Tutankh
the extra-terrest

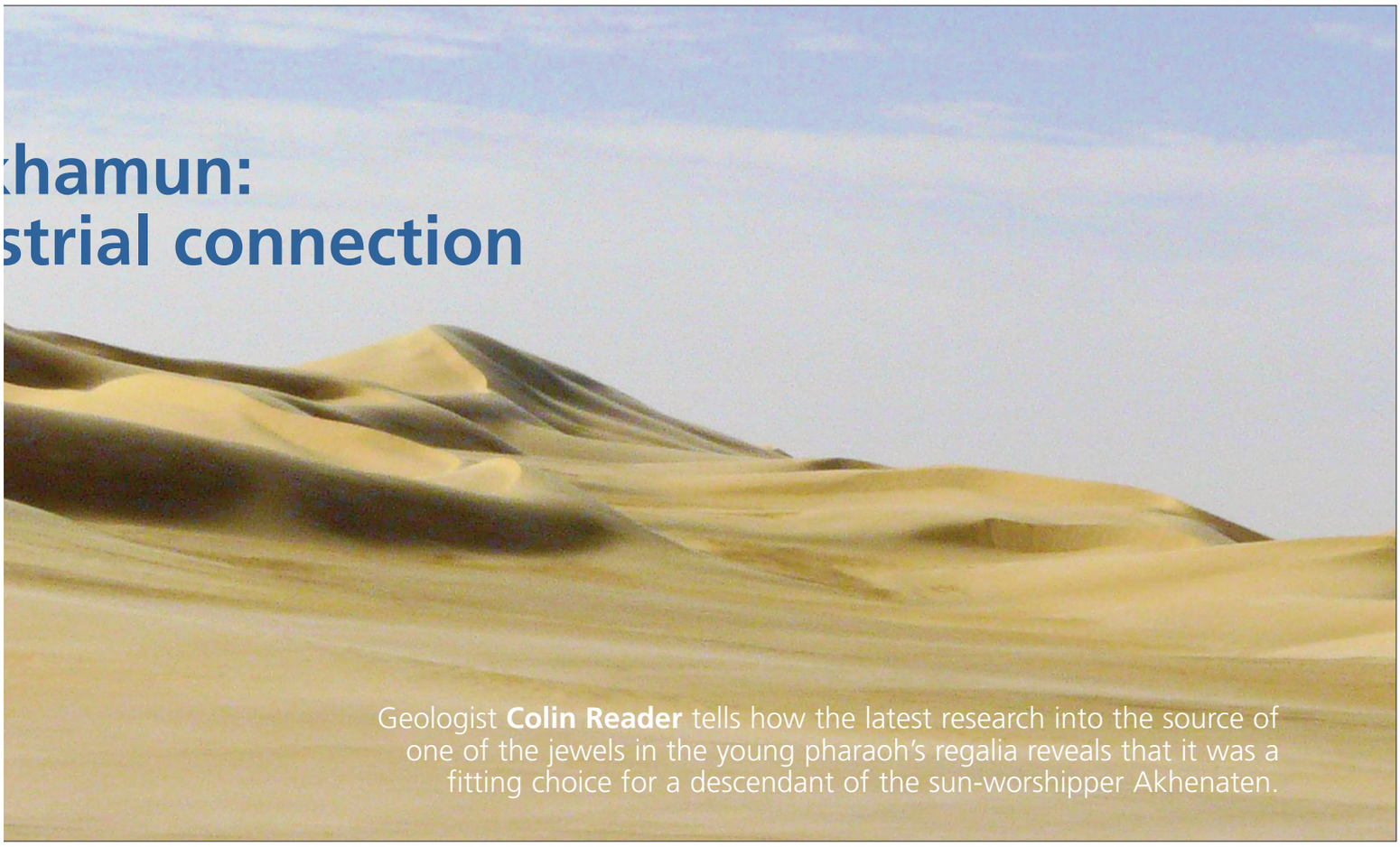
Tutankhamun's Tomb: KV62

The ornate gold and bejewelled pectoral shown on the left was one of the many treasures discovered in 1922 by Howard Carter and his team in Tutankhamun's famous tomb, KV62. Although perhaps not one of the most celebrated pieces from Tutankhamun's trove, it is one of the most interesting and thought-provoking and as explained in this article, can take us to the most unexpected places … .

For many years, the translucent green scarab at the centrepiece of this exceptional piece of gold-working was assumed to be carved from a piece of green chalcedony. Chalcedony is a fairly common semi-precious stone which in other colours and forms, is probably better known as agate. In 1996, however, during a visit to the Egyptian Museum in Cairo, mineralogist Vincenzo de Michelle realised that, rather than a piece of chalcedony, the scarab was carved from a far more exotic material: silica glass.

