Over the last century, palaeontologists have found many fragments of spider webs in amber, which is fossilized tree gum. The webs (or small fragments of them) get incorporated into exuding tree gum, which flows over them and preserves them so perfectly that arachnologists (people who study spiders) can often tell what family of spiders made the web and even what part of the web is preserved—for example, signal threads or web fibres with sticky globules of silk for trapping insects. Amber containing fossil spider web is known from Europe, the Middle East, and the Caribbean, the oldest specimens being from the Cretaceous period, some 100 million years old.

Until recently, amber was the only known source of information about fossil spider webs, and it was generally thought to be the only means for preserving such fragile structures. But discoveries in the Namib Desert have radically changed our thinking and opened up a new field of research.

A mystery solved
The Namibia Palaeontology Expedition started surveying the fossil sand dunes (aeolianites) of the Namib Desert in 1992 and discovered many fossil bird eggs and reptile and mammal bones and teeth, as well as a bewildering variety of trace fossils made by small animals, such as beetles and rodents, that burrowed through the sand when it was loose. The expedition also found fossilized termite mounds, petrified beetle cocoons, and even some mineralised wood lice, preserved in calcite (CaCO₃). But most extraordinary of all was finding small white dome-shaped structures with lobed margins about 2 cm across, similar in shape to clover leaves. Each of these structures is preserved as a layer of calcite about 2 mm thick cemented onto a nodule of hardened sand.

For several years we didn’t know what these structures were, till I observed some peculiar traces in the sand near the Tsondab River in the Namib-Naukluft Park. These looked superficially like antelope spoor but did not occur in trails; they were scattered randomly over the surface of the sand. Excavation of one of them revealed a mat of thick spider web with a vertical tube-shaped burrow beneath, and the literature soon revealed that it was made by the buck spoor spider (Seothyra). The similarity of these Seothyra roof mats and the calcite domes was immediately apparent.

How a web becomes fossilized
The structure of the Soothyra tube and roof web is extremely fragile. A strong wind, for example, can easily destroy it by blowing away the sand, or a passing gemsbok or hyena could step on it and ruin it. After hatching, baby Soothyra eat...
their mother, and they consume the roof web as well because it is a rich source of protein. So physical destruction is probably the fate of more than 99.9% of the webs ever built.

Now and then, one will be buried by wind-blow sand and protected from such damage. Even then, its chances of survival are infinitesimally small - the web can rot and fossils, of which there are many in the Namib, can eat it or damage it by their burrowing activities.

Very occasionally, however, the sand surrounding the web becomes moist (perhaps after rain, or due to fog precipitation or to a rise in groundwater level), which improves its chances of being preserved. The moisture can dissolve calcium carbonate from surrounding sand, which can then diffuse into the spider web. The pore spaces in the surrounding sand are too large for them to act as diffusion traps, but the pore spaces in spider webs are of suitable dimensions for such chemical processes to occur. With sufficient diffusion of molecules of calcium carbonate into the web structure, the entire web can be replaced by calcite - the web is fossilized.

Millions of years later, wind may erode the surrounding sand to uncover such fossils, exposing them to physical damage. But once in a while a passing palaeontologist may notice a small white gleaming dome-shaped structure with lobed margins, may bend down to pick it up, and may even wonder what it is before throwing it away. Or he may keep it, and embark on a lengthy search to interpret how it formed, how old it is, and what it means.

**What the fossils reveal**

Seothyra currently occurs widely in southern Africa in areas where there is loose sand or gravelly soil that is dry most of the year. In the Namib Desert, the spiders survive at the thermal limit. Exposed to the heat of the desert day for a few minutes they die, but waiting safely in the bottom of their burrows, where the temperature is much lower than at the surface, they are safe. If a passing ant gets caught in the trap on the surface, it vibrates the signal thread alerting the spider at the bottom of the burrow that its next meal is trying to get away. By analysing the vibrations in the signal threads, the spider can tell which of the lobes to lift so as to capture its prey. Each time it lifts a lobe, it disturbs the sand that covers the appropriate marginal lobe, captures its prey, carries it down to the bottom of its tunnel, and eats it at leisure. The discovery at Rooiplepel of 16-million-year-old fossil webs that look extremely similar to those of extant Seothyra reveals that buck spoor spiders quickly adapted to the sandy desert conditions that became established in the Namib at that time.

