

COMPILING AMERICAN GEOLOGICAL
LITERATURE, 1669 TO 1850:
A SYSTEMATIC APPROACH TO NATURAL
HISTORY BIBLIOGRAPHY

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INTRODUCTION

The need for comprehensive and accurate bibliographies in the natural sciences is obvious. As a result of a combination of recently published library reference aids, microfilm reproductions of rare sources, and new word-processing capabilities, the production of systematic historical bibliographies is far easier than it was in the past.

From 1971 to 1980 we compiled and revised a geological bibliography of pre-1851 American-published sources (Hazen and Hazen, 1980). The objective of this review is to document our systematic approach to producing *American Geological Literature* in order to aid and encourage others engaged in bibliographic efforts. In addition, we highlight some of the advantages of word processing in the production of a bibliography.

DEFINING THE CONTENT

The first step in compiling a bibliography is to define the scope of the work. There is no simple solution to this problem, and each bibliographer must carefully consider his time and interests. In general, the broader the scope, the longer and possibly less comprehensive the result will be.

In *American Geological Literature*, we wished to produce a bibliography primarily for the use of historians of American natural science. We define geology in its broadest sense; references include both descriptive and analytical accounts of earth materials from all countries, geological processes and events, and mining and related economic pursuits. Several previously published earth-science bibliographies contain substantial numbers of historical references, but, in general, these works list only significant scientific articles or books. Thousands of other publications, including pamphlets on mining, book reviews of geology texts, notices of transient phenomena such as earthquakes and volcanoes, and accounts of geologists and their work, had never been cataloged. Additional unrecorded publications, including eighteenth century earthquake sermons, popular accounts of natural disasters, mining company stockholders' reports, and geological poetry, have little formal scientific content, yet are important to the historian as documents of the varied ways in which man viewed the earth. We sought to list all these geological publications. Unfortunately, it was necessary to omit newspaper

articles from the bibliography because examination of the more than two million American newspaper issues published through 1850 was impossible.

Only American-published works were included. Many important European periodicals were not available to us, and any attempt to compile a list of foreign-published material would have fallen far short of a complete record. Of course, foreign texts and articles captured the attention of American scientists. As a consequence many of these works were abstracted, reviewed, or even republished in the United States and thus appear in the bibliography.

The bibliography was limited to sources published before 1851 for reasons of time and space. The extension of the work through 1860 would have doubled the number of entries (Hazen, 1980).

COMPILATION PROCEDURES

The bibliography was compiled from three main groups of sources: previously published bibliographies, periodicals, and library catalogs. As a first step a "core" list of references was compiled from existing geological and related bibliographies (of which there are more than eighty). Foremost among these tools are the well-known compilations of Darton (1896), Nickles (1923), Meisel (1924–1927), and Pestana (1972). Other more specialized bibliographies on the geology of most states, on specific geological phenomena, or of a specific author, supplemented the initial list. Of course, catalogs of historical imprints by Bristol (1970), Evans (1903–1934), Sabin (1961), Shaw and Shoemaker (1958–1965), Shipton (1955), and Shoemaker (1964–) were valuable in identifying early geological publications. Approximately 4,000 references were found in previously published bibliographies, and these entries comprised the core list.

Among the core references fewer than fifty different American-published periodicals were cited. To ensure that additional periodicals containing geological literature were not omitted, we conducted a search of the *Union List of Serials* (Titus, 1965), and all pre-1851 journals were noted. More than 2,000 titles were found, and although more than half of these were extremely rare and unavailable in complete runs, nearly 1,000 complete early American journals were to be found in American libraries. Of the complete runs, approximately 700 were accessible to us, many through the *American Periodical Microfilm Series* (Xerox University Microfilms, 1975). Included in the 700 titles were all major popular, literary, review, scientific, juvenile, eclectic, agricultural, medical, military, mining, mechanical, and religious periodicals published in the United States through 1850. Each of these journal runs was examined page by page for all earth-science notes, articles, and reviews. Journal sources added almost 10,000 references to the core list.

The list of 14,000 references was further expanded by entries found during a search of the Library of Congress printed catalogs and the card catalogs of selected research libraries. The most comprehensive source is the *National Union Catalog* (Mansell, 1968–1980). All entries on an author list, compiled from all book and article authors in the list of 14,000 references, were searched in Mansell for additional entries. In addition, the card catalog of

the Baker Library of the Harvard Business School provided a source for mining and railroad company reports. Almost 1,000 book and pamphlet references were added through systematic searching of these library catalogs.

In an effort to conserve space in the final publication, the approximately 15,000 references were consolidated to 11,133 entries in three ways. Books that had multiple printings, or in some cases multiple editions, were listed under a single entry. Journal articles that appeared in two or more different periodicals were listed under a single numbered entry. Finally, dozens of short one- to nine-line notices on similar topics from a given periodical (e.g., notes on mining in *Niles' Weekly Register* or notes on volcanoes in *Scientific American*) were combined and listed as single entries.

