group[11] found previously that the channel TRPN1 is likely to mediate mechanotransduction in zebrafish. This channel has 29 so-called ankyrin repeats, which form a thin helical structure (Fig. 2c) that has been suggested to be elastic (V. Bennett, personal communication) and to serve as a gating spring[12]. Indeed, our simulations of ankyrin have demonstrated the appropriate stiffness and elongation.

So perhaps each tip link, now identified[1,2] as containing cadherin 23, is more like a stiff cable than an elastic spring. And perhaps each transduction channel carries its own spring, in the form of numerous ankyrin repeats. If so, the textbook figures must be redrawn, and more questions answered. What is the relevant channel in vertebrates other than zebrafish, many of which lack TRPN1? Could another member of this channel family be connected to a separate ankyrin spring in mammals? How are these proteins attached to each other, and how might other Usher-associated genes be involved? And what does this marvellous machinery do in photoreceptors of the eye, which express many of these proteins but have no obvious use for mechanotransduction? ■

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Meteoritics

Stars in stones

Sara Russell

Silicate minerals that predate the Solar System have been detected inside primitive stony meteorites. Isotopic analysis suggests that the silicates probably condensed around dying ancient stars.

Meteorites that date from around the time of the formation of the Solar System — a little over four and a half billion years ago — are testament to the events that occurred before and during planet formation. Most of the interstellar dust that went into forming planetary precursors was melted, vaporized, shocked and, once incorporated into asteroids, further heated and damaged. This has caused the chemistry and isotopic composition of minerals from meteorites to become more homogeneous. But a few mineral survivors predate these events. These presolar grains originated around stars that were the predecessors of our own, and made up part of the interstellar medium before collapsing into our Solar System. Several carbonaceous and oxide presolar grains have been identified in meteorite samples. Nagashima *et al.*[1] have now uncovered presolar specimens of silicates, the most common rock-forming minerals (page 921 of this issue).

This discovery is impressive, because presolar silicates are much more difficult to find than presolar carbonaceous and oxide grains. The latter are resistant to acid and can be separated out of a meteorite by dissolving away the major components — silicates and metal. The solid residue that survives can then be examined for grains of interest. This technique has been compared (by Edward Anders) to burning down a haystack to find the needle, and is more than a little distressing for meteorite curators. Nevertheless, it is a relatively straightforward way for researchers to find presolar gems.

The presolar grains identified so far are all chemically resilient enough to have survived this acid processing: silicon carbide, graphite, aluminium oxide and spinel, at levels of up to a few parts per million. Diamonds, which make up to 0.1% of some meteorites, might also be presolar, but their carbon-isotope composition and variable relative abundance in ancient objects has raised some doubt about this[2]. Because these gems condensed around ancient stars, they offer unique insight into how stars synthesize isotopes, how easily different parts of the star mix together and how grains condense in the relatively cool circumstellar region. They also provide a snapshot of the interstellar medium several billion years ago, so we can judge how the composition of our Galaxy has evolved since before the Sun came into existence.

As well as studying presolar grains in

100 YEARS AGO

To the April number of the *Independent Review* Dr. A. R. Wallace contributes the first part of an article on "The Birds of Paradise in the Arabian Nights." In the introductory paragraphs the author states that he is generally disposed to believe in the truth of the popular legends connected with natural history, the assertion that vipers swallow their young being a case in point. Accordingly he is predisposed to look with favour on the theory that the "Islands of Wak-Wak" mentioned in the "Arabian Nights" are really the Aru Islands, and that they take their name from "wawk-wawk," the cry of the great bird-of-paradise. The portion of the article contained in the issue before us deals only with the identification of the locality to which "the bride with the feather-dress" was brought with the south-eastern lower slopes of the Elburz Mountains. We shall await with interest Dr. Wallace's proofs that "Hasan" actually visited the home of the birds-of-paradise.
From *Nature* 28 April 1904.

50 YEARS AGO

A very important group of higher Primates has been discovered in Africa, the Australopithecinae. They include *Australopithecus*, *Plesianthropus* and *Paranthropus* from South and most probably "*Meganthropus africanus*" from East Africa. The position of *Telanthropus* from the *Plesianthropus*-layers of Swartkrans is still under dispute. The large amount of data now at hand leaves no doubt that the Australopithecinae are members of the Hominidae… The reduction of the dentition only affects the face; their increase in brain capacity is slight and depends upon the absolute size of the species; the possession of a sagittal crest in the large specimen parallels the development of the same structure in the anthropoids. It seems that towards the end of the Pliocene period the early Hominidae were separated into several branches — Australopithecinae in Africa, *Gigantopithecus* (and undescribed forms) in China, Pithecanthropi in Asia — and that only one of them, the Pithecanthropi, by a harmonious reduction of the whole dentition and — this is the most important point — by an exaggerated and accelerated increase of the brain capacity, gave rise to the Hominidae, of which group we are the most human members. G. H. R. von Koenigswald
From *Nature* 1 May 1954.

Zoology

Nose of moose

K. WARD/CORBIS

The distinctive size and shape of the moose's nose are a godsend for cartoonists. But to biologists this nose is no joke. Hence the investigations undertaken by Andrew B. Clifford and Lawrence M. Witmer (*J. Zool.* **262,** 339–360; 2004), "With a mind on the enigmatic function of the nose of moose".