Many plants and animals were affected by the climatic changes from savanna to desert. Savanna species went extinct locally or they adapted, evolving into new forms. The burrowing spiders, because of their subterranean behaviour, were partially buffered from the full harshness of the desert environment and had a head start on many inhabitants of the region. The fossilized Seothyra roof webs preserved in the fossil dunes of the Namib elegantly attest to the rapid adaptation of this family of spiders to the extreme conditions in the region for the past 17 million years. They also provide the only known evidence of the existence of these spiders in the fossil record: no body fossils of Seothyra have ever been found.

Other trace fossils that occur in dizzying quantities and innumerable varieties in the Namib aeolianites will yield precious information about the evolution of the Namib fauna and flora and the climatic conditions at various stages in the desert’s history. Fossilized >>
Climate change in the Namib

Before the Middle Miocene period (some 16–17 million years ago): the Namib was a savanna area, with grassland, trees, and various vertebrates (e.g. primitive antelopes, ostriches, crocodiles, and daddies).

At the end of the Early Miocene: the Antarctic Ice Cap expanded to continental scale, causing global climatic changes. The cold climatic belts increased in area, and the subtropical and tropical ones were squeezed northwards towards the equator. The Southern Namib changed from savanna to steppe, and winter rainfall replaced the summer rainfall of the Early Miocene.

From steppe to hyper-arid desert: The new configuration of the world’s climatic belts led to the formation of the South Atlantic anticyclone as we know it today; the dune building in the indurated sands of the Namib show consistent southerly wind directions from 17 million years ago to today and, in that time, vast volumes of glacial melt water have been shed into the oceans surrounding the Antarctic continent.

Being fresh and cold (therefore denser than seawater), melt water sinks to the ocean depths and flows away from the continent. The rotation of the globe ensures that the cold bottom water drifts northeastwards, where it eventually encounters the continental shelves on the west side of continents (South America, southwest Africa, and western Australia). Here the water is forced upwards by a combination of two factors: the upward slope of the continental shelf and the offshore winds related to the South Atlantic anticyclone that blow surface waters away from the shore towards the open ocean. Water wells upwards from the depths to fill the place left by the departing surface water: these upwelling cells of cold water intensify the arid conditions along the southwestern coast of Africa, turning the Namib from semi-arid steppe into hyper-arid desert.

Red’s a winner

The colour red in certain animal, fish, and bird species is a sexually selected sign of male quality, and attaching artificial red stimuli experimentally can increase the male’s dominance. Now scientists show that the colour red can improve human performance across a range of competitive sports.

In the 2004 Olympic Games, contestants in four combat sports (boxing, tae kwon do, Greco-Roman wrestling, and freestyle wrestling) were randomly assigned red or blue outfits (or body protectors). For all four competitions, contestants wearing red consistently won more fights. Across rounds in each competition, 16 of 21 rounds had more red than blue winners, with only four rounds having more blue winners; across weight classes in each sport, 19 of 29 classes had more red winners, with only six having more blue winners. The statistically significant advantage apparently extends to team sports. In the Euro 2004 international soccer tournament, teams wore shirts of different colours in different matches. The results of five teams were analysed, and each did better when they wore predominantly red shirts and played against opponents in colours other than blue (four played their other matches in white, one in blue). Given differences of skill and strength among contestants, the advantage of wearing the colour red is greatest where the contestants are evenly matched. But maybe it’s worth regulating the colour of sportswear, to ensure level playing fields in sport?

A drink a day (but no more)

A single drink a day can protect older women against mental decline, say two new studies. US researchers followed alcohol consumption among more than 11 000 women enrolled in one of the largest investigations into the risk factors for major chronic illnesses in women. Over six years, starting in 1995, they assessed the mental status of women 70 and older, using tests of memory, verbal fluency, and general mental skills. Women who consumed one drink a day (up to 15 grams of alcohol) had significantly better test results, scoring about a year and a half younger than the nondrinkers or than those who drank 15–30 grams a day. Another study, using different tests of mental ability, reported similar results in a group of 4 460 women.

Such benefits could be connected to the significantly lower rates of cardiovascular disease among moderate drinkers. Also, alcohol appears to raise levels of HDL (so-called ‘good’) cholesterol and to reduce levels of certain blood clotting agents, perhaps helping to prevent heart attacks and the small, subclinical strokes that cause vascular damage in the brain and lead to mental deterioration.

More studies are needed, however, before nondrinkers should be encouraged to start drinking alcohol, say doctors, and everyone without fail needs to guard against alcohol abuse.