The bibliography is still incomplete for several types of published sources. Perhaps the least complete portion is the listing of mining and railroad company publications (share advertisements, stockholders' reports, mine geology reports, articles of incorporation, and bylaws), which must have been published for many of the hundreds of operating mines in the United States. Only about 300 mining imprints were found in our search, and it is anticipated that many more will be found by other researchers. It is also to be expected that other earth-science articles will be found in the 1,300 periodicals not examined by us. However, we have included all scientific journals, and most of the omitted titles had only one or two volumes published. Therefore, it seems certain that the great majority of such articles have been listed.

ORGANIZATION AND PRESENTATION

The gathering of references is more than half the bibliographer's battle. The remaining tasks—organization and presentation—have been made vastly easier since the advent of word processing. The first, and most time-consuming, step in preparing a list of references for publication is the clerical operation of typing the entries into magnetic storage (usually a magnetic diskette). It is desirable to select a consistent set of abbreviations for periodical titles before typing the reference list. This reference list must be proofread with extreme care, but this is the last time the proofreading needs to be done. When the typing is complete it is a simple matter to arrange the references automatically, whether alphabetically by author, chronologically, by place of imprint, or in other ways with a word-processing system. The entire file of references, which was typed in arbitrary order, may thus be arranged in a preferred sequence. Additional information, such as author dates, can be added manually.

It is desirable, for ease in handling cross-references and for use in indexing (see below), to assign each reference a consecutive number. It is possible to assign these numbers automatically after the reference file is in its final sequence. Thus, there will be no errors in numbering from the first through the final entry.

In the final step before printing the bibliography the references must be transformed into an easy-to-read format. We prefer an arrangement in which

the references are listed alphabetically by author, then chronologically within each author entry, with the reference number, author, and date each appearing in a separate set of columns. This format is easy to read, and specific reference numbers, authors, or years may be located rapidly.

Modern letter-quality printers produce high-quality copy that is suitable for direct transfer to printing plates. *American Geological Literature*, for example, was produced in this fast and inexpensive way. The number of characters per line and lines per inch must be carefully scaled to ensure efficient use of the printed page without loss of legibility. A print density of 18 characters per inch and 12 lines per inch is satisfactory for most reference works. Page numbers, alphabetic keys, or consecutive reference numbers can be added by the printer at the top of each page.

INDEXING

If the reference list is the heart of a bibliography, the index is its soul. Without an accurate and detailed index even the most comprehensive bibliography is of limited use to any but the most dedicated users. Word processing has facilitated the rapid and accurate indexing of bibliographies; time savings of 90% compared with manual indexing are typical. The following procedures constitute one method of "computerized" indexing.

The bibliographer must first assign key words or index terms to each reference. This information is typed into a master index file, which for each bibliographic entry contains the reference number followed by any desired number of key words. Consider, for example, a hypothetical reference number 1347, an article on gold mining in California with special emphasis on geological setting and mine safety. Index entries might include "California/Gold Mining", "Gold Mining/California", "California/Geology", and "Mine Safety." The master index file entry for this article would appear as follows:

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1347
California$Gold Mining
California/Geology
Mine Safety
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The symbol "\$" is used to indicate that both "California" and "Gold Mining" are to appear as main headings, with the other as subheading. The symbol "/" is used to indicate that only "California" is a main heading and "Geology" is the subheading. The use of "Mine Safety" alone indicates that there is no subheading. Typing of the master index file may be streamlined by substituting abbreviations for commonly used key words or phrases (e.g., "CF" for California or "GM" for Gold Mining). These abbreviations may be expanded automatically after the entire master index file has been typed. Proofreading of reference numbers is best done from the master index file. Each number appears only once, and numbers should be in consecutive order in this file.

The master index file, when complete, consists of a number and key words for each reference. The master file is transformed into final form in two

TABLE 1 Three steps in the production of indices with a word processing system. Hypothetical references 1347 through 1350 are given as examples.

STEP 1: Master Index File Typing this file into magnetic storage is the first step in production of an index.	STEP 2: Expanded Index File This file is in alphabetical order and is generated automatically from the master index file.	STEP 3: Final Index File This file, which is suitable for printing, is generated automatically from the expanded index file.
1347 California\$Gold Mining California/Geology Mine Safety 1348 Massachusetts/Geology Massachusetts\$Geological Maps Massachusetts\$Coal Mining 1349 Mine Safety Connecticut\$Copper Mining Connecticut\$Coal Mining 1350 Granite\$Russia Building Stones/Granite	Building Stones/Granite: 1350 California/Geology: 1347 California/Gold Mining: 1347 Coal Mining/Connecticut: 1349 Coal Mining/Massachusetts: 1348 Connecticut/Coal Mining: 1349 Connecticut/Copper Mining: 1349 Copper Mining/Connecticut: 1349 Geological Maps/ Massachusetts: 1348 Gold Mining/California: 1347 Granite/Russia: 1350 Massachusetts/Coal Mining: 1348 Massachusetts/Geological Maps: 1348 Massachusetts/Geology: 1348 Mine Safety: 1347 Mine Safety: 1349 Russia/Granite: 1350	Building Stones Granite: 1350 California Geology: 1347 Gold Mining: 1347 Coal Mining Connecticut: 1349 Massachusetts: 1348 Connecticut Coal Mining: 1349 Copper Mining: 1349 Copper Mining Connecticut: 1349 Geological Maps Massachusetts: 1348 Gold Mining California: 1347 Granite Russia: 1350 Massachusetts Coal Mining: 1348 Geological Maps: 1348 Geology: 1348 Mine Safety: 1347, 1349 Russia Granite: 1350

