

## Characteristics of Use of Geology Literature

*A citation analysis was made of a selection of the geology literature to determine the characteristics of literature use in current geologic research. More than three-fourths of the citations examined were to serial literature. More than 87 per cent were to literature in the English language. More than one-third were to publications that had appeared during the previous five years. Forty-six titles included half of the journal articles cited. Only 59 per cent of the references were to journals classed by LC in geology; the balance fell in other disciplines.*

**G**EOLOGIC LITERATURE apparently does not become outdated as rapidly as the literature of some other sciences.<sup>1</sup> A dozen years have elapsed since the last major study on the topic, and this span was believed to be sufficient to warrant another analysis of geologic literature.

It has been the purpose of this study to analyze the characteristics of use of the literature of geology. The characteristics were defined by Stevens<sup>2</sup> and included:

1. The form, whether book, serial, or other, that the literature of geology took.
2. The language distribution of the literature.
3. The time span over which the literature remained useful to researchers.
4. The title distribution which gave an

<sup>1</sup> Charles Harvey Brown, *Scientific Serials: Characteristics and Lists of Most Cited Publications in Mathematics, Physics, Chemistry, Geology, Physiology, Botany, Zoology, and Entomology*. ("ACRL Monograph Number 16," [Chicago: Association of College and Research Libraries, 1956]), p. 106-7.

<sup>2</sup> Rolland E. Stevens, *Characteristics of Subject Literatures*. ("ACRL Monograph Number 6," [Chicago: Association of College and Research Libraries, 1953]), p. 12-17.

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indication of the number of sources which had to be consulted in order to keep abreast of a subject specialization.

5. The number of different subject areas which contained information useful to a geologist.

There have been three studies in the past similar to the present one. The Gross and Woodford analysis<sup>3</sup> of 1931 examined six American serials published in 1929. From the study can be determined the form dispersion, temporal span, language dispersion, title distribution, and the subject dispersion of the geologic literature of the period. Both Brown<sup>4</sup> and LaoSunthara<sup>5</sup> conducted studies of the serial literature of geology in 1956. Brown analyzed the 1953 and 1954 issues of the journals used as source journals in the Gross and Woodford study. The same dispersions, with the exception of form distribution, were discussed by, or could be gathered from, the Brown study. Brown mentioned

<sup>3</sup> P. L. K. Gross and A. O. Woodford, "Serial Literature Used by American Geologists," *Science*, LXXIII (June 19, 1931), 660-64.

<sup>4</sup> Brown, *op. cit.*, p. 189.

<sup>5</sup> Maria Eugenia LaoSunthara, "Some Bibliographical Characteristics of Serial Literature in the Field of Geology" (unpublished doctoral dissertation, Indiana University, Bloomington, 1956), 94p.

form dispersion specifically only insofar as citations to books were concerned.<sup>6</sup>

As the basis of a pilot study, Lao-Sunthara utilized the 1952 issues of six of the journals Gross and Woodford found to be most important in their analysis. The pilot study served to determine the source journals for the main investigation. The characteristics analyzed in the present study were covered by Lao-Sunthara.

The data for this study were obtained from ten source journals which were chosen by requesting that a selected group of librarians in charge of geologic collections from all parts of the United States rank geologic serials in the order of importance to their libraries. The 1960 and 1965 issues of the source journals were studied. The source journals were: *Geological Society of America; Bulletin, Journal of Geology, American Association of Petroleum Geologists; Bulletin, American Journal of Science, U.S. Geological Survey; Bulletin, U.S. Geological Survey; Professional Paper, Economic Geology, American Mineralogist; Journal of Geophysical Research; Journal of Paleontology.*

Citation counting was used, and for each citation was recorded its subject area, title, language, form, and its date. It was decided that only a sample of the total population was necessary in order to analyze the literature, and through the use of a statistical formula found in Yamane<sup>7</sup> the necessary sample size was deter-

mined. The formula was  $n = \frac{N}{1 + Ne^2}$  where  $n$  = the size of the sample,  $N$  = the total population,  $e$  = the error in per cent. The sample size for both 1960 and 1965 was increased to four hundred to facilitate later computations. After finding the sample size, the most straightforward method of obtaining a

distribution sample from population, according to Wert,<sup>8</sup> consists of choosing the individual cases by unrestricted random sampling, with the aid of a table of random numbers, an easily applied device for selecting a random sample from population, each number of which can be identified and numbered. The table of random numbers used in this study was The Rand Corporation's *A Million Random Digits.*<sup>9</sup>

The findings of this analysis show that:

1. Serial literature was the most important form of literature used by geologists. In 1965, 75.5 per cent of the citations were to periodicals, with 21.5 per cent to books, and the balance, 3 per cent, divided between maps, theses, and other unpublished papers. Table 1 is an analysis of the form dispersion for 1960 and 1965.

