distribution of each element, especially over the area of the Northern Pennine Orefield, the influence of which appears to extend from the classic area of veined Lower Carboniferous sediments, well to the east into the Permian and Triassic. The genesis of the lead-fluorite mineralisation evidently remains controversial and while much of the stream sediment geochemistry can be explained by the known occurrences of major minerals (baryte, witherite, fluorite, galena, sphalerite) and minor 'exotic' minerals (e.g. cobalt arsenides), there are intriguing pointers to further styles of mineralisation, including gold, in places.

However, it is the environmental geochemist who will gain most by studying this Atlas, in which there is a surprising diversity in element distribution, given that the area is dominated by a sedimentary sequence of fairly limited stratigraphic range. Coal mining waste has made a particularly conspicuous impact on the regional geochemistry, leading to enhanced values for Be, Co, Cu, Pb, V, Zn, Ga, Li, K and Rb as well as local enrichments in As, Sn, Mo, Bi and Sb.

This carefully structured and well produced volume, providing information with exceptional visual impact, is excellent value for the price.

A. J. HALL

Hill, C.A. and Forti, P. *Cave Minerals of the World* (second edition). Huntsville, Alabama (National Speleological Society), 1997. 463pp. Price $70.00 ISBN 1-879961-07-5 (Available from the National Speleological Society, 2813 Cave Avenue, Huntsville, AL 35810-4431).

This is a magnificent book, being a much expanded version of the first author's *Cave Minerals* (1976, 173 pp) and both authors' *Cave Minerals of the World* first edition (1986, 238 pp). This second edition is more than double the length of the first providing a measure of the rapid growth of the subject.

The authors list 255 mineral species found in caves plus 38 varieties of calcite speleothems such as stalactites, stalagmites, helictites and flowstone. Most minerals are illustrated in full colour, though the lack of scale bars made some difficult to appreciate, and a few photos were upside down. Each mineral entry is accompanied by a bibliographic index with the references combined in a single list of nearly 4500 entries. There is a glossary and a comprehensive index. End-papers bear useful diagrams of the variety of cave environments where minerals may be found.

The authors use a definition of a cave as a natural cavity enterable by man. They specifically exclude vugs from their definition of a cave but some mineral-lined cavities large enough to enter are, in fact, just large vugs and minerals from these are included. Mineral veins, too, are excluded from the definition, but then many epithermal veins have cavities large enough to enter. Though some small vugs and veins are excluded, it still means that most of the usual hydrothermal suites of minerals such as galena, baryte and fluorite are listed, as well as their oxidation products.

The authors have also included lava tubes and blisters as caves, with an accompanying suite of silicate minerals. Fumaroles, often lined with sulphur or silica minerals, are included in their survey, though normally they only become accessible after fumarolic activity is extinct.

Two of the largest groups of cave minerals listed are phosphates (52) and sulphates (63). The former group includes several which are really weathering products associated with bone-bearing deposits or with bat or bird guano. The sulphates include many minerals associated with evaporitic conditions in caves of arid areas as well as some found in fumaroles.

Nearly half the book is taken up with contributed articles on special topics and on descriptions of a Top Ten of mineralogical caves. The special topics provide useful concise summaries of some controversial topics. These include the calcite/aragonite problem, crystallography and colour of speleothems, microclimates in caves, trace elements, microbial activity on speleothems, luminescence, dating methods, hydrothermal minerals, relationship with archaeological deposits, the alleged deposition of minerals by aerosols, conservation and display.

The Top Ten caves provide case histories of cave mineral assemblages from various environments, e.g. an Australian lava cave noted for its phosphates derived from bat guano; Lechuguilla Cave in New Mexico, famed for the origin of both the cave and its minerals by sulphuric acid emanations; and Cupp-Coutunn Cave in Turkmenistan which went through a late hydrothermal phase. However, there seems little point in including the French Blue Cave (with blue aragonite helictites) when it seems to be mainly a Roman mine working and is sealed with concrete to preserve it - probably affecting the microclimate and thus mineral deposition within.

The book is well produced and would grace any coffee-table but the English translations of Russian contributions are not always clear in meaning and there is a scatter of mistakes. Figure 27 should be attributed to A. Eavis. However, the book should be on every serious mineralogist's shelf and in every appropriate library.

T. D. FORD