Essays of an Information Scientist, Vol:2, p.102-106, 1974-76 Current Contents, #30, p.5-9, July 24, 1974

"Current Comments"

Journal Citation Studies. X. Geology and Geophysics

July 24, 1974 Number 30

In a recent issue of *Nature*,[1] there is a discussion of a semantic professional confusion between geology and geophysics. A similar confusion is found in attempts to classify and name important 'geology' journals.

When we published our first comprehensive citation analysis of scientific journals, two short lists were included.[2] The first list ranked the 152 most cited journals of science. The second list ranked the 152 journals with highest impact. The impact was calculated by dividing citations of those journals in 1969 by the number of articles they had published in 1967 and 1968.

In a letter to the editor of *Science* N.C. Janke of the Department of Geology of the California State University at Sacramento warned against the misuse of citation data in evaluating journals by "harried" librarians and administrators who "would be unlikely to analyze the analysis" fruitfully.[3] My reply on that point and others included the statement that he gave "my colleagues in the library and information sciences little credit for their ability to analyze data."[4]

Janke was particularly worried that there were "no general geology journals listed in the 152 most frequently cited journals ranked by impact factor." Presumably citation analysis would work against journals in small fields like his own, where the scope of research (facilities, money, people) cannot compare, for example, with that of biomedicine, chemistry, etc. The original list I had submitted to *Science* had in fact included 565 journals. On this list certain 'geology' journals did show up.

However, the data below will demonstrate that citation analysis and *ISI's Journal Citation Reports®* (*JCR*)[5] work for 'little' science as well as for 'big' science. By use of the *JCR* we have developed a guide to the most important geological literature. Consider whether, if you were required to start a solid collection of geology journals, it would not be reasonable to base your judgments on the data below.

I would assume that you know there is a *Journal of Geology*. After all, it ranked 240th in the *JCR*. Whether you might start instead with the *Journal of Geophysical Research*, which ranked 60th, or the *Geochimica Cosmochimica Acta* (104th) depends on the inclusiveness of your definition of geology. Apparently, Janke did not consider them 'geological'.

In the *JCR*, one finds that *J. Geology* cites the following journals most frequently:

J. Geology (self-citation)
B. Geol. Soc. Amer.
Science
Amer. J. Science
J. Sediment. Petrology
B. Amer. Assoc. Petrol. Geol.
Nature
J. Geophys. Res
Geol. Soc. London Quart.
Amer. Mineralogist

If you were to assume that mineralogy is to be of major concern, you could next pick *Amer. Mineralogist*

Figure 1. Highly Cited Journals in Geology and Geophysics.

This list shows the number of times each of the journals was cited in 1969-72 by the 'geology' journals listed in Figure 2. (See reference 2 for a detailed explanation of the source of the data).