LEFT: One of the pectorals found in Tutankhamun's tomb, KV62. Its centre-piece, a translucent green scarab, is carved from silica glass.
Photo: RBP

khamun: strial connection



Geologist **Colin Reader** tells how the latest research into the source of one of the jewels in the young pharaoh's regalia reveals that it was a fitting choice for a descendant of the sun-worshipper Akhenaten.

Although the scarab in Tutankhamun's pectoral is the only example of silica glass known to have been used in ancient Egyptian artefacts, this was not the first or indeed the only example known from an Egyptian context. The earliest description of silica glass in Egypt comes from an 1846 expedition to the Western Desert – that vast sand-strewn area west of the Nile that extends to the border with Libya and beyond into the arid wastes of the Sahara *(see above)*.

The mystery is how this apparently unremarkable chunk of silica glass found its way to the Nile Valley in the New Kingdom and why it was so admired by the ancient Egyptians that it was used as a finely-carved centrepiece for a prominent item of royal regalia. Surely, neither the royal court nor the craftsmen of New Kingdom Egypt could have known what this strange material was?

Zerzura

After leaving Luxor in our fleet of desert-ready Landcruisers *(see right)*, it took us

ABOVE, TOP: The Great Sand Sea of Egypt's Western Desert.

RIGHT: *En route* across the Western Desert.

ABOVE
Abu Ballas.

BELOW
The thousand foot-high cliffs of the Gilf Kebir from the south.

nine days to reach the area of the vast Western Desert in which silica glass is found. Admittedly, we had taken the long route, following a great loop which took us south west from Dakhla Oasis, past Abu Ballas *(above)*, to approach the towering cliffs of the Gilf Kebir from their most dramatic aspect: from the south *(below)*. Gilf Kebir translates into English as the 'great barrier', a name that truly befits this huge desert plateau. Towering 300 metres (1000 feet) over the surrounding desert, the resilient strata of the Gilf lie close to Egypt's border with Libya and cover an area about the size of Switzerland. Revealed to the Western world during the deep-desert explorations of the Egyptian Geological Survey in 1932 and perhaps best-known from the fictional work, *English Patient*, the Gilf Kebir is steeped in mystery.

One of the objectives of the Egyptian Geological Survey's expedition was to seek out evidence for the legendary lost civilisation of Zerzura. The idea of a civilisation inhabiting the desert may seem a little odd, but the climate of North-East Africa has been in constant flux. As recently as ten thousand years ago, the area of the Western Desert was more savannah-like and, as the area became increasingly arid, its inhabitants are likely to have sought out upland areas such as the Gilf as refuges from the spreading desert.

Although there is nothing to link them positively with Zerzura, judging by the themes depicted in their rock art the people of the Gilf do not appear to have been an impoverished group of settlers living at the limits of survival. Although I may be taking the depictions far too literally, rock-art from sites such as the Cave of the Swimmers and Mestekawi Cave suggest that the inhabitants of the Gilf were farmers, had access to game for hunting and had time for leisure activities: most famously swimming *(see opposite)*. The starkly differing body shapes of the people represented by this rock art *(see p. 38)*, may also suggest that the Gilf had been a place where cultures from across Africa met, perhaps to trade.

In recent years, a new scientific discipline of desert road archaeology has identified a network of trading routes crossing what has hitherto been regard-

ROCK ART
FROM THE GILF KEBIR

ABOVE LEFT
Polychrome cattle (from Cave of the Swimmers).

ABOVE RIGHT
Antelope (from Mestekawi Cave).

LEFT
And, of course, swimmers (Cave of the Swimmers).

DIFFERENT BODY SHAPES DEPICTED IN ROCK ART FROM THE GILF KEBIR

ABOVE LEFT
A slender couple from the Cave of the Swimmers.

ABOVE RIGHT
A muscular group from Mestekawi Cave.

RIGHT
A very broad-shouldered group from Mestekawi Cave.

ed as unpassable desert. One of the most significant routes yet identified left Dakhla Oasis, travelling southwest past Abu Ballas, just as we had done on our desert adventure *(p. 36, top)*. Rather than just serve as a distant landmark used to fix a course across the otherwise featureless desert, prominent hills like Abu Ballas also served as way-stations: sites manned perhaps seasonally and stocked with provisions to allow the long-distance trading caravans to take on fresh food and water and even take on fresh animals before venturing out once more into the desert wastes. Beyond Abu Ballas, these trade routes appear to have circled the Gilf and the mountainous region of Gebel Uweinat further to the South-west, before heading either into Libya or through Chad and into Africa's heartland.

