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EDITORIAL

A new high JIF for *American Mineralogist* (by all early indications), why you shouldn't care, and a note on values

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The onset of summer means many things—baseball, fresh stone fruit, camping in the Sierra, and of course, the new Journal Impact Factors (JIF). As you read this Editorial the JIF report has likely already been released, and we expect *American Mineralogist* has climbed significantly in the rankings (see reasoning below). We (perhaps prematurely) thank our authors, as this increase is due entirely to the support of those who entrust their very best works to the journal—an act utterly crucial for any journal to survive, especially in recent decades for journals published by scientific societies. Here we provide some muted celebration of the anticipated event with some qualifying context.

As noted earlier (Putirka 2016), baseball fans put vastly more effort into deciding whether Don Sutton or Tom Seaver was the better pitcher than scientists do in ranking journals or one another. We don't know why. But this is not to say that rankings are meaningless. And they can be fun, especially when the stakes are low and when they provide unexpected results (my heart says "Sutton"; the numbers say "Seaver"). Oftentimes, though, rankings have far-reaching impact. For example, the failed news magazine *U.S. News and World Report* (USN&WR), ironically releases its college and university rankings each fall. These rankings affect how thousands of families spend tens to hundreds of thousands of dollars. But a now-defunct news magazine is not the only game in town. The profitable *Washington Monthly* (or WM) also ranks colleges and universities. To cite their online editorial, they rate "*schools based on what they are doing for the country. It's our answer to* U.S. News & World Report*, which relies on crude and easily manipulated measures of wealth, exclusivity, and prestige*".

As it happens, in 2016 WM ranks Fresno State 25th in the nation, among 303 of the supposed best universities in the U.S. (see: http://washingtonmonthly.com/college_guide); this compares to Fresno State's rank of 220 (out of 310) in USN&WR's catalog of "National Universities." Familiar names top WM's list: Stanford at no. 1, Harvard at no. 2. At 25th, Fresno State is about the equal of Columbia (no. 23), Cornell (no. 27), The University of Wisconsin-Madison (no. 28), Dartmouth (no. 29), and Virginia Tech (no. 30), somewhat better than Cal Tech (no. 34), and Rice (no. 36), and significantly better than Johns Hopkins (no. 47), Brown (no. 49), the University of Chicago (no. 92), and 269 other colleges and universities.

At this point you are likely asking: Is WM some fly-by-night publisher based in Clovis? Is Fresno State really better than the University of Chicago? And what makes any ranking valid anyway? Good questions all, and the answers are: "No," "In many respects, 'Yes'," and "Whatever it is you value." Fresno State ranks low in the USN&WR catalog because those editors value "reputation" and the money that comes into a university. They also really like it when prospective students are turned away in droves. In contrast, WM values "social mobility" (where Fresno State ranks 27th overall) and "Community Service" (where Fresno State ranks 4th and 20th nationally, by two different of their measures). And the WM rankings include another 20 criteria, which like USN&WR include graduation rates, but unlike USN&WR also account for the incomes earned by students following graduation, as compared to expected incomes as predicted by SAT scores. WM also includes a reputation factor, not as an opinion survey as in USN&WR, but by counting how many faculty earn "significant awards" (Fresno State being tied among many for last, with a score of zero). However, in the WM rankings, universities can't ride the reputation train for free: this factor carries a small weight compared to the combined weights attributed to enrollment of first-generation students, the numbers of students that go on to earn Ph.D.s, student income 10 years after graduation, and whether universities can do all this while maintaining a reasonable tuition.

Are the WM rankings better? It depends upon what you value. For example, one of my alma maters, the California State University-Los Angeles (or Cal State LA), doesn't appear at all in the WM catalog, nor is it among the 310 "National Universities" in USN&WR, where it instead ranks 61st among USN&WR's "Regional Universities West". But Cal State LA is ranked no. 1 in the nation among 2202 colleges and universities examined by the Equality of Opportunity Project or EOP (see: http://www.equality-of-opportunity.org/, 2017). In the EOP, Cal State LA outshines not just Fresno State, but Stanford, Harvard, Princeton, Yale, UC Berkeley—basically everyone. In the EOP, just one measure is used: "upward mobility" (albeit measured in various ways). In their highlighted ranking, upward mobility is taken as the percentage of students that move from the bottom to the top quintile of income earners in the U.S. The editors' motivation stems from an observation: a 30-year-old born in 1940 had a 90% chance of earning more money than their parents; but for a 30-year-old born in 1984 that likelihood drops to 50%. This trend is a measure of the so-called "hollowing out of the middle class" that was much in discussion last year. The authors of the study looked at whether certain colleges or universities might do a better job of propelling their graduates up the income ladder—and there are some big differences. Cal State LA tops the list with 9.9% of their graduates moving from the bottom to the top quintile of income. How do they do it? For one, Cal State LA ranks 10th in the nation in terms of "low-income access," which they achieve by accepting 33.1% of their students from the bottom quintile of parent income, giving those students more chances to achieve. By comparison, Stanford and Harvard tap the bottom income quintile at about 1/10th the rate of Cal State LA (median parent incomes are >$170,000 at Stanford