steps, as illustrated in Table 1. In the first step the file is automatically edited so that each separate index entry is expanded into full form and placed in alphabetical order. Thus, the three line entries for reference 1347 above now appear as four entries (heading/subheading:number) in correct order:

- California/Geology:1347
- California/Gold Mining:1347
- Gold Mining/California:1347
- Mine Safety:1347

At this point it is especially easy to proofread the index headings and subheadings for consistency of spelling and usage. This expanded index file, like any computer file, can be revised and edited by hand.

The final automatic editing procedure is the consolidation of all main headings and subheadings, with reference numbers following in numerical order (Table 1). Additional index information, such as *see* and *see also* entries, should be added to this file by hand. Like the main body of the bibliography, the final index file may be printed on a letter-quality machine for direct publication.

It should be emphasized that this indexing procedure completely eliminates the time-consuming and error-prone use of index cards. Proofreading is greatly simplified, and index typing and formatting are completely automated. It should also be noted that this index procedure is equally applicable to books and manuscripts, where page numbers may be substituted for reference numbers.

CONCLUSIONS

The production of a bibliography has always been, and likely always will be, a time-consuming task. As a result of recently available library reference works and reproductions of rare eighteenth and nineteenth century sources, the bibliographer's task has been made significantly easier. Word processing has resulted in faster, more accurate, and more economical production of these bibliographies.

The production of a comprehensive bibliography for all aspects of American-published natural history through 1850 is certainly an obtainable goal. *American Geological Literature*, with 15,000 references, was completed in the equivalent of one-and-a-half years of work by one person, following procedures outlined above. A comprehensive bibliography of botany or zoology would probably contain no more than two to three times that number of entries, so the time scale of such an endeavor is not unreasonable. The rewards of such a project would more than repay the dedicated bibliographer.

REFERENCES

- BRISTOL, R. P., 1970 *Supplement to Charles Evans' American Bibliography*. Charlottesville: University Press of Virginia, 636 p.
- DARTON, N. H., 1896 Catalogue and index of contributions to North American geology, 1732-1891. *U.S. Geological Survey Bulletin* 127, 1045 p.
- EVANS, C., 1903-1934 *American Bibliography*. Chicago: Blakely Press, 12 v.
- HAZEN, R. M., 1980 Publication in American geology to 1850. *Journal of Geological Education* 28:249-255.
- HAZEN, R. M., and HAZEN M. H., 1980 *American Geological Literature, 1669 to 1850*. Stroudsburg, PA: Dowden, Hutchinson and Ross, Inc., 431 p.
- MEISEL, M., 1924-1927 *A Bibliography of American Natural History*. New York: Premier Publishing Co., 3 v.
- MANSELL [publisher], 1968-1980 *National Union Catalog: Pre-1956 Imprints*. London: Mansell, 680 v.
- NICKLES, J. M., 1923 Geological Literature on North America, 1785-1918. *U.S. Geological Survey Bulletin* 746. 1167 p.
- PESTANA, H. R., 1972 *Bibliography of Congressional Geology*. New York: Hafner Publishing Co., 285 p.
- SABIN, J., 1961 *A Dictionary of Books Relating to America, from Its Discovery to the Present Time*. Amsterdam: N. Israel, 29 v.
- SHAW, R. R., and SHOEMAKER R. H., 1958-1965 *American Bibliography: A Preliminary Checklist*. New York: Scarecrow Press, 19 v., Addenda.
- SHIPTON, C. K., 1955 *Charles Evans' American Bibliography*, Volume 13. Worcester, Massachusetts: American Antiquarian Society.

SHOEMAKER, R. H., 1964 (continuing) *Checklist of American Imprints, 1820-*. New York: Scarecrow Press.

TITUS, E. B., ed., 1965 *Union List of Serials in Libraries of the United States and Canada*, 3rd edition. New York: H. W. Wilson, 5 v.

XEROX University Microfilms, 1975 *American Periodicals, 1700-1900: A Consolidated Bibliography*. Ann Arbor, MI:Xerox University Microfilms, 30 p.