Almaden groups all reported structures that were similar to the Geophysical Laboratory's, but which had orthorhombic rather than tetragonal symmetry. The difference in length of the relevant crystallographic axes was no more than one per cent or so, but Hazen knew that he should have been able to detect a difference of this magnitude. What had gone wrong?

A hurried discussion in the lobby with Robert Beyers of IBM Almaden, in which Beyers showed Hazen electron micrographs of highly twinned, orthorhombic 123, provided Hazen with an explanation just in time for his own talk. He proposed that the superconductor could adopt two different structures. Rapid quenching from high temperature yielded the higher-symmetry, tetragonal structure, whereas slower cooling allowed a structural rearrangement to take place, yielding the orthorhombic variant. The twinning seen in Beyers's micrographs was simply the crystal's way of adapting to the structural transition.

All this we now know to be true, and Hazen tells us in an epilogue that, after several weeks of worrying that they had somehow missed seeing the orthorhombic distortion in their crystals, the Geophysical Laboratory's structure was vindicated by other observations of tetragonal 123. What he doesn't tell us — a touch disingenuously, one feels — is that tetragonal 123 is not superconducting. He concludes, "To say that we 'won' seems, in retrospect, much too narrow a point of view"; in fact, if they won a race at all, it was unfortunately not the one they had entered.

While this error of omission will certainly not detract from the book's appeal for non-specialists, it may tarnish it somewhat for those in the field. Yet specialists will find much to interest them, including the fullest exposition yet of the notorious 'Yb for Y' episode — the substitution, whether accidental or intentional, of the chemical symbol for ytterbium for that of yttrium in the version of Chu's paper first submitted to *Physical Review Letters*.

As Hazen states in the preface, the book presents one participant's view of the race to solve the superconductor structure. Above all, it stands as an illuminating description of the "scientific symbiosis" between people with different knowledge and expertise that is becoming increasingly necessary as science grows more complex, and scientists more specialized. The field of high-temperature superconductivity is encouraging such symbiosis on a grand scale, as physicists find they can learn something from chemists, crystallographers and ceramists. It will be a long time (if ever) before the solid-state physicists have their backwater to themselves again. □

Laura Garwin is Physical Sciences Editor of Nature.

A wild social life

Adrian Lister

Elephant Memories: Thirteen Years in the Life of an Elephant Family. By Cynthia Moss. *Elm Tree Books*, 27 Wrights Lane, London/William Morrow, New York: 1988. Pp.336. £15.95, \$22.95.

CYNTHIA MOSS has devoted 15 years to a study of the elephants in Amboseli National Park, Kenya, during which time she has come to know each of the 600 or so animals as individuals. In *Elephant Memories* she describes in a most engaging way the fruits of this unique venture.

Elephants are highly social animals. They live in close-knit family groups led by an experienced female or 'matriarch', and associate to varying degrees with other families. Moss's first task was to

animal nor long-term cycles of climate and vegetation. Moss describes, for example, the way in which bond relationships and hierarchies evolve over the years and how they are affected by events such as the death of a matriarch; and the drastic shifts in patterns of migration, feeding and reproduction which were observed between years of drought and plenty. Previously contradictory conclusions about elephant behaviour and ecology are seen to be the result of studies carried out under varying conditions. The list of questions that can be answered by the data from long-term research lengthens almost exponentially with each year that passes.

Details of individual behaviour provide additional interest. 'Play behaviour', in which both adults and young participate, may involve throwing sticks, squirting water and running about in circles. Re-united relatives greet each other with much excitement and intertwining of

Tug of war — elephants at play in the water.

learn to identify all the animals in her study area, using particular features such as ear shape for recognition. Together with her colleagues, she could then begin to accumulate a vast body of data on patterns of association between individuals, daily and annual cycles of movement and feeding, reproductive behaviour and success, growth and development, and the effects on all of these factors of short- and long-term environmental change.

Each chapter begins with a brief narrative account of a period in the life of the study families, which illustrates a particular theme: drought, birth and babies, social relationships, population dynamics and so on. The reader is given a real feel for elephant life on a day-to-day basis in the wild. The chapter then continues with an extended discussion of its theme, incorporating the results of the scientific study. The result is an imaginative and highly readable text which will captivate non-specialists as well as providing a wealth of insight for professional ethologists, ecologists and conservationists.

It is the perspective of the years which gives the study its special importance. The very few comparable examples include Jane Goodall's work on chimpanzees and Fiona Guinness's on red deer. Projects such as these are simply irreplaceable by shorter-term studies, which encompass neither the full generation time of the

trunks. Animals which have died are covered with branches and dust by their relatives, who may keep vigil beside them for several days.

Finally, the book provides an informed and up-to-date account of the status of elephants in Africa as a whole, and the problems for their future survival. An estimated 80,000 of Africa's 800,000 elephants are now being killed annually for ivory, mostly by poachers. The establishment of game parks and reserves may ensure that the elephant survives, but Moss is critical of culling programmes which are often based on data collected at one particular time, and which may ultimately cause more ecological disruption than allowing natural regulatory mechanisms to operate. Her own studies of population dynamics in the undisturbed conditions of Amboseli will provide, for the first time, base-line data that should help in the conservation of all elephants.

Africa's elephants could have no more dedicated or persuasive champion than Cynthia Moss. Her whole book forms an impassioned plea for the preservation of conditions in which they can live their rich and complex lives to the full, as well as for the continued funding of research into these extraordinary animals. □

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