fascinating chemical and mineralogical variation has led to them being subjected to intensive study. In the introduction to this publication, the author points out that 'an understanding of their genesis is essential if we are to understand fully the workings of the solid earth'. He also stresses their economic importance as sources of a wide range of industrial raw materials (e.g. phosphate, vermiculite, Nb, Cu, rare earth elements). Over 2000 localities are now known, including more than 300 carbonatites.

The author compiled this catalogue of alkaline rocks and carbonatites because no world-wide survey had been available previously He has included all occurrences that could be traced in four parts, the first of which deals with North and South America. Parts 2, 3 and 4 (to be published) will deal with, in order: Africa; U.S.S.R.; and Asia, Europe (excluding U.S.S.R.), Australasia, Antarctica, and the oceanic islands.

The main criteria for classification as alkaline rocks are the presence of modal feldspathoids (including analcime) and/or alkaline pyroxenes and amphiboles. Also included are fenites, certain ultramafic and melilite-bearing rocks (e.g. alnöites), and some highly potassic rocks (but not kimberlites). Carbonatites include igneous and metasomatic types as well as some that may be metamorphic in origin.

The catalogue is arranged nationally with each occurrence being assigned a national number. Information includes: geographic coordinates; brief descriptions of complexes (including simplified geological maps), petrographic relations, principal results of some specialized geochemical studies; economic aspects; age data; references to crucial published work for each occurrence, and a full reference list at the end of each national section. A locality index cites both national number and page number.

Part 1 includes data for Canada (165 occurrences), Greenland (44), Mexico (17), U.S.A. (144), Argentina (17), Bolivia (7), Brazil (116), Chile (3), Colombia (3), Costa Rica (3), Dominican Republic (1), Ecuador (1), Guyana (3), Haiti (1), Honduras (1), Paraguay (26), Peru (4), Uruguay (3), Venezuela (2).

The catalogue is well-produced on a large page format (A4) and contains abundant factual information; the reference lists are particularly valuable. One possible problem is that the classification criteria for alkaline rocks has led to the omission of some complexes which are genetically related to other complexes which are included. Thus the Ascutney complex, Vermont, is omitted even though it is undoubtedly a member of the White Mountain Magma Series. There may be other such omissions.

The author is to be congratulated on compiling this detailed catalogue. Some of the occurrences are only reported in obscure journals and survey reports making this comprehensive list particularly useful for geologists working on alkaline rocks. Thus the full catalogue will be an essential purchase for university, survey and mining company libraries as well as for specialist workers, although the latter may eventually find the cost for the whole catalogue rather prohibitive.

C. M. B. HENDERSON

Woods, T. L. and Garrels, R. M. *Thermodynamic Values at Low Temperature for Natural Inorganic Materials: an uncritical summary*. New York and Oxford (Oxford University Press), 1987, xvi + 266 pp. Price £17.50.

In numero veritas! Since the application of thermodynamics to sedimentary geochemistry was pioneered by Professor Garrels, any compilation of thermodynamic data by him will inevitably be vested with considerable authority. In this case, rightly so. A gap in the existing provision of data has been apparent for some time, as none of the other compilations include quite the right mix of aqueous species and rock-forming minerals which is necessary for sedimentary geochemistry.

The thermodynamic data in this text is ordered initially alphabetically (by the name of the first element in the formula, not by its symbol); however, within the listing for each element, the compounds are presented in a fixed (but arbitrary?) order. The data itself comprise the formula, compound name, and state, together with values for the enthalpies, free energies, and entropies under standard conditions. The units are joules, and the sources of data are numerically keyed to a list of references. A valuable feature of the data set is that the range of values (up to 10 in some cases) found for some coupounds gives a good idea of the possible errors in estimating the free energy changes for selected reactions. These values are presented uncritically, but there is a suitable caveat in the introduction as to the dangers of using data from different sources. I will certainly use these tables regularly, and will acquire a set for teaching. They are clearly printed and are robustly bound, and the latter will prove to be a thoughtful feature in view of their potential usage. An essential buy for any serious sedimentary geochmemist at £17.50.

R. RAISWELL

Williams, K. L. *Introduction to X-ray Spectrometry: X-ray fluorescence and electron microprobe analysis*. London and Boston (Allen and Unwin),

1987. xiv + 370 pp. Price £35.00 (hardback), £17.95 (paper).

X-ray fluorescence (XRF) and electron microprobe analysis have become routine chemical analysis techniques in both university and industrial settings. In this book Professor Williams aims to give new users of these techniques an understanding of the physical background to the instrumentation and the physical factors controlling data quality, and of the procedures used to convert raw data into analyses. Such knowledge is important because in many laboratories instrumental automation and computerized data processing means that new users often do little more than select and prepare samples for analysis, and therefore gain little experience of the multitude of machine and operator errors than can influence their results.

As the author points out in his preface, no material in the book is 'new', and it must therefore be judged on its effectiveness in bringing together information from disparate sources and presenting it so as to interest analysts whose instinctive desire is just to see the 'right' numbers being churned out by a black box. To a large extent I feel that the author has been successful here, though it is perhaps difficult to judge when one already has some knowledge of the principles involved. The coverage of X-ray production, their interactions with matter, dispersion and detection was reasonably comprehensive and readable, although the discussion of semiconductor theory (chapter 2) seemed excessive. The summary of instrumentation and energy *vs.* wavelength-dispersive spectrometry is informative although most of the latter discussion relates to energy-dispersive systems as used on microprobes, with little reference to EDS–XRF.

Chapters 7, 8 and 9, which deal with sources of error in the analyses and how they can be overcome, are perhaps the most important part of the book. Unfortunately it is not easy to organize these subjects into a systematic order and there is a tendency here for the reader to get bemused by a maze of headings and subheadings. Perhaps shorter chapters, focusssed on single sources of error, would have been helpful here. Nevertheless, I found most of the material readable despite the occasionally complex algebra, and that many of the important aspects of generation of analyses were covered. The biggest omission seemed to me to be the absence of any details of calibration techniques between true concentration and corrected X-ray intensities. This is probably in part the result of the book being directed to a wide audience with many different sample types, for which different types of calibration standard are appropriate. I feel that this book would have been of greater value to the geological community if it had included a short discussion of the origin and characteristics of international standard samples, such as those of the USGS, and of the often-unwarranted faith placed by analysts in the 'recommended values' for element concentrations in standards. In silicate trace-element analysis it is extremely difficult to prepare satisfactory synthetic standards, and thus the final influences on analysis quality are the published standard analyses and the method of calibration. It is common to treat published standard analyses as of equal validity and to draw by eye a regression line through the standard concentration *vs.* X-ray intensity data. Sophisticated computer regression, including an estimate of error on the standard analyses, can greatly improve the reliability of calibration but is not treated in the book.

In addition, given that the author has a geological background, I was a little disappointed at the shortage of geological examples. There are plenty of examples in the geological literature of poor analytical techniques and unjustifiable confidence in poor data, often originating from established laboratory procedures rather than a novice analyst, that could have been used to illustrate the pitfalls noted in this book. Indeed, a guide on how to recognise poor data in the literature would have been most helpful.

Despite these omissions, I would recommend this book to students newly commencing XRF or microprobe analysis, in the hope that it would make them think more carefully about the generation of their numbers.

M. F. THIRLWALL