2. The language distribution of geologic literature was low when compared to that of some other subject literatures.<sup>10</sup> Eighty-seven and one half per cent of the citations were to materials published in English in 1965. German was the most frequently used foreign language, followed by French and Dutch. Table 2 indicates the language dispersion for 1960 and 1965.

3. In 1965, the temporal distribution of the literature was high. It was determined that the geologist involved in research would have to go back fifteen years to search about 70 per cent of the useful literature, and about twenty-five years to search about 80 per cent of the literature. An analysis of the temporal dispersion is found in Table 3.

4. The title dispersion for the litera-

<sup>8</sup> James E. Wert, Charles O. Neidt, and J. Stanley Ahmann, *Statistical Methods in Educational and Psychological Research* (New York: Appleton-Century-Crofts, Inc., 1954), p. 108-109.

<sup>9</sup> The Rand Corporation, *A Million Random Digits with 100,000 Normal Deviates* (Glencoe, Illinois: The Free Press, 1955), 400 and 200 p.

<sup>10</sup> The various dispersions of other subjects literature may be found in Stevens' *Characteristics of Subject Literatures.*

<sup>6</sup> Brown, *op. cit.*, p. 106.

<sup>7</sup> Taro Yamane, *Statistics; an Introductory Analysis*, 2d ed. (New York: Harper and Row, 1967), p. 579-81.

TABLE 1  
FORM DISPERSION OF GEOLOGIC LITERATURE

Form of References	Number of Citations 1960	Per Cent of Citations 1960	Number of Citations 1965	Per Cent of Citations 1965
Serials . . . . .	317	79.2	302	75.5
Books . . . . .	70	17.5	86	21.5
Maps . . . . .	7	1.7	7	1.7
Theses . . . . .	3	0.8	3	0.8
Other Unpublished Papers . . . . .	3	0.8	2	0.5
Totals . . . . .	400	100.0	400	100.0

TABLE 2  
LANGUAGE DISPERSION OF GEOLOGIC LITERATURE

Language of Material Cited	Number of Citations 1960	Per Cent of Citations 1960	Number of Citations 1965	Per Cent of Citations 1965
English . . . . .	349	87.3	350	87.5
German . . . . .	6	1.5	15	3.8
French . . . . .	13	3.2	10	2.5
Dutch . . . . .	2	0.5	10	2.5
Italian . . . . .	4	1.0	—	—
Japanese . . . . .	7	1.8	3	0.8
Norwegian . . . . .	3	0.8	—	—
Russian . . . . .	5	1.2	3	0.8
Czechoslovak . . . . .	—	—	2	0.5
Swedish . . . . .	3	0.8	2	0.5
Austrian . . . . .	—	—	1	0.3
Belgian . . . . .	—	—	1	0.2
Danish . . . . .	3	0.8	1	0.2
Greenlandic . . . . .	—	—	1	0.2
Spanish . . . . .	2	0.5	1	0.2
Brazilian . . . . .	1	0.2	—	—
Finnish . . . . .	1	0.2	—	—
Icelandic . . . . .	1	0.2	—	—
Totals . . . . .	400	100.0	400	100.0

TABLE 3  
TEMPORAL DISPERSION OF GEOLOGIC LITERATURE

Years of Publication	Number of Citations 1960	Per Cent of Citations 1960	Number of Citations 1965	Per Cent of Citations 1965
1961-1965 . . . . .	—	—	141	35.3
1951-1960 . . . . .	207	51.8	148	37.0
1941-1950 . . . . .	77	19.3	42	10.5
1931-1940 . . . . .	46	11.5	22	5.5
1921-1930 . . . . .	21	5.2	17	4.2
1911-1920 . . . . .	22	5.5	8	2.0
1901-1910 . . . . .	5	1.2	8	2.0
1900 and Earlier . . . . .	22	5.5	14	3.5
Totals . . . . .	400	100.0	400	100.0