Given our current understanding, it seems that these desert trading expeditions were not a constant feature of pharaonic Egypt. The discovery of a cartouche of the Fourth Dynasty pharaoh Djedefra at one way-station site, however, indicates that these desert trading expeditions had been established at a very early stage in the pharaonic period.

The Great Sand Sea

The constantly shifting dunes of the Great Sand Sea *(see pp.34-35, top and opposite, top)* run north-south for hundreds of kilometres and are so large that they are slowly burying the northern part of the Gilf. Within a relatively small area of this vast hyper-arid region, gravel-sized specimens of silica glass can be found lying on the desert floor between the towering dunes *(see opposite, bottom)*.

Given the inclusion of a piece of silica glass in Tutankhamun's funerary treasures, it is clear that, at some point prior to the Eighteenth Dynasty, at least one crossing of the Great Sand Sea had been completed by the pharaonic Egyptians. Although no desert trading routes are known from this area, any that had been established may now be lost beneath the constantly shifting sands. But rather than be so prosaic, it is far more interesting to speculate whether silica glass was included as the centrepiece of Tutankhamun's pectoral because it celebrated the survival of an important royal trading expedition that got lost in the Western Desert. Against all the odds, perhaps this expedition managed to survive a crossing of the Great Sand Sea, bringing pieces of the unusual stone that they encountered during their perilous journey. We may never know the reality of the situation, but I

think it is safe to say that neither the boy-king, his courtiers nor his jewellers fully understood the remarkable origins of this strange translucent material.

Impact

From a global perspective, silica glass is not unusual. The material is known from a number of sites across our planet and generally forms as a result of meteorite impacts. These high energy collisions rapidly melt the exposed soils and rocks and as the molten ejecta travels through the air, it cools to form lumps of natural glass. Natural glass formed in this way is rich in silica, one of the Earth's most abundant minerals. One of the unusual features of Egyptian Silica Glass, however, is that it is extremely rich in silica, unusually so, with concentrations generally greater than 96%.

Given its origins, silica glass is most often associated with an impact feature – usually a crater – and it is here that the mysteries associated with the Egyptian Silica Glass deepen. Despite radar mapping of huge swathes of the Western Desert and Libya, undertaken during a number of Space Shuttle missions, no suitable impact crater has yet been identified. It may be possible, however, to explain this lack of an impact feature by considering the geological history of the Western Desert.

One of the few things that the geologists who have studied Egyptian Silica Glass can agree on is its age. Detailed laboratory analysis has established that the material formed about twenty-nine million years ago, at a time when the Western Desert was very different from today. Deposits of petrified wood in rocks dated to some thirty-six million years ago have long been taken as an indicator of a great northward-flowing river system – dubbed the Gilf River – that once drained a fertile landscape that is now the Western Desert. About ten million years ago, the Earth's climate experienced great natural changes which saw the end of the Gilf River and ultimately led to the evolution of the River Nile. As the climate dried out and the dominant winds changed, the vast quantity of sand that the Gilf River system had eroded from the landscape and carried out to sea was blown back onto the land. Not only did this huge volume of sand completely bury the valleys of the Gilf River, it also formed the massive dune systems of the Great Sand Sea. With the demise of the Gilf River occurring between thirty-six million and ten million years ago, it is possible that the evidence for a meteorite impact that occurred twenty-nine million years ago is lost deep beneath these sands. But this explanation may be far too simplistic.

Other than the age of the silica glass and its high silica content, the scientists who have studied this material seem to agree on very little. One author has suggested that the smoothly polished nature of Egyptian Silica Glass indicates that it has been transported by flowing water, a theory which may be consistent with the existence of the Gilf River. Transport by water may also explain the work of another researcher who has analysed the

ABOVE
Towering dunes in the Great Sand Sea.

BELOW
A fragment of silica glass *in situ*.

4% or so of the silica glass that isn't silica and has concluded that the elements that make up this minor fraction are more typical of ancient igneous rocks rather than the geologically more recent sedimentary sandstones and limestones that cover the area of what is now the Western Desert. Outcrops of ancient igneous rocks are limited in Egypt, occurring at places like Aswan and extending to the west as a chain of isolated exposures across the Western Desert. The presence of minor components more typical of igneous rocks in Egyptian Silica Glass may indicate an impact in areas of exposed igneous strata but could also indicate an impact in an area where the soils had been formed from the erosion of igneous rocks. Given that the Gilf River system will have aggressively eroded the landscape through which it flowed, this once more brings us back to the idea that the Gilf River may have played a significant role in the history of Egyptian Silica Glass.