Rank	Times Cited 1961-1972	Journal Title
1.	8032	J. Geophys. Res.
2.	1704	Geochim. Cosmochim. Acta
3.	1616	Science
4.	1608	Astrophysical J.
5.	1452	Nature
6.	1292	B. Geol. Soc. Amer.
7.	1184	Economic Geology
8.	1164	B. Seismol. Soc. Amer.
9.	1164	Planet. Space Sci.
10.	1120	J. Atmos. Sci.
11.	1040	J. Sediment. Petrol.
12.	1004	J. Geology
13.	936	Amer. J. Science
14.	908	Amer. Mineralogist
15.	772	J. Atmos. Terr. Phys.
16.	748	Trans. Amer. Geophys. Union
17.	584	Soil Sci. Soc. Amer. Proc.
18.	580	Deep-Sea Res.
19.	580	Earth Planet. Sci. Lett.
20.	552	Theses
21.	528	B. Amer. Assoc. Petrol. Geol.
22.	524	Geophys. J. Roy. Astr. Soc.
23.	508	Izv. Akad. Nauk SSSR FAO
24.	460	Canad. J. Phys.
25.	432	J. Chem. Phys.
26.	428	Proc. Roy. Soc. Lond.
27.	420	Phys. Rev.
28.	416	Ann. Geophysique
29.	416	Icarus
30.	396	J. Petrology
31.	368	Soil Sci.
32.	360	Tellus
33.	336	Space Res.
34.	328	Geophysics
35.	324	Quart. J. Roy. Meteorol. Soc.
36.	320	Astron. Zh.
37.	308	J. Fluid Mech.
38.	288	New Zealand J. Geol. Geophys.
39.	280	Canad. J. Earth Sci.
40.	272	J. Marine Res.
41.	268	Mineralogical Mag.
42.	268	Rev. Geophys. Space Phys.
43.	244	Hydrocarbon Processing
44.	236	Doklady Akad. Nauk SSSR
45.	236	Geomagnetizm Aeronomiya
46.	220	Astronomical J.
47.	208	Contr. Miner. Petrol.
48.	208	Space Sci. Rev.
49.	192	Quart. J. Geol. Soc. London
50.	188	Appl. Optics
51.	184	Mon. Not. Roy. Astr. Soc.
52.	184	Radioscience
53.	180	J. Appl. Phys.
54.	180	J. Opt. Soc. Amer.
55.	176	Marine Geology
56.	176	Phil. Trans. Roy. Soc. Lond.
57.	176	Phys. Fluids
58.	172	Sov. Soil Sci.
59.	172	J. Soil Sci.
60.	168	Izv. Akad. Nauk. SSSR
61.	164	Mon. Weather Rev.
62.	164	Phys. Rev. Lett.
63.	160	J. Phys. Chem.
64.	148	Carnegie Inst. Yb.
65.	144	Geol. Mag.
66.	140	B. Earthquake Res. I.T.
67.	132	J. Appl. Meteorol.
68.	120	Acta Crystallogr.
69.	116	J. Amer. Chem. Soc.
70.	112	Philosophical Mag.
71.	112	Zschr. Kristallogr.
72.	100	Geokhimiya
73.	100	US Geol. Surv.
74.	96	J. Palaeontology
75.	96	Metallurg. J.
76.	92	J. Amer. Ceramic Soc.
77.	92	Smithsonian Contr. Astrophys.
78.	84	J. Meteor. Soc. Japan
79.	80	Comptes Rendus etc.
80.	76	Agronomy J.
81.	76	Ind. Eng. Chem.
82.	76	J. Physics
83.	76	Sedimentology
84.	76	Trans. Roy. Soc. New Zealand
85.	72	J. Geomagn. Geoelect.
86.	72	Meteorologiya Gidrologiya
87.	72	New Zealand J. Sci. Techn.
88.	68	Radiocarbon
89.	68	Rev. Mod. Phys.
90.	64	B. Amer. Meteorol. Soc.
91.	64	Geochem. Int.
92.	64	J. Geol. Soc. Australia
93.	60	Astronomy & Astrophysics
94.	60	Proc. IEEE
95.	60	Tectonophysics
96.	60	Zschr. Naturforsch.
97.	56	Agrokhimiya
98.	56	B. New Zealand Geol. Surv.
99.	56	Dev. Sediment. Petrol.
100.	56	Limnol. Oceanogr.
101.	56	Norsk Geol. Tskr.
102.	56	Opt. Spectrosc. USSR
103.	56	Rep. Ionosph. Space Res.
104.	56	Soc. Petrol. Eng. J.
105.	52	Clays Clay Minerals
106.	52	Mining Mag.
107.	48	Z. Petrol. Technol.
108.	48	Trans. Faraday Soc.