TABLE 4  
TITLE DISPERSION FOR 1960

Rank	Title	Number of Citations	Per Cent of Citations	Cumulative Per Cent of Citations
1	Geological Society of America. Bulletin	28	7.00	
2	U.S. Geological Survey. Bulletin	17	4.25	11.25
3	U.S. Geological Survey. Professional Paper	15	3.75	15.00
4	Economic Geology	11	2.75	17.75
5	American Association of Petroleum Geologists. Bulletin	9	2.25	20.00
6	American Journal of Science	8	2.00	22.00
6	Journal of Geology	8	2.00	24.00
8	Journal of Paleontology	6	1.50	25.50
9	Journal of Geophysical Research	5	1.25	26.75
10	American Mineralogist	4	1.00	27.75
10	Gulf Coast Association of Geological Societies Transactions	4	1.00	28.75
10	Mineralogical Magazine	4	1.00	29.75
10	Nature	4	1.00	30.75
10	Royal Astronomical Society. Monthly Notices, Geophysical Supplements	4	1.00	31.75
10	Royal Society of London. Proceedings	4	1.00	32.75
10	Science	4	1.00	33.75
17	Akademiia Nauk SSSR. Doklady	3	0.75	34.50
17	Canada. Geological Survey. Memoirs	3	0.75	35.25
17	Canada. Geological Survey. Summary Report	3	0.75	36.00
17	Geological Society of America. Special Paper	3	0.75	36.75
17	Institute of Radio Engineers. Proceedings	3	0.75	37.50
17	U.S. Bureau of Mines. Report of Investigations	3	0.75	38.25
23	Academy of Natural Sciences of Philadelphia. Proceedings	2	0.50	38.75
23	American Chemical Society. Journal	2	0.50	39.25
23	American Meteorological Society. Bulletin	2	0.50	39.75
23	Arkiv for Mineralogi och Geologi	2	0.50	40.25
23	California. University. Department of Geological Sciences. Bulletin	2	0.50	40.75
23	Discovery Reports	2	0.50	41.25
23	Eclogae Geologicae Helvetiae	2	0.50	41.75
23	Geochimica et Cosmochimica Acta	2	0.50	42.25
23	Geological Society of America. Memoirs	2	0.50	42.75
23	Geological Society of London. Quarterly Journal	2	0.50	43.25
23	Harvard University. Museum of Comparative Zoology. Bulletin	2	0.50	43.75
23	Japan. Geological Survey. Bulletin	2	0.50	44.25
23	Journal of Atmospheric and Terrestrial Physics	2	0.50	44.75
23	Journal of Geomagnetism and Geoelectricity	2	0.50	45.25
23	Neues Jahrbuch fur Mineralogie, Geologie und Palaontologie	2	0.50	45.75
23	New York. State Museum. Bulletin	2	0.50	46.25
23	Physical Review	2	0.50	46.75
23	Royal Society of London. Philosophical Transactions	2	0.50	47.25
23	Societe Geologique de France. Bulletin	2	0.50	47.75
23	Societe Geologique de France. Memoires	2	0.50	48.25

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TABLE 4 (Continued)

Rank	Title	Number of Citations	Per Cent of Citations	Cumulative Per Cent of Citations
23	U.S. Geological Survey. Annual Report	2	0.50	48.75
23	U.S. National Bureau of Standards. Journal of Research	2	0.50	49.25
23	U.S. Weather Bureau. Monthly Weather Review	2	0.50	49.75
23	Washington Academy of Sciences. Journal	2	0.50	50.25
47	One hundred ninety-nine titles with one citation each: 116 serials, 70 books, 7 maps, 3 theses, 3 other unpublished papers	199	49.75	100.0

ture was high. In 1960, the first forty-six journals accounted for just over 50 per cent of the literature, and in order to cover 75 per cent of the literature, one had to search 145 titles. Table 4 indicates the title dispersion for 1960. In 1965, the first thirty-seven serials accounted for 50 per cent of the literature, and in order to cover 75 per cent of the literature, one had to search 127 titles. Table 5 indicates the title dispersion for 1965.

The subject distribution of geologic literature was also high. Subjects other than geology accounted for 43 per cent of the literature used by research geologists in 1960 and 40.8 per cent in 1965. Table 6 is an analysis of the subject dispersion.

The findings of this study have several implications for libraries which either have geologic research collections or are contemplating such collections. Tables 4 and 5, which indicate the title dispersions for 1960 and 1965, may serve as guides to determine which titles to obtain on first purchase. In addition, since these titles have been the most useful to research workers in geology, the tables may offer help in determining which serials to bind for future reference.

Since it was found that serials were the most common form of literature used, a library may decide to allocate the majority of its budget for the pur-

chase of periodicals and divide the balance among the other useful forms of literature.

Because of the dependence upon literature in subject areas other than geology, librarians in charge of geologic collections in a departmentalized university library may work cooperatively with other departments to avoid purchase duplications. In a centralized collection, the geologic researcher will be best served by locating other useful subject areas such as physics and mining engineering near the geologic collection. Librarians in charge of specialized geologic collections must also be aware of these other subject areas so as to be able to provide researchers with the necessary material either through purchase or interlibrary loan.

In hiring personnel, a lack of a language proficiency would seem to be no great barrier to employment, although a working knowledge of French or German would prove helpful.

The temporal distribution may serve as a guide to librarians, indicating to them the degree to which useful information is found in the geologic literature of the past, and should, therefore, be kept in the collection. The temporal dispersion may also serve as a guide to librarians desiring to purchase backfiles of periodicals by indicating how far back in time to purchase.