Comet

There may be another explanation for the absence of an impact crater in the Western Desert, however. An unusual fragment of black stone was discovered by geologist Aly Barakat in 1996 in the Egyptian Silica Glass fields. Detailed analysis of this stone suggests that it might be something very rare indeed – possibly the first significant fragment of a comet ever found on Earth.

Not only does the black material found by Barakat have ratios of oxygen and carbon that are not generally found in terrestrial rocks, the gases trapped within the specimen were present in ratios that are not only quite unearthly but don't resemble those found in conventional meteorites, reinforcing the possible cometary origin of this material.

Another key finding of the analytical work that has been undertaken is the presence of small pieces of diamond in Barakat's specimen, which, it is assumed, formed under the high pressure of a shock event – either an impact or possibly the air-burst explosion of a comet as it struck the Earth's atmosphere. A similar cometary air-burst is thought to explain the Tunguska explosion of 1908:

(see https://en.wikipedia.org/wiki/Tunguska_event).

The immense energy released from such an explosion would readily explain the formation of the Egyptian silica glass without the need for an accompanying impact crater.

Further analysis on samples of Barakat's specimen (since its discovery, the material has become known as 'Hypatia') were reported in 2018. A wide variety of analyses were undertaken and have identified similarities with dust collected from a comet by NASA's Stardust mission. This and other evidence has led the authors to suggest that the origins of Hypatia may lie outside our Solar System or may be linked with the actual formation of the Solar System. As such, Hypatia can possibly be associated with the formation of the Sun itself.

In drawing their conclusions, the authors of the 2018 research (see Further Reading) state that, although further work is required, when taking all the evidence together the most likely explanation for the characteristics of Hypatia are that Barakat's specimen is the remains of a comet which, some twenty-nine million years ago, entered the Earth's atmosphere and exploded in a huge air-burst over what is now Egypt's Great Sand Sea. Small fragments of the core of the comet survived as Hypatia, but the energy associated with the airburst was sufficient to melt the surface soils, with the molten ejecta solidifying into silica glass.

A Controversy that is Not Settled

Before closing, I should note that the links between Hypatia and Egyptian Silica Glass described above have yet to be proven. As one researcher put it:

> "There is no connection between the diamond-bearing rock fragment [Hypatia] and the LDG [Libyan Desert Glass, as Egyptian Silica Glass is commonly referred to] except that they occur in the same region."

There is, however, the contrary view of other researchers:

> "You have Libyan Desert Glass … and you have a piece which is basically a shocked fragment of cometary core in the same area, so you start putting two and two together."

When the decision was taken to include a piece of silica glass in Tutankhamun's bejewelled golden pectoral, the courtiers of the Eighteenth Dynasty could not have known of the origins of Egyptian Silica Glass or its likely links with Hypatia – a material which is possibly older than the Sun. In the immediate post-Amarna age, when the Sun-god was at the centre of Egyptian theology, it is strange to think that a bizarre green stone found perhaps under traumatic conditions by a royal expedition lost in the Great Sand Sea should become a centrepiece for an important piece of royal regalia. If only they had known what a fitting choice that was … .

Colin Reader

Colin is a Fellow of the Geological Society of London and a Chartered Geologist with more than twenty five years' professional experience in the application of geology, geomorphology and hydrology to construction. A regular contributor to AE Magazine (most recently in articles about the ancient landscape of Saqqara in AE105 and 106), he was first attracted to ancient Egypt by the controversy over the age of the Great Sphinx at Giza and what the weathering and erosion of that monument could tell us about its age. He went on to research the geology of Egypt in broader terms, particularly the way the Egyptian landmass evolved.

Further Reading

Sampsell, Bonnie M. *A Traveller's Guide to the Geology of Egypt* – a general exploration of the geology of Egypt.

Förster, Frank and Riemer, Heiko (eds.) (2013) "Desert Road Archaeology" in *Africa Praehistorica 27* – an edited volume of research papers on desert road archaeology.

Belyanin, Georgy A. *et al.*(2018) "Petrography of the carbonaceous, diamond-bearing stone 'Hypatia' from southwest Egypt: A contribution to the debate on its origin." in *Geochimica et Cosmochimica* Acta 223, 462 to 492 – the latest technical summary of the composition and origin of Hypatia.

All photos by the author unless otherwise stated.