S. & .N. GEARY/TONY STONE

Figure 1 **Super conduct: the line of soldiers has less size disorder than the marching band. In superconductors, the disorder is fixed by the sizes and mix of different cations.**

ions to the oxygen in the CuO_2 sheet. Hole concentration and lattice size affect T_c. The choice of dopant used to attain the optimal hole concentration also affects T_c, but no convincing explanation for the variations had been proposed.

Now, Attfield *et al.*[1] show that, at a fixed hole concentration and lattice size, the degree of lattice-size disorder in the LaO layer has a powerful effect on T_c. Those lattices with minimal size disorder (that is, whose dopant ions have similar radii to the lanthanum ions) have the highest T_c; those with bigger or smaller dopant ions, and therefore more disorder and stress in the lattice, have lower T_c. And this is in materials where the lattice is supposed by many to be irrelevant, except in providing the CuO_2 plane as a sort of flower-bed in which exotic electronic states can come to life.

Some readers may be left dissatisfied because the authors do not try to explain the observed effect with a microscopic model, but it seems wise to me. We are in the midst of what seem to be weekly developments and discussions about the superconducting mechanism in cuprates, and these data point to none of the options in a straightforward manner. Although the authors have observed a similarly strong effect of disorder on the magnetoresistance in manganites, it would be surprising if the underlying mechanism is the same in the two systems. The effect could be something trivial — such as the smearing out of the electronic density of states by disorder — or more subtle, perhaps reflecting the competition between how strongly the dopants localize their charge on nearby transition-metal–oxygen units, and how strongly such charges tend to delocalize.

This paper helps to rid me of an old demon. In early December 1986, a physicist colleague grabbed me in the hallway on his way to a seminar to be given by Koichi Kitazawa (who was visiting Bell Labs from the University of Tokyo) on a new kind of superconductor. He dragged me in, and I sat in the back row, feeling distinctly out of place — superconductivity at the time being the domain of condensed-matter physicists and not solid-state chemists. Kitazawa had agreed to give an informal talk on Tokyo's confirmation of superconductivity at 28 K in the La–Ba–Cu–O chemical system, published only weeks before by the two Swiss scientists Georg Bednorz and Alex Muller. During the seminar, a telephone was brought into the room and Kitazawa called the lab back home (where it was 4 a.m.), to learn that they had just determined that the superconducting compound in the system was the now famous La_2CuO_4 structure, doped with barium.

I left the room after the seminar thinking that if barium was a good dopant, then certainly strontium should be better, being almost identical in size to lanthanum. Within a few days our group and others around the world had seen superconductivity at the then astounding temperature of 38 K in the strontium analogue $La_{1.8}Sr_{0.2}CuO_4$. The cuprate genie was out of the bottle. Although the idea seemed simple enough at the time, like many things about copper oxide superconductors to follow, we were soon to figure out that the story was by no means so simple. I have been wondering ever since why that small change in dopant should increase T_c so dramatically. Attfield and co-workers have now provided an answer.

One might find it astonishing that more than a decade would pass since the first observations of superconductivity in this family of compounds and the presentation of a unifying hypothesis explaining the observed variations in T_c. The delay is a testimony to the complexity of this still remarkable class of materials, especially the way they continue to shroud their true nature beneath layer upon layer of obscuration. It is also a testimony to the nature of the scientific process, in which some with just the right point of view see clearly what was invisible to many others. The delay makes the understanding all the more sweet. □

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3. Anderson, P. W. *The Theory of High Temperature Superconductivity* (Princeton Univ. Press, NJ, 1997).

Palaeontology

Ancient Australian arthropods

This little creature, some 3$^{1}/_{2}$ cm in length and probably a relative of present-day centipedes and millipedes (myriapods), was crawling around what is now Australia almost 400 million years ago. As G. D. Edgecombe reports elsewhere in this issue (*Nature* 394, 172–175; 1998), this fossil and a younger one were identified in deposits that date to the Early and Mid Devonian, respectively, and plausibly become the oldest-known Australian land animals. That they were terrestrial is surmised from what seems to be a spiracle, the external opening of the tracheal system employed by air-breathing arthropods, of which myriapods are a constituent group.

In the Devonian, today's southern continents plus India were formed into the supercontinent Gondwanaland. Previous examples of terrestrial arthropods of Devonian age have come only from the other supercontinent of the time, Laurasia. Most notably, the new fossils are assigned to the genus *Maldybulakia* from Kazakhstan, and so greatly extend the

known geographical range of this type of myriapod. That begs the question of how the two places might have been connected in the past. Edgecombe points to a Lower Devonian reconstruction which links Kazakhstan and Australia by a land bridge through north China. Further specimens might be found there.

One hopes, however, that miracles of fossilization mean that other examples will be the remains of complete animals. These two have lost their heads.

Tim Lincoln