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Limpet teeth bared as nature's strongest material

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Spiders' webs are often said to be tougher than steel but the strongest biological material yet discovered is, in fact, the teeth of limpets, which could be used to build the cars, boats and planes of the future, according to new research.

Details of a series of experiments, published in the Royal Society journal *Interface* today, reveal how limpet teeth are the strongest biological material on record, surpassing spider silk and comparable to the strongest man-made fibres such as carbon. The

teeth of the common limpet, which is found in seas surrounding Britain and across western Europe, "need to be mechanically robust to avoid catastrophic failure when rasping over rock surfaces during feeding", according to researchers from the University of Portsmouth, Queen Mary University London and the University of Trento, Italy.

They were subjected to a battery of tests involving special machinery to see how much stress could be applied before they broke.

The teeth were so hard that a diamond saw had to be used

to slice them into tiny pieces, which were then reduced further by being bombarded with atoms from an ion beam.

The widths of the resulting samples were 100 times smaller than the diameter of a human hair. But the natural properties of limpet teeth, containing a material known as goethite that forms in the

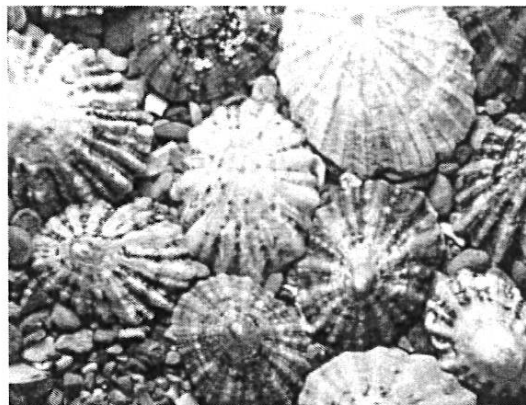
limpet as it grows, were found to be the same irrespective of how small the samples were.

The study concluded: "The tensile strength of limpet teeth can reach values significantly higher than spider silk, currently considered the strongest biological material, only

comparable to the strongest commercial carbon fibres."

Scientists believe the structure could be reproduced in engineering racing cars and boat hulls.

Professor Asa Barber, who led the study, said: "Limpet-tooth strength is comparable to the fibres used in bullet-proof vests and the carbon fibres commonly used in composites for aerospace structures and Formula 1 cars. The limpet makes something in a biological process that performs as well as man-made materials that are not recyclable and use harmful chemicals."



Limpet teeth are as tough as man-made carbon fibre **FOTORESEARCH**