T. L. DAULTON/MATS SCI. DIV., ARGONNE NATL LAB.

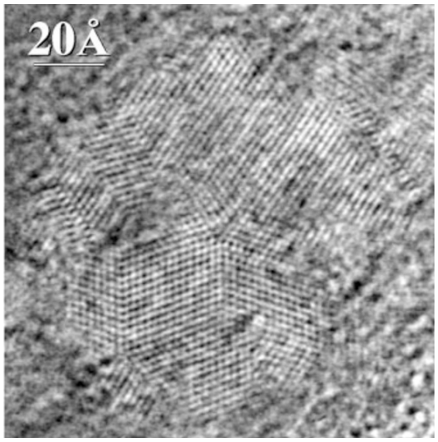

Figure 1 **A diamond of about 10^{-17} carats. It is older than the Solar System, and may have condensed in the remnants of a supernova.**

what the sources were. Because the carbon-isotope composition of these grains is within the normal Solar-System range, and the isotope anomalies are observed only in trace elements, it is not clear whether all the grains are pre-solar, or just a small fraction of them. It is even possible that the pre-solar material is contained in a different mineral, hidden within the diamonds.

The supernova-origin idea is supported by extremely anomalous xenon-isotope patterns in these samples. Even though this element is so rare that only one diamond in a million contains a xenon atom, it has been shown that the diamonds are highly enriched in the two lightest and also the two heaviest isotopes of xenon. No known single nuclear process can form such material, but two together could: the lighter xenon isotopes are formed during the 'p' process, and the heavier during the 'r' process, two types of nuclear reaction that are known to happen in supernovae.

The two processes occur in different layers of the exploding star, so in theory heavy- and light-xenon-bearing material should be separable in the laboratory[3]. Nevertheless, more than 20 years of analysis has not allowed us to untwine these two signatures, indicating either that these diamonds are a single population that formed from isotopically homogeneous xenon, or that the different populations are very well mixed[4].

The experiment reported in Dublin finally appears to have succeeded in separating the two components (A. Meshik and colleagues, Washington Univ., St Louis). A laser was fired at a collection of diamonds spread out thinly on sapphire plates, and the evolved gases were collected. This technique may owe its success to the fact that some diamonds contain more nitrogen than others[5]. Nitrogen-enriched diamonds tend to be coloured, and so these crystals will absorb more laser light, heat up, and emit their noble gases more efficiently than clear, nitrogen-poor diamonds.

The gases evolved in the latest experiment, presumably mostly from nitrogen-rich diamonds, contained less of the lighter xenon isotopes than bulk diamonds. This result implies that heavier xenon is preferentially located in nitrogen-rich grains and lighter in nitrogen-poor grains, suggesting the existence of two populations of supernova diamonds. These data confirm our understanding of nucleosynthetic processes occurring in supernovae, and suggest that the expanding shells of the supernovae involved did not mix well, at least until they had cooled enough to allow solid material to condense.

If the result is confirmed, isotopic and chemical analyses of elements other than xenon will be required to investigate the characteristics of the separated components thoroughly. This will constrain the nucleosynthetic processes occurring in specific regions of the supernovae responsible. One outstanding issue that may be resolved by these future experiments is the formation of the heavy-xenon-enriched component. The isotope abundances of this component appear to require condensation of solids just hours after the explosion, contradicting observations that dust only begins to form about a year after the supernova burst[6].

The new result is grounds for hope that these questions can be answered. Meteoritic diamonds may be forever, but the mysteries surrounding their origins might not last quite so long. □

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Behavioural genetics

Worming out social secrets

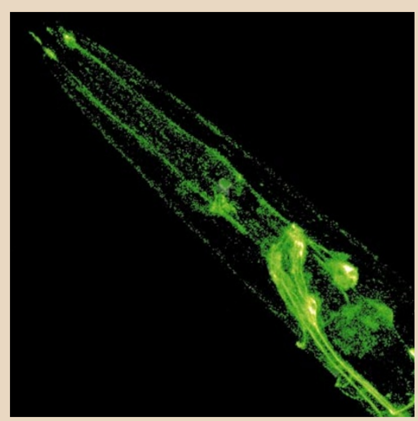
Some species of the nematode worm (*Caenorhabditis elegans*) are sociable diners, clumping together to share a meal, yet others are more solitary. Why? According to a report by de Bono and Bargmann (*Cell* 94, 679–689; 1998), these differences can be explained by a change of just one amino acid in a putative neuropeptide receptor.

The authors analysed mutations that cause solitary worm strains to form social aggregates. Solitary worms browse alone on bacterial lawns, forming clumps only when food is scarce. But the mutants always swarm together and show other behavioural differences, such as a tendency to burrow into the agar medium.

All of the mutations that caused worms to turn — from solitary to sociable behaviour — mapped to the gene for NPR-1, a seven-transmembrane-domain receptor. The NPR-1 protein closely resembles neuropeptide-Y receptors, which, in humans, are found throughout the brain. Indeed, de Bono and Bargmann detected *C. elegans* NPR-1 in neurons of the head, ventral cord and preanal ganglion (pictured).

The authors next studied the *npr-1* gene in 15 wild strains of *C. elegans*. Whereas the solitary worms had a valine residue at position 215 of the NPR-1 chain, their sociable counterparts used phenylalanine. This residue is thought to affect the specificity of NPR-1 signalling through guanine-nucleotide-binding (G) proteins, so it may help to transduce the signals that drive the worms to clump.

Could changes in neuropeptide pathways be a widespread mechanism for altering nematode behaviour? Another study by Nelson *et al.* (*Science* 281, 1686–1690; 1998) suggests that they could. These authors disrupted *flp-1*, a member of the FMRFamide-related neuropeptide gene family in *C. elegans*, and found behavioural defects in the worms, including a lack of



coordination and hyperactivity.

Nematodes probably aggregate because of a mutually attractive stimulus, an as-yet-unknown neuropeptide, that acts through the NPR-1 receptor. Because the worms clump only on bacterial lawns, food is likely to regulate secretion of the neuropeptide — in other words, for worms, as for humans, food is important in social behaviour. **Alison Mitchell**