109.	44	J. Acoust. Soc. Amer.	121.	32	Chem. Geol.
110.	44	Philippine Geologist	122.	32	J. Quant. Spectrosc.
111.	44	Publ. Astron. Soc. Pacific	123.	32	Meteor. Z.
112.	44	Rev. Mod. Phys.	124.	32	Plant & Soil
113.	40	Australian J. Physics	125.	28	Australian J. Soil Res.
114.	40	B. Marine Sci.	126.	28	B. Can. Petrol. Geol.
115.	40	Fuel	127.	28	Geol. J.
116.	40	Geol. Assoc. Proc.	128.	28	Int. Geol. Rev.
117.	40	Mineralium Deposita	129.	28	J. Mol. Spectroscopy
118.	36	B. Volcanol.	130.	28	Meteor. Monogr.
119.	36	Comm. Lunar Planet.	131.	24	Proc. Nat. Acad. Sci. USA
120.	36	Res. Geochem.	132.	24	Publ. Astron. Soc. Japan

and find in the *JCR* that it cites most frequently--in addition to the journals just listed--also the following:

Zschr. Kristallogr.
Acta Crystallogr.
Mineralogical Mag.
J. Amer. Ceramic Soc.
Carnegie Inst. Yearbook
Naturwissenschaften
J. Amer. Chem. Soc.
J. Petrology

If next you pick *J. Geophys. Res.*, you find it cites most frequently, again in addition to the journals already discovered, these:

Planet. Space Sci. Lett.
Trans. Amer. Geophys. Union
B. Seismol. Soc. Amer.
Canad. J. Physics
Astrophysical J.
Phys. Rev.
J. Atmos. Terr. Phys

Since I don't know exactly what kind of 'geologist' I am working for in this instance, I continued the process until I obtained the list in Figure 1. It shows the number of times each journal was cited by 'geological' journals. I might have compiled the list by first scanning the complete multidisciplinary list of most cited journals in the *JCR*, picking out the 'geological' titles, and combining their citation data to produce the list given in Figure 1. Had I done that, I would have first come up with the list shown in Figure 2. It shows the number of times each journal was cited by all journals processed for the *Science Citation Index*®. The impact factor is also given.

The effectiveness of the *JCR* in constructing 'core' lists of this type is illustrated by the case of the *Amer. J. Science*. Assuming I had ignored it because of its deceptive title, I would soon have been alerted to its geological content because it continued to pop up on lists of journals cited by journals that were themselves cited by *J. Geology*.

I might, nevertheless, still have assumed that it is, like *Science* and *Nature*, a 'general science' journal. A few quick calculations show that it isn't. For example, *Science* was cited about 39,000 times in 1969. Although it ranks third among the journals listed in Figure 1, the 1616 citations involved account for only 4% of its total citations. On the other hand, *Amer. J. Science* was cited 1940 times in 1969, and 936 of those citations, 48%, were citations from 'geological' journals.

Any remaining doubt is removed by consulting the *JCR* to see what journals cited it. The first dozen tell the story rather quickly, since they account for 50% of the citations involved:

Amer. J. Science (self-citation)
Geol. Soc. Amer. B.
J. Sediment. Petrol.
Economic Geology
J. Petrology
Contr. Minerol. Petrol.
Earch Sci. Rev.
Geochim. Internat. USSR
Amer. Mineralogist

Figure 2. Geology and Geophysics Journals among the 1000 Most Cited Journals of Science

This list shows 'geological' journals among the 1000 most cited journals processed for the *SCI*. For each journal, the list gives total citations (by journals of any type) and impact factor (average number of citations per article published).