The moose, *Alces alces*, is a member of the deer family, but its nasal apparatus is unlike that of any of its relatives. The apparatus overhangs the mouth, and the nostrils are large and laterally sited, as seen in this picture. The muzzle contains a long and complex nasal cavity, with a highly complicated muscle and cartilage system.

Using a variety of techniques, Clifford and Witmer undertook detailed anatomical studies of heads of moose that had been killed after being hit by vehicles, and of related species. Among the adaptive explanations they look at are that the nasal set-up enhances blood and brain cooling when escaping from predators, or that its mobile or tactile features improve the efficiency of feeding.

The authors' best bet, however, is that the curious design of the moose muzzle centres on the nostrils, and is primarily so that the nostrils can be closed when feeding under water. But, as they say, that conclusion is not watertight, and a further explanation — the ability to derive directional information from smell — remains plausible. **Tim Lincoln**

meteorites, we have recently learnt a lot about mineral grains in space by characterizing them remotely. For example, one of the most surprising findings of the Infrared Space Observatory mission was the great variety of types of star around which fine-grained silicates crystallize. It thus seemed certain that the young Solar System would also have contained interstellar silicate dust, as well as the other known grains, and there should be silicates from a variety of stellar environments in our meteorite collections.

Silicates make up the bulk of chondritic meteorites, however, so searching for the presolar variety requires a more subtle approach than for carbonaceous and oxide grains — akin to inspecting the haystack straw by straw. It requires both admirable patience and an ingenious analytical technique. Nagashima's group has developed a micro-imaging technique[3] that uses an ion microscope to detect different isotopes (such as those of oxygen — ^{16}O, ^{17}O and ^{18}O). In the images produced, any region of the meteorite that does not match isotopically the overall composition of the meteorite — and hence might be presolar in origin — shows up as a 'hotspot'. Nagashima *et al.*[1] have found hotspots *in situ* in the meteorites Acfer 094 and NWA 530: one micrometre-sized presolar grain made of the silicate olivine, plus five clusters of very fine-grained silicate that contain at least one presolar component.

This technique is remarkable in that it has managed to compete with the new-generation ion probe, the 'NanoSIMS', developed specifically for isotope-mapping over very small areas and hence perfect for the interstellar silicate search. In a parallel study, Nguyen and Zinner[4] have also reported presolar silicates in a sample of Acfer 094, captured in exquisite detail in NanoSIMS images. But these authors worked with a disaggregated sample of the meteorite: Nagashima and colleagues' detection has the advantage of being an *in situ* measurement.

The presolar silicates identified by Nagashima *et al.*[1] have a higher ratio of the oxygen isotope ^{17}O relative to the two other stable isotopes of oxygen, ^{16}O and ^{18}O, than does the bulk of the material in the Solar System. The silicon isotope composition of the grains is, however, close to normal. These nuclides formed inside stars and their isotopic abundances reflect the composition of the star, its size and its evolutionary stage; the grains that eventually took up these isotopes effectively bear a fingerprint that identifies the kind of star in which they evolved. The isotopic make-up of the presolar silicates suggests that they formed around red giants[1] — stars nearing the end of their lifetime and losing mass into space.

Nagashima *et al.* put the abundance of presolar silicates at between 3 and 30 parts per million, making them perhaps the most abundant type of presolar grain known (with the possible exception of diamonds). This abundance is very high for meteoritic presolar material, but it is about 100 times lower than that of the presolar silicates detected in interplanetary dust particles collected in the stratosphere[5]. The reason for the substantial difference in these values might be that the meteorites studied here originated in asteroids in the inner Solar System, whereas at least some interplanetary dust particles come from comets, which originate much farther from the Sun. Dust from the asteroidal regions might have experienced higher temperatures, at least intermittently, than dust farther out; or the presolar cloud might have been heterogeneous. Other presolar grains such as silicon carbide do not seem to be so depleted in meteorites, compared with their abundance in dust particles.

A comparative study of different meteorites should provide insight into how presolar grains were mixed and processed as the Solar System formed, and perhaps into the thermal profile of the early Solar System. If more silicate grains can be found, they should also help to answer the question of whether the inner Solar System once hosted presolar silicates that had formed in different astronomical environments. ■

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Palaeoanthropology

Neanderthal teeth lined up

Jay Kelley

A huge amount of biological information is preserved in the growth records of teeth. Tapping into those records provides a tantalizing look at how quickly Neanderthals grew up and reached maturity.

It is nearly 150 years since the existence of Neanderthals was first recognized, but debate about their relationship to modern humans remains as contentious as ever. Were they supplanted by modern humans or subsumed through interbreeding[1–4]? Information on Neanderthal growth[5], as well as genetic data[6,7], have recently been added to traditional studies of morphology in attempts to discern if we carry in ourselves any heritage of these immediate predecessors of modern humans in Europe. On page 936 of this issue[8], Ramirez Rozzi and Bermudez de Castro describe additional data on Neanderthal development that bear on their relationship not only to *Homo sapiens*, but to earlier European hominids as well.