the less as genuine a craftsman as the village carpenter, though his workshop may smell of oil rather than of wood shavings.

These two books serve the valuable purpose of emphasizing that village life had an unhurried simplicity and gave a contentment to its inhabitants that is frequently lacking at the present time. One of the great problems for the future is to fuse this essential completeness of village life with the intellectual ferment so characteristic of the present time. Few would willingly wish to retain the intellectual stagnation that was too often a characteristic of village life in the past.   E. W. RUSSELL.

FOUNDATIONS OF ASTRONOMY

Foundations of Astronomy
By Prof. W. M. Smart. Pp. vii+268. (London, New York and Toronto : Longmans, Green and Co., Ltd., 1942.) 16s. net.

PROF. W. M. SMART needs no introduction as a writer of astronomical books. These range from popular accounts such as "The Sun, the Stars and the Universe" to his valuable and comprehensive work "Stellar Dynamics", dealing with the movements of the stars.

The work now under review falls in the gap between popular descriptions of astronomy and general text-books for university students, such as the standard "Text-book on Spherical Astronomy" by the same author, now in its second edition. "Foundations of Astronomy" is intended for students taking a first-year course in astronomy in the universities and for all those interested in the subject who feel the need for a more solid foundation than the many descriptive books can provide. The author hopes also that the book will be of value to the many young men in the naval and air forces, who are required to have some knowledge of astronomy in its application to navigation as an introduction to the Service manuals in which greater emphasis is laid on technical matters.

Commencing with chapters on "The Geometry of the Sphere" and "The Celestial Sphere", the book gives definitions of most of the astronomical terms, accompanied by full and careful explanations, which will be found simple to follow, and by illustrative examples. A prominent feature in these explanations is the use of appropriate diagrams, well thought out and produced. Along with these definitions there occur many descriptions and explanations of natural phenomena which will be found illuminating. It is worth noting that the spherical trigonometry used is made to depend on one formula only—the cosine formula—and that this dependence is direct in each case.

Although the astronomy is mainly positional, the chapter on "The Stars" includes a brief introduction to the spectrum and to some of the important and fascinating results which may be obtained by studying the constitution of the light from the stars. A chapter on the "Determination of Position on the Earth" is also included.

A useful feature is the inclusion of a number of examples for the student at the end of nearly every chapter, together with a collection of answers at the end of the book. Appendixes give tables of astronomical constants and the elements of the planets and the satellites, and the book possesses a useful index.

The work is beautifully printed and shows very little evidence of war-time production.

A few minor misprints and obscurities have been noted, but only one seems likely to cause confusion ; in section 138, on the "Heights of Lunar Mountains", it should be noted that only a particular case is concerned, when M is on, or very near, the moon's equator (incidentally, Y is not a cusp).

"Foundations of Astronomy" as a whole gives a simple and adequate account of astronomical terms and usage ; further, it is at the same time just a little more than a bare text-book in that it describes rather more phenomena than are needed to explain the definitions. The mathematical attainments of the student are carefully considered, as is indicated by the use of asterisks to point out sections which may be omitted from a first reading, and by the very careful explanations, particularly in the more elementary parts—the true "Foundations"
                                      J. C. P. MILLER.

DRAINAGE OF OIL WELLS

Oil Well Drainage
By Dr. Stanley C. Herold. Pp. xv+407. (Stanford University, Calif.: Stanford University Press ; London : Oxford University Press, 1942.) 30s. net.

PETROLEUM technologists, especially on the production side, will be familiar with the author's "Analytical Principles of the Production of Oil, Gas and Water from Wells", published in 1928 —a severely mathematical treatise of a complex subject. Reviewing that volume the writer stated at the time that it was "unquestionably a remarkable effort for one man and nothing quite like it has appeared before in the annals of petroleum literature". The same can be said of this, Dr. Herold's latest work. This time it is the story of oil well drainage shorn of mathematics (except in a brief appendix) but replete with recorded incidents and observations skilfully interpreted in terms of what is unseen in natural oil reservoirs. The basis of this work is primary analysis of any particular North American oilfield by reference to a questionnaire of twenty-one questions (introduction) to which appropriate answers, where they can be given, are collated and resulting data segregated according to whether the oilfield is Palæozoic or Cenozoic.

This division into "older" and "younger" constitutes a twofold classification governing considerations of reservoir energy ; the function of natural gas ; radius and area of drainage ; regional drainage and water encroachment ; drainage across property lines ; effects of stratigraphy and structure on drainage ; effects of reservoir penetration on drainage ; effects of multiple zones on drainage ; effects of rates of production on drainage ; effects of field development on drainage ; drainage by wells of all or no gas ; injection of gas, water or oil ; reservoir content, ultimate recovery and reserves ; abandoned oil and gas ; curtailment, proration and conservation.

There are always snags in any attempt at simplification of highly variable functions, especially of fluids like petroleum and natural gas. For example, oil wells drawing from Tertiary deposits may simulate Carboniferous or older formational types of production and *vice versa*. The admittedly rarer instances of Mesozoic oil may possess production characteristics of either Cenozoic or Palæozoic pools ; the author apparently sees no reason to suspect a third type of