*Absolute Age Determination: Physical and Chemical Dating Methods and Their Application.* MEBUS A. GEYH and HELMUT SCHLEICHER. Translated by R. CLARK NEWCOMB. Springer-Verlag, New York. 1990. xi + 503 pp., figures, appendixes, index, table. $69.00 (paper).

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This comprehensive and well-organized compilation of 76 absolute-dating methods was designed as a reference text for both geoscientists and archaeologists. The detailed table of contents identifies the techniques as standard (***), routine (**), individual case studies (*), and in development/obsolete (no asterisk). This scheme is repeated on a foldout table that charts the dating methods, their age ranges, and the materials to which each technique may be applied.

Chapters one through three offer a general discussion of absolute vs. relative dating, the importance of sample selection, and how to package samples for analysis. The authors rightly point out that errors resulting from the sample itself (context, contamination, heterogeneity) are often larger than the analytical error of the age determination. These sections contain useful information for avoiding nonmeasurement errors and on how to compare results from different laboratories and from different dating methods. The use of standards and the need for interlaboratory calibration are particularly stressed. The proper statistical treatment and interpretation and publication of raw chronological data are discussed in Chapter four.

Chapters six through eight, on radiometric, chronostratigraphic, and chemical dating methods, respectively, are the focus of this volume. They include substantial sections on the standard methods of potassium/argon ($^{40}K/^{40}Ar$), rubidium/strontium ($^{87}Rb/^{87}Sr$), uranium/thorium/lead ($^{238}U/^{206}Pb$, $^{235}U/^{207}Pb$, $^{232}Th/^{208}Pb$, $^{230}Th/^{234}U$), radiocarbon ($^{14}C$), thermoluminescence (TL), fission track (FT), paleomagnetism, oxygen isotopes ($\delta^{18}O$), amino-acid racemization (AAR), and obsidian hydration. Up to 15–20 pages are devoted to each of these techniques.

Each section follows the same outline: (1) summary information including dating range, precision, suitable materials, and sample size; (2) basic concept, with fundamental principles and equations; (3) sample treatment and measurement; (4) scope and potential, limitations, representative examples; and (5) nonchronological applications. Detection and measurement systems (e.g., accelerator mass spectrometry [AMS], proportional and scintillation counters) are covered in Chapter five, since they are commonly applied to several different dating techniques. The coverage of each dating method includes the kind of detail that an experienced investigator would require, with extensive citations of both the historical and current literature. The applications listed are usually not more than citations, however, which is an area that should have been amplified if the volume were truly intended as a text. While archaeology students with no scientific background can review the principles of isotopic decay in Chapter five, competence in mathematic and scientific notation is generally assumed.

The section on radiocarbon dating (conventional and AMS), for example, is quite thorough, with detailed information on the materials that can be dated and typical sample-size requirements; the precision that can be achieved (it is argued that most reported standard deviations are too small by a factor of as much as 2); the conventions and calibrations used (with good illustrations); and the limitations imposed by particular materials (e.g., shells, ceramic sherds, rock varnishes, and iron objects), contamination, and the reservoir and Suess effects. In addition to archaeology and paleobotany, the applications cited include dating groundwater, glaciers, stalagmites, and soil formation; the study of ocean currents; and modern air pollution.

Routine dating methods such as electron spin resonance (ESR) are also covered, as are up-and-coming methods such as beryllium-10 ($^{10}Be$) for marine sediments; calcium-41 ($^{41}Ca$) for bones and calcareous sediments; and calcium diffusion and cation ratios in plaster and rock art. In fact, just about every dating method for which an application has been published has been given some space. These range from the rarely used differential thermoanalysis (DTA) to outdated methods such as the use of pleochroic haloes to estimate the age of mineral crystals. Many of the techniques covered in this volume have quite specific geological applications, and are not broadly applicable in archaeology.

The 62-page bibliography includes citations through 1989. There are additional, separate lists of the journals which frequently publish papers on geochronology, and of geochronology textbooks. The appendixes include a 23-page glossary, a table of stable and radioactive isotopes, and the addresses of analytical laboratories around the world. The last is cross-referenced with the chapters on each technique, and is alphabetized by city.

Newcomb should be commended for his translation, which has rendered the German original into smooth-flowing English. The text has a few too many typographical errors, but there are not nearly as many as one frequently encounters in a translated work. The book is printed on quality, acid-free paper and is sturdily bound with a heavy-duty paper cover. Geyh and Schleicher have produced a reference book well worth the $69.00 price; there are however other, less-comprehensive texts designed specifically for archaeologists, which are available for under $30.00.