimmers is perhaps the best known rock-art site in the Gilf region *(see above)*. However, more recent expeditions have identified other even more amazing sites hidden in the vast network of *wadis* that fringe the Gilf. This rock art clearly shows that while 'the West' was ignorant of this

ABOVE
The cliffs of the Gilf Kebir rising from the desert.

BELOW
The rock art in the Cave of the Swimmers.

BELOW
One of the *wadis* of the Gilf Kebir.

ABOVE
The Mestakawi Cave.

area until recently, the landscape and wildlife of the area has been known intimately for thousands of years by the region's inhabitants *(see above)*.

It is this evidence for ancient habitation in the area that may explain the New Kingdom Egyptians' familiarity with the Western Desert and its resources – such as the silica glass used in the Tutankhamun pectoral. From our modern perspective, we may wonder how the Ancient Egyptians knew of the silica glass fields or of areas such as the Gilf. What motivated them to explore the inhospitable wastes of the Western Desert and how could they have known that there was anything out there worth the effort? It is wrong, however, to view the question in those terms.

Thousands of years ago, the area to the west of the Nile would have been habitable, with savannah and areas of acacia scrub. Across the region, permanent settlements would have been strung out between areas occupied by nomadic hunter/gatherers. As the climate dried out, the nomadic way of life would have become progressively more difficult and the areas in which permanent settlement could be sustained would have become increasingly isolated. As the Western Desert became a more desolate place to live, communities would have been drawn to the Nile Valley, the desert oases or to more favourable areas to the south of Egypt. As the former inhabitants of the Western Desert became subsumed into the populations of the surrounding areas, so too did their folk memories – memories of ancient trading routes such as those that archaeologists have now identified running south-westward from Dakhla, via Abu Ballas (the 'Father of Pots'), the Gilf Kebir and probably into the heart of Africa.

As long as these folk memories remained, the people of north east Africa would have known that the deserts could be crossed and would have known of the routes that could be taken. Although these memories would have dimmed with time, they may have lived on in isolated areas such as the Gilf Kebir, where localised climatic conditions may have sustained settlements until relatively recently. It is these more recent cultures that may have spawned legends of lost civilisations such as that of Zerzura, which was thought to exist deep in the Western Desert. The search for Zerzura was the motivation for some of the Western world's early twentieth century explorations of the region – explorations that provided the inspiration for the novel and film *The English Patient*. In many ways *The English Patient* perpetuates the traditions of this remote area: a work of fiction that has been attached to historical characters and can, therefore, be regarded as a modern legend. Should we regard the ancient legend of Zezura in the same way? Is there any historical basis for these tales of a lost civilisation in the desert? I can't answer that question, but when crossing the Great Sand Sea or standing beneath the looming cliffs of the Gilf Kebir, it is easy to get caught up in the magic of the Western Desert and fantastic tales of lost civilisations.

Colin Reader

Colin is a geologist by profession. In recent years he has become very interested in the geology of Egypt and also in the archaeology of the Old Kingdom in particular. Has guided a number of trips to the deserts of Egypt and his theories regarding the age of the monuments of the Giza plateau, especially the Great Sphinx, have gained wide acceptance among many professional Egyptologists. He is Chairman of the Manchester Ancient Egypt Society, and a regular contributor to AE.

Apart from those otherwise attributed, all photos in this article are the author's.