	Times Cited 1969	Impact Factor	Journal Title
1.	2408	2.253	Amer. J Science
2.	2516	1.058	Amer. Mineralogist
3.	736	1.132	Ann. Geophysique
*4.	1188	0.785	B. Amer. Assoc. Petrol. Geol.
5.	1376	2.039	B. Seismol. Soc. Amer.
6.	508	0.931	Canad. J. Earth Sci.
7.	1240	1.893	Deep-Sea Res.
8.	1076	2.262	Earth Planet. Sci. Lett.
9.	1580	1.246	Economic Geology
10.	3256	2.725	Geochim. Cosmochim. Acta
*11.	380	0.144	Geol. Mag.
*12.	416	0.100	Geomagnetizm Aeronom.
13.	896	1.635	Geophys. J Roy. Astr. Soc.
14.	616	0.358	Geophysics
15.	512	0.446	Hydrocarbon Processing
16.	520	0.961	Izv. Akad. Nauk SSSR Fiz. Atmos. Okeana
17.	776	1.697	Icarus
*18.	572	0.155	Izv. Akad. Nauk SSSR Ser. Geofiz.
19.	1940	2.016	J. Atmos. Sci.
20.	1568	1.642	J. Atmos. Terr. Phys.
21.	2120	1.871	J. Geology
22.	14284	3.665	J. Geophys. Res.
*23.	452	0.386	J. Palaeontology
24.	760	4.965	J. Petrology
25.	1692	1.726	J. Sediment. Petrol.
26.	512	0.861	J. Soil Sci.
27.	684	0.640	Mineralogical Mag.
28.	468	0.598	New Zealand J. Geol. Geophys.
29.	2032	2.753	Planet. Space Sci.
30.	524	4.685	Rev. Geophys. Space Phys.
31.	536	1.573	Soc. Petrol. Eng. J.
*32.	2528	0.923	Soil Sci.
33.	2156	0.867	Soil Sci. Soc. Amer. Proc.
34.	376	0.099	Soviet Soil Science
35.	544	2.492	Space Sci. Rev.
36.	952	1.114	Tellus
37.	1372	0.136	Trans. Amer. Geophys. Union

***Journals marked with an asterisk occur among the 1000 most cited in 1969, but did not contribute to development of the 'geological' list in Figure 1. These journals either began publication after 1969, were not covered in 1969, or have not yet been included among source journals processed in detail for cited/citing relationships for the *ISI Journal Citation Reports*.**

J. Geology
Mineralogical Mag.
Nature
Sedimentology

While *Nature* is clearly not pure geology, it ranks as the fifth most important journal in the field. Perhaps the most dramatic result of the analysis was the discovery that the small *Journal of Petrology* which ranked 636th in terms of total citations ranked 50th in terms of impact. An interesting item on the list is number 20, "Theses". In few of the lists we have compiled have theses figured so prominently. Sixty-eight of these citations are of theses from the Oregon State University.

I hope this demonstration, in addition to supplying useful lists for geologists and their information science colleagues, will also allay any fears that citation analysis discriminates against specialties, either in evaluating a collection or in building one.

1. Runcorn, S.K. Geology ⊃ geophysics? [A letter to the editor of] *Nature* 249 (5460):794, 28 June 74. – As this editorial went to press, the then current issue of *Nature* included Runcorn's letter on the professional and scientific relationship between geology and geophysics in the UK. There the work of geophysics has been "faithfully discharged . . . by the Royal Astronomical Society to the mystery of our friends abroad" since, earlier in the century, the Geological Society "refused to take geophysics under its wing." That fact, and not only the advent of space flight, causes 'astronomy' and 'astrophysics' journals to appear on our lists of 'geology' journals. As Runcorn points out, there is little sense any longer in the quibble. If geology began primarily as the science of Earth as a rock, it must now encompass our knowledge of Earth and its moon as rocks floating in space.

2. Garfield, E. Citation analysis as a tool in journal evaluation. *Science* 178:471-79, 1972. Reprinted in *Current Contents® (CC®)* No. 33, 15 August 1973, p. 5-6.

3. Janke, N.C. Journal evaluation. [A letter to the editor of] *Science* 182:1196-97, 1973.

4. Garfield, E. Journal evaluation. [A letter to the editor of] *Science* 182:1197-98, 1973.

5. ———. The new *ISI Journal Citation Reports* should significantly affect the future course of scientific publication. *Current Contents (CC)* No. 33, 15 August 1973, p. 5-6.