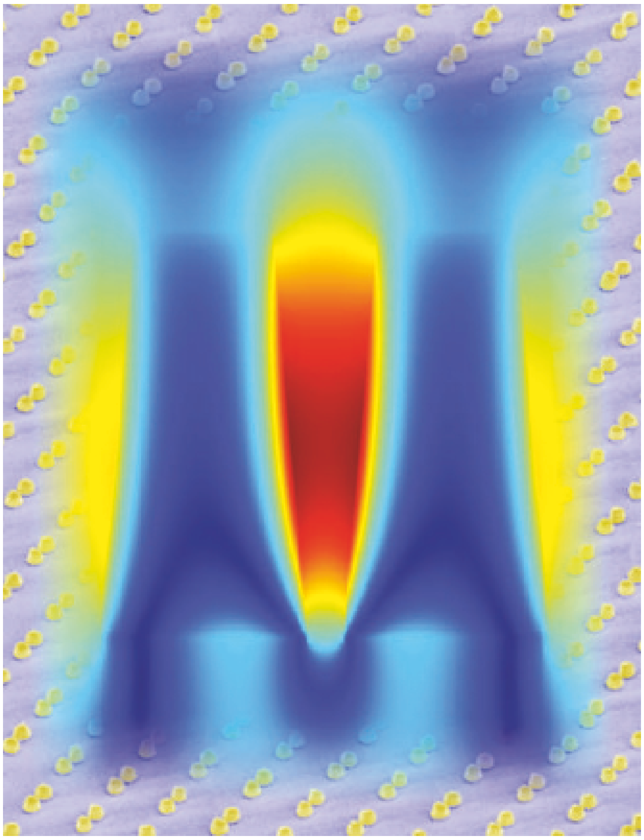

Figure 2 | The negative consequences of magnetism. The distribution of the magnetic field excited by light around a pair of gold nanoposts in Grigorenko and colleagues' study[1]. The suppression of the magnetic field by the action of the bar magnets that leads to the structure's negative permeability is shown by the areas coloured in blue. The image is superimposed on a micrograph of an ensemble of nanopost pairs. (Courtesy of A. Grigorenko and colleagues.)

cancel the electric field. This leads to the gold structure having negative permeability.

Were it not for the rather large imaginary contribution to their material's permeability, Grigorenko and colleagues would already have found the way to negative refraction. Although their achievement stops short of this, they were able, by matching the impedance (defined as the ratio ϵ/μ) of their patterned gold to that of an adjacent dielectric, to stop it reflecting. This is in itself a significant step towards a perfect lens, and other novel optical components for visible frequencies.

Further hurdles remain to be overcome. Reducing the imaginary contribution to the optical permeability will be no trivial task. It is also not obvious how structures such as those developed by Grigorenko and colleagues[1] might be made three-dimensional. Nevertheless, it seems that what nanopatterned gold is losing in glister, it is gaining in transparency. ■

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PALAEONTOLOGY

Data on a plate

The weird fossil pictured here is a specimen of *Ceratocystis* — a member of an ancient group of animals, the Stylophora, that lived roughly 500 million to 300 million years ago. Stylophorans, which were just centimetres in length, bear little resemblance to any extant animal and have defied categorization for decades.

Sébastien Clausen and Andrew B. Smith, in a report elsewhere in this issue (*Nature* **438**, 351–354; 2005), claim to have broken the deadlock. They have identified a single feature which, they argue, rules out two of three hypotheses about the biology of stylophorans. Figure 1 of their paper (page 351) offers a quick guide to the hypotheses under test.

The body of *Ceratocystis* is divided into a large, irregular-plated blob at one end; a long, thin, segmented section at the other (apparently constructed as a column of discs); and a connecting region that looks like bellows run over by a lawnmower. The only feature on which all authorities agree concerns the various plates: they look exactly like the calcitic plates of echinoderms, a large group of marine organisms that today includes starfishes, sea urchins and the like.

This assignment has given rise to the three hypotheses. The most enduring is that the long segmented section and the connecting region comprise a mobile stem. Many fossil echinoderms, and some extant ones — the crinoids — have similar appendages. According to this view, stylophorans are very primitive echinoderms that evolved before the appearance of other echinoderm features, such as the distinctive water-vascular system manifested as arrays of canals ending in avenues of 'tube-feet'.

In one of the alternative hypotheses, stylophorans are held to be highly evolved echinoderms in which the stalk is a feeding arm, with a mouth somewhere in the middle linked to tube-feet that are covered by retractable plates. In the other hypothesis, they are interpreted as primitive chordates that retain a calcite skeleton from a more remote common ancestor of echinoderms and chordates, and the stalk contains muscle blocks, a notochord and a brain.

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Clausen and Smith tackle the job of inferring the soft parts of *Ceratocystis* by studying the microstructure of the calcite plates. The mid-stalk region of the creature bears one large ossicle known as the stylocone, and the surface structure of the calcite (replaced by iron oxides in the specimens studied) has textures that, by analogy with modern echinoderms, give an indication of the kind of tissue to which the stylocone was adjacent in life.

It seems that the part of the stylocone adjoining the long segmented section faced connective tissue, as is now seen in modern stalked echinoderms such as crinoids. In contrast, the part of the stylocone next to the bellows region shows a surface similar to those that in echinoderms act as attachment sites for muscle. There are no signs of anything like a mouth or tube-feet as implied by the feeding-arm model, and the plates in the stalk do not seem to have been hinged to allow exposure of tube-feet. The chordate hypothesis is also ruled out, as the muscle would have inserted directly into the calcite, rather than being bound up in discrete, chordate-style muscle blocks.

The conclusion, then, is that *Ceratocystis* used its appendage as a muscular, locomotory organ. So its anatomy (and its evolutionary position) conforms to the oldest and least demanding of the three hypotheses.

Henry Gee