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and Harvard, but $36,600 at Cal State LA). In addition, Cal State LA must also hire good teachers, since none of the nine universities that rank higher in "low-income access" score better than a 3.6% rate on the key upward mobility scale. Incidentally, 11 of the least selective Cal State Universities rank in the top 6% of all universities; Fresno State ranks in the top 2.5%; all CUNY schools rank in the top 2%; and another of my alma maters, Glendale Community College, ranks in the top 1%.

The WM and EOP rankings nearly (but not at all precisely) invert the sorting of USN&WR because they invert the value system. USN&WR, perhaps unwittingly, places high value on high tuition and also (purposefully) on highly select student cohorts. But both these characteristics put universities at a decided disadvantage in the WM sorting, where institutions are rewarded for offering a high-quality, affordable education to anyone willing to work hard, regardless of family background or income.

In summary, rankings express our values, whatever they may be.

Other values, and a new journal impact factor

At *American Mineralogist,* we value robust and wide-ranging discussions of peer-reviewed studies on Mineralogy, Petrology, and Geochemistry (the latter being effectively mineral chemistry in most cases), which are of sufficiently broad interest to warrant international-scale publication. Our hope is that most papers that we publish will be reasonably well cited. We are also happy to publish articles that might only rarely be cited, but where reviewers indicate that the articles might warrant wide discussion in classrooms, electronic social media, or newspapers (as illustrated earlier this year by Hazen et al.). In effect, we hope that our articles are influential in some way.

But how do we quantify influence? Citations are a vital measure. But *American Mineralogist* subscribers, being particularly thoughtful and discerning, will know that JIF, or H-index, are simplistic measures, providing no substitute for a sense of judgment. So while we're pleased about our presumed elevated JIF—we're not hosting a party. (Heck, at the time of this writing, we're not even sure the "official" JIF number went up). But Table 1 illustrates the expectation (see Table notes, regarding some of the oddities of JIF calculation). We compare total citations accrued to papers published in 2014–2015, beginning from the date of publication, until the end of 2016; our JIFtc (for "JIF-total citations") is the average number of these citations on a per-paper basis. Our JIFtc is like a JIF (and matches the time frame for the new, 2017 report), but with a subtle difference: in a JIF, it is appropriate to *only* count those citations accrued during the calendar year 2016 (for papers published in 2014–2015). For our JIFtc, we count the *total numbers of citations accrued since publication*. Why do we do this? Because it's easy. To obtain the JIF from JIFtc, one would have to go through each Web of Science entry for each paper in each journal and find only those citations that occurred in 2016. I started this Editorial in January; to verify the Thomson-Reuters JIF, I'd still be at it. But truly, if a paper published in 2014 has a total of 20 citations, does it really matter that 14 occurred in 2016 while 6 appeared in 2014–2015? Do we lose currency if we fail to disregard the first 6 citations? Probably not. And for this reason, we propose that for vastly less effort, we abandon JIF and use JIFtc instead—not because it represents a new value of assessment, but rather because like WM or Cal State LA, we value equal opportunity—no one institution should monopolize assessment of influence, and anyone with access to the Web of Science can calculate a JIFtc. Moreover, it's also easy to calculate a running value. One can just as easily calculate a JIFtc in October 2017, for papers published from October 2015 to October 2016. The result would be perfectly comparable to a JIFtc calculated in any other month, so long as a given time interval is preserved. So with the JIFtc, editors, authors, or anyone else having few hobbies and time to burn, can un-tether themselves from yearly published, and not easily reproduced, JIF rankings, provided one's institution subscribes to the Web of Science.

Valuing citations and citation rates

In Table 1, we rank *American Mineralogist* among some similar journals (also including *Science*) by H-index (the largest number of papers x that have received x or more citations), which would seem even more relevant for journals than for individual scientists. Why rank by H-index? Because it's a perfectly useful measure. And in the current JIF cycle (2014–2015), *American Mineralogist*'s H-index earns a top score among the illustrated journals (by no means comprehensive; other journals have higher scores). Note also the low H-index for *Science*, a virtue of its very low publication rate in Mineralogy/Petrology/Geochemistry (the only areas counted here). *American Mineralogist*'s JIFtc is also quite healthy; it has been close to 2.0 for several years (interestingly similar to our JIF, although technically, JIFtc should always be higher) where at 3.25 we are this year comparable to *Contributions to Mineralogy and Petrology* (CMP), whose score is 3.48 (and we're closer still if we exclude our editorials, biographical material, book reviews, etc.).