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TABLE 5  
TITLE DISPERSION FOR 1965

Rank	Title	Number of Citations	Per Cent of Citations	Cumulative Per Cent of Citations
1	Geological Society of America. Bulletin	29	7.25	
2	Journal of Geophysical Research	23	5.75	13.00
3	Economic Geology	15	3.75	16.75
4	American Association of Petroleum Geologists. Bulletin	12	3.00	19.75
5	U.S. Geological Survey. Bulletin	10	2.50	22.25
5	U.S. Geological Survey. Professional Paper	10	2.50	24.75
7	Science	9	2.25	27.00
8	Journal of Paleontology	8	2.00	29.00
9	American Mineralogist	6	1.50	30.50
9	Geochimica et Cosmochimica Acta	6	1.50	32.00
11	Geological Society of America. Memoirs	5	1.25	33.25
12	American Journal of Science	4	1.00	34.25
12	Journal of Geology	4	1.00	35.25
12	Journal of Sedimentary Petrology	4	1.00	36.25
12	Nature	4	1.00	37.25
12	Physical Review	4	1.00	38.25
17	Acta Crystallographica	3	0.75	39.00
17	Mineralogical Magazine	3	0.75	39.75
17	Ohio. Geological Survey. Bulletin	3	0.75	40.50
17	Seismological Society of America. Bulletin	3	0.75	41.25
17	U.S. Geological Survey. Water-Supply Paper	3	0.75	42.00
22	Academy of Natural Sciences of Philadelphia. Proceedings	2	0.50	42.50
22	Akademiia Nauk SSSR. Izvestiya. Seriya Geofizicheskaya	2	0.50	43.00
22	American Geophysical Union. Transactions	2	0.50	43.50
22	Bulletins of American Paleontology	2	0.50	44.00
22	Canada. Geological Survey. Memoirs	2	0.50	44.50
22	Colorado Scientific Society. Proceedings	2	0.50	45.00
22	Eclogae Geologicae Helvetiae	2	0.50	45.50
22	Geological Society of America. Special Paper	2	0.50	46.00
22	Geologische Rundschau	2	0.50	46.50
22	Geophysical Journal	2	0.50	47.00
22	Geophysics	2	0.50	47.50
22	Georgia. Geological Survey. Bulletin	2	0.50	48.00
22	Icarus	2	0.50	48.50
22	India. Geological Survey. Memoirs	2	0.50	49.00
22	Indian Botanical Society. Journal	2	0.50	49.50
22	Journal of Applied Physics	2	0.50	50.00
22	Journal of Atmospheric and Terrestrial Physics	2	0.50	50.50
22	Journal of Chemical Physics	2	0.50	51.00
22	Physical Review Letters	2	0.50	51.50
22	Physical Society of London. Proceedings	2	0.50	52.00
22	Philosophical Magazine	2	0.50	52.50
22	Planetary and Space Science	2	0.50	53.00
22	Scientific American	2	0.50	53.50
22	Societe Geologique de France. Bulletin	2	0.50	54.00
22	Soil Science	2	0.50	54.50
22	Space Research	2	0.50	55.00
48	One hundred eighty titles with one citation each: 82 periodicals, 86 books, 7 maps, 3 theses, 2 other unpublished papers	180	45.00	100.00

TABLE 6  
SUBJECT DISTRIBUTION OF GEOLOGIC LITERATURE

Subject Area	Number of Citations 1960	Per Cent of Citations 1960	Number of Citations 1965	Per Cent of Citations 1965
Geology (QE)	228	57.0	237	59.2
Physics (QC)	40	10.0	79	19.8
Science, General (Q)	50	12.5	30	7.5
Mining Engineering.				
Mineral Industries (TN)	21	5.2	8	2.0
Astronomy (QB)	7	1.8	7	1.8
Chemistry (QD)	6	1.5	7	1.8
Natural History (QH)	11	2.7	7	1.8
Mathematics (QA)	2	0.5	4	1.0
Agriculture (S)	5	1.2	3	0.8
Electrical Engineering and Industries (TK)	—	—	3	0.8
Aeronautics (TL)	—	—	2	0.5
Botany (QK)	5	1.2	2	0.5
Chemical Technology (TP)	2	0.5	2	0.5
Engineering, General.				
Civil Engineering (TA)	3	0.8	2	0.5
Technology, General (T)	1	0.2	2	0.5
Economic History and Conditions (HC)	1	0.2	—	—
Geography, General (G)	3	0.8	1	0.2
Oceanology and Oceanography (GC)	3	0.8	1	0.2
Publications of Learned Societies, General (AS)	2	0.5	1	0.2
Student Fraternities and Societies, U.S. (LJ)	—	—	1	0.2
Zoology (QL)	3	0.8	1	0.2
Totals	400	100.0	400	100.0

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