

## BOOK REVIEWS

Buchwald (Vagn F.). *Handbook of Iron Meteorites. Their History, Distribution, Composition and Structure*. Berkeley and London (Univ. of California Press), xii+1426 pp., 2124 figs. (3 volumes), 1976. Price £98.00.

Most present-day *Handbooks* are put together by several editors and consist of separate chapters by a multitude of contributors who attempt to review the existing literature in a specific area of study. Vagn Buchwald's *Handbook of Iron Meteorites* is very different; it is a single-handed circumnavigation of the whole of iron meteorites and the vast bulk of the work is an eyewitness account of what he personally and alone has seen. There are also modest accounts of a few of the expeditions that he has, at one time or another, undertaken in his efforts to harvest meteoritic iron for scientific study.

Volumes 2 and 3 (pp. 245–820, figs. 230–1142, and pp. 821–1418, figs. 1143–2124) are devoted to alphabetically arranged descriptions of the 532 different iron meteorites with their numerous related fragments and sometimes damaged portions with, in addition, a number of pseudometeorites. In most instances the verbal description of the structure is accompanied by excellent photographs, by critically selected chemical analyses, and by an account of the more recent history of the material. There is also a record of how it is distributed among the major collections. In this part of the work the author's avowed intention is to present a description of meteorite structures, not an explanation or a comprehensive theory. However, it is not easy to find a form of words that is purely descriptive and has no overtones of an explanatory model. Also it is sometimes very difficult to pass over the opportunity of discussing the more unusual structures and attempting to explain how they were achieved. These occasional discussions of structure-forming processes are always of interest, but it is a weakness of the personal method of presentation that it is not made clear to what extent alternative interpretations and hypotheses are available.

A good proportion of iron meteorites belong to chemically defined and, by presumption, genetically related, groups and a particularly valuable aspect of the present work is the way in which systematic trends and ranges of structural detail are reported for the individual members within the different chemical groups. Unfortunately the method of individual, alphabetically arranged, descriptions makes it impossible to effect a complete and systematic inter-comparison at all points, and, moreover, significant elements of structure are occasionally glossed over in the primary description of an individual, only to be emphasized in another place as part of the comparative description of another meteorite. Hence the only sure way to cover the whole subject is to read the whole book. Of course the author is well aware of these difficulties of presentation and he has provided in Volume 1 a series of tables (pp. 147–243) in which the members of the different chemical groups are listed in chemical sequence, together with condensed structural detail.

Since the major part of this work is a record of the author's hitherto unpublished personal researches it might be appropriate to take note of some of the important new contributions or redistributions of emphasis that are presented. Artificial alteration by man and atmospheric entry effects are most carefully considered, along with the effects of terrestrial corrosion. The interplay of these factors makes it possible to discuss the amount of material that has been lost as a result of corrosion—which is often surprisingly small, and to diagnose unambiguously the thermal damage that has been inflicted by man—which is unfortunately all too common. In these areas of study the surface and near-surface structures are of paramount importance and are powerfully investigated by the method of microhardness survey, which the author has

made his own speciality. Cosmic alteration effects are usually more uniform and deep-seated, and, in addition to the already well-documented Neumann lines, range from pre-terrestrial cracks and fissures in both compound and metal phases, slip and shear displacements of different magnitudes, pressure-induced polymorphic transformation, transformation-induced deformation, reheating, repeated reheating, and cyclic reheating (with or without detectable previous deformation). These cosmic alterations are reported in detail and constitute a most valuable addition to the literature. In particular the careful separation of terrestrial from pre-terrestrial effects produces for the first time a reliable list of cosmic reheating effects, the occurrence of which will come as a surprise to many and which urgently requires an explanation. Another aspect to which the author pays valuable attention is the presumably atmospheric disruption of brittle, phosphide-rich showers such as Sikhote Alin or ductile, phosphorus-poor showers such as Gibeon. In relation to the Gibeon material a most impressive array of evidence is presented in favour of a detailed examination of the huge amount of material that is available but which has not been properly examined by modern methods. In this context the non-specialist reader will be astounded to discover how many well-preserved (and even observed falls of) iron meteorites have to date been subjected to completely inadequate structural investigation.

Attention could also be directed to the wealth of observation that is reported on the polycrystalline character or troilite content and distribution of the parent taenite in a number of meteoritic irons and to the most valuable way in which the author records structures and compositions that do not fit into established groups. As a personal preference I would have wished for more extensive photographic illustration of these group-anomalous structures even at the expense of some comparative pictures of group-members.

The text portion of Volume 1 represents a general introduction to meteoritic iron in terms of astronomy and age determination, chemistry and classification schemes, shapes, sizes, and surface characteristics, the phase constitution of the primary structure of meteoritic iron and also the secondary structures produced by shock, reheating, and weathering. This general text is excellently illustrated and provides a basic introduction to iron meteorites. It also serves to define some of the terms that are employed in the detailed descriptions of Volumes 2 and 3. Most of the 'descriptive' terms employed in the present work are in harmony with earlier usage although a few, such as island arcs of phosphide crystals, are newly minted to accommodate features that have not hitherto been widely discussed. Thus it appears a pity that the type of plessite in which kamacite appears as fat needles, or spindles, should be renamed 'acicular' in place of the 'spindle plessite' terminology that would flow directly from the usage in Perry's 1944 monograph. The word 'acicular' has strong martensitic overtones in metallurgical terminology and many people already use the term acicular plessite to indicate a martensitic-bainitic morphology as distinct from kamacite spindles.

Eight pages of index are intended only to accommodate major illustrated features and one returns to the earlier statement that the only way to cover the whole subject is to read the whole book. This can be thoroughly recommended as a pleasurable occupation. The book is a joy to handle. Beautifully bound, excellently printed and illustrated, and on good paper. It retains the flavour of an earlier, heroic, age of book production and we are not likely to see its replacement.

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