Table 1. Rankings by H-index for articles published in 2014–2015[a]

	No. of items[b]	Sum of all citations	Average citations (JIFtc[c])	H-index	Total cites for top-cited
American Mineralogist	**549**	**1782**	**3.25**	**14**	**24**
Journal of Petrology	176	903	5.13	14	25
Elements	120	621	5.18	12	69
Contributions to Mineralogy and Petrology	254	883	3.48	11	20
Journal of Metamorphic Geology	104	609	5.86	11	48
Reviews in Mineralogy and Geochemistry	50	410	8.2	11	25
Mineralogical Magazine	256	487	1.9	8	20
Physics and Chemistry of Minerals	150	406	2.71	8	33
European Journal of Mineralogy	134	309	2.31	8	18
Science[d]	8	277	34.62	6	101
Clay Minerals	102	172	1.69	6	14
Canadian Mineralogist	137	146	1.07	5	9
Clays & Clay Minerals	75	107	1.43	5	9

[a] For ease of collection, data were obtained from the Web of Science, "Create Citation Report" feature (in January 2017).

[b] The total numbers of documents are in a formal sense, too high for a JIF, for all journals noted because in its "Citation Report", the Web of Science takes the sum of articles, editorials, corrections, and biographical material (and calls these "Results"). But *American Mineralogist* published just scientific 518 articles in 2014–2015. Of our 549 "items", four are errata, and the remaining items are editorials, book reviews and biographical items. Excluding these "non-articles" the "Average Citations per Item" would be higher, as would be our reported JIFtc and the JIFtc of all other listed journals. Society-published journals are more adversely affected, as we tend to publish more in the way of book reviews, and biographical materials.

[c] JIFtc is a Journal Impact Factor based on total citations, rather than just those citations obtained in the year following publication. The JIF typically reported is expected to include only articles, and citations to such, but unlike the JIFtc, would only count citations that accrue in the calendar year 2016, not since the date of publication.

[d] For the journal *Science*, we only take papers found by searching on the "topics" of "geochemistry," "petrology," and "mineralogy."

Table 2. Total citations for articles published in 2010–2011[a]

	No. of items	Sum of all citations	Average citations (JIFtc[a])	H-index	Total cites for top cited
American Mineralogist	**443**	**6090**	**13.75**	**28**	**1069**
Journal of Petrology	184	6015	32.69	41	828
Journal of Metamorphic Geology	100	2500	25	28	222
Contributions to Mineralogy and Petrology	237	5233	22.08	36	205
Science	8	651	81.38	8	171
Elements	121	2046	16.91	28	168
European Journal of Mineralogy	164	1244	7.59	15	100
Reviews in Mineralogy and Geochemistry	62	1687	27.21	24	82
Canadian Mineralogist	215	1542	7.17	16	76
Mineralogical Magazine	142	1030	7.25	14	71
Clays & Clay Minerals	126	978	7.76	15	42
Clay Minerals	93	540	5.81	12	36
Physics and Chemistry of Minerals	149	1187	7.97	15	27

[a] As in Table 1, data were obtained from the Web of Science, "Create Citation Report" feature, in January 2017. At the time of publication of this editorial, total citations and thus JIFtc and H-index, etc., should be higher.

For all we know (at this writing) our JIF might be higher than CMP; the by-now published JIF values from Thomson-Reuters (now Clarivate Analytics) should at least put us close to CMP—and if this is not the case, then all the more reason to abandon JIF in favor of the independently reproducible JIFtc.

We should in any case abandon the one-parameter model, and instead also consider total citations, total cites for top cited papers, H-index, etc.—as if we were doing something important, like buying stocks, or putting together a fantasy baseball team. Let's first ask: how useful is the one-parameter (JIF) model as a predictor of citation potential? Table 1 compares citations for the top-cited papers of several journals, and these are only weakly correlated to JIFtc, which captures 32% of the variation, if *Science* is excluded (as an extreme, *Science* controls R^2, which is 0.71 when added in). For example, the top-cited papers in *American Mineralogist* and *Journal of Petrology* are nearly the same despite having different JIFtc. Even more interesting is Table 2, which shows an even weaker correlation between JIFtc and total citations for top papers ($R^2 = 0.18$), when tallying citations for papers published in 2010–2011, this time including *Science*. Moreover, the top-cited papers of several "specialty" journals received many more total citations than the top cited *Science* paper. Could it be that *publishing in specialty journals is better for long-term citation counts*? If nothing else, Table 2 shows that JIF is not a sure predictor of citation potential. These data also force us to consider the timescale at which citations accrue. If your paper receives 100 citations total, would you rather that all 100 come in the first two years of publication, be spread over the first 10-years post-publication, or that the citations are sparse at first, but come readily 50 years later? Might the latter case be the most influential? Perhaps the first case is, by so overwhelming the community with intellectual force and vigor that further discussion is deemed as only so much useless effort?

Valuing readership

One of our editorial philosophies at *American Mineralogist* may be phrased as a problem: we are not sure how, or if it is even useful or possible, to separate publication from readership. As a result, we expect that when we publish a paper, there is some non-trivial audience. If that audience is known ahead of time to be, say, two, then an e-mail, compared to a peer-reviewed paper, is vastly more efficient a means of communication, and less burdensome to potential reviewers and Associate and Managing Editors. But we don't ever really know readership. It's probably not equal to subscription rates, as we are not quite like a news magazine—journals are rarely read cover to cover. Might citations be a reliable proxy? As a test, we can compare citations to downloads (tabulations of the frequency with which individual papers are downloaded, which comprise our "Most Read" papers on our web site); surely, downloads must measure interest at some level, although we don't know what happens after a paper is downloaded. Figure 1 shows total citations accrued to 24 papers published in the January 2007 issue of *American Mineralogist*, and compares these to the total number of times each paper was downloaded in 2016. There is a positive correlation to be sure, but only a weak one, with downloads capturing just 35% of the variation in total citations. So which paper is (or was) the most influential? Should we take the sum of citations and downloads? Or the product? There is no governing theory. Perhaps papers that are well cited early on, but poorly downloaded later, are losing influence, or were mistakenly influential to begin with. Or they were so highly influential that we no longer concern ourselves with the result. Or 2016 was an off year.

More interesting still is that some frequently downloaded papers in 2016 have few or even no citations. Figures 1b and 1c show total citations for all those papers that were downloaded ≥100 times in 2016, and published between 2007–2012 (so have no effect on our current JIF). Two of the most frequently downloaded papers have 0 citations. The single most downloaded paper has 7 citations, collecting them at a rate of <2 cites/year. Maximum citation values seem almost anti-correlated with total downloads in 2016, interrupted by only one paper published in 2010 (see Table 2), that comes into view in the log-scale version of the plot (Fig. 1c). Figure 2 shows total downloads in 2016 for all papers published from 1976 to 2016. Clearly, download rates are more frequent for more recently published articles. But the peaks and valleys show that some papers command attention many years after publication. It should be noted, by the way, that the drop off in download rates for papers published between 1976–1997 is artificial; our electronic platform host, GeoscienceWorld, does not carry the complete text of articles in that time interval; readers must instead go to the *American Mineralogist* web site, where the articles are free to all, but for which we have no download statistics. In any case, what might we say of the many papers that are frequently downloaded but rarely cited? Do they simply make good reading material? Are these papers like the works of Josiah Willard Gibbs, waiting to explode into relevance and influence at some later date? Or are they attractive in some superficial way, but then after being downloaded are found wanting?

Dodgers' fans must acknowledge that Tom Seaver outpitched Don Sutton, and that Hank Aaron was a much better hitter than Ron Cey or Dusty Baker. But we can't obtain anywhere near that level of certainty in ranking journals, or papers (or the authors that write them), by citation counts alone. We have at best only a mean understanding of influence, on a short timescale.

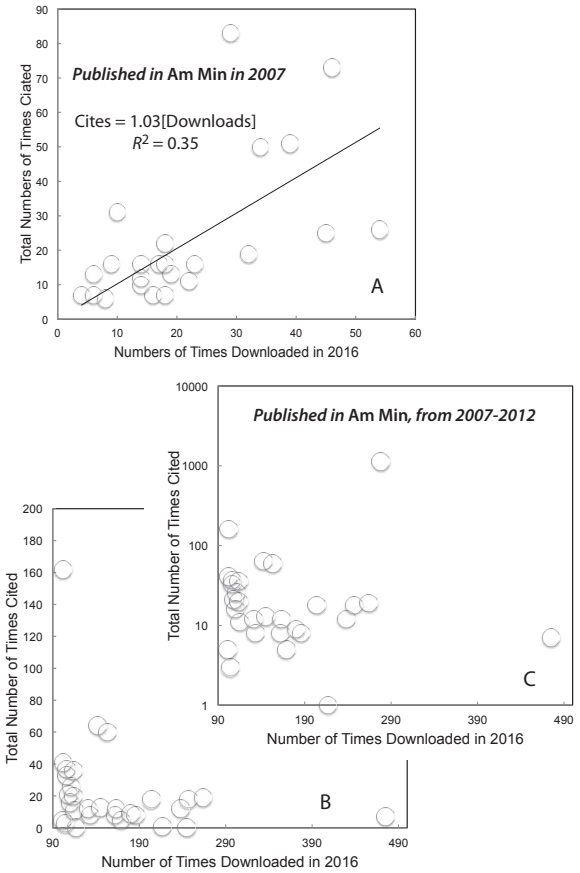

Figure 1. (**a**) Comparison of the total citations accrued to 24 papers published in January 2007 in *American Mineralogist* to the total number of times these papers were downloaded in 2016. Two additional papers were published that month but not downloaded and are not shown. The regression line was fitted assuming a 0-intercept. In **b** and **c**, we compare the total number of downloads in 2016 to the total number of citations these papers have accrued over their lifetime, for those papers downloaded ≥100 times in 2016; **c** is the same as **b** but uses a log scale for total citations to show the most highly cited paper from 2007 (see Table 2).

A call for sophistication

So we are left with this problem: we desire to objectively inform our decisions of new hires, or promotion or tenure decisions, or where to publish our next paper; yet compared to baseball, we inhabit an influence-assessment stone-age—and the bronze age is nowhere in sight. Our challenge, and it's not an easy one, is to predict which papers will not only be frequently cited, but frequently read. In the process, *we may make sacrifices in our JIF, so as to serve the scientific and public interest*. It would be no matter if authors and those in managerial positions could increase their level of sophistication even slightly in assessing journal (or individual) success. But we are not lost. Our sense of judgment can be informed by a range of readily available factors, such as those listed in Tables 1 and 2. We are thus not displeased with our anticipated climb in the JIF rankings, but we remain cognizant that JIF is a blunt instrument—used by some to inflict blunt-force trauma on some perfectly good society-published journals, by a refusal to publish with such, if in the interest of their readership, journals publish papers that are not obviously destined to be highly cited over a short time frame.

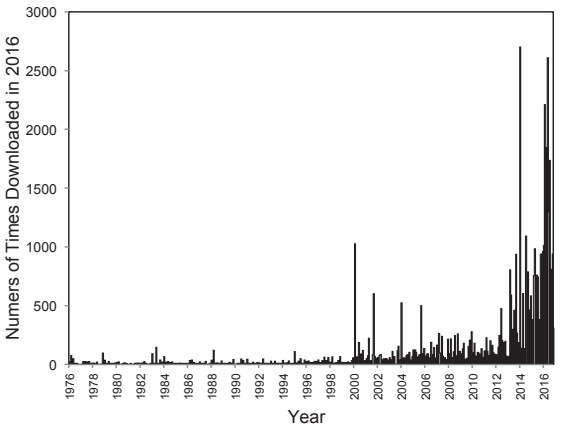

Figure 2. Total downloads in 2016 for papers published from 1976 to 2016.Low download rates from 1976–1998 are artificial, since our electronic host, GSW, does not carry the full text of these articles.

Fake news, fake journals, and the increasing urgency to support society-published journals

As PBS NewsHour anchor Jim Lehrer once predicted, the proliferation of unreliable and highly biased news sources would eventually enhance traditional news outlets. The breaking point seemed to come last year, as the *New York Times*, *Los Angeles Times*, *Washington Post*, and *Wall Street Journal* all saw sharply increased and in some cases record subscription rates (http://www.npr.org/sections/thetwo-way/2016/12/27/507140760/big-newspapers-are-booming-washington-post-to-add-sixty-newsroom-jobs). The conditions facing science are parallel. *American Mineralogist* subscribers surely have discriminating tastes. But entire web sites are now devoted to spotting predatory journals with convincing titles, and unethical review and pricing policies. Worse still, some journals purposely mimic the peer-review journal system to parade as valid what is complete and utter nonsense, especially on topics of current political or social interest; and the non-science public has too little exposure to our world to differentiate, and may readily accept what is reported in "journals" masquerading as "peer-review," or reports deriving therefrom. Who better to hold back the tide than society-published journals, rooted in long-standing scientific associations, with experience in journal publishing spanning decades or centuries? These have no profit motive nor political agenda. Our only motive is to serve the scientific community, and by extension, the public good—only our reputation is held at risk. This is not to say that we and other such journals do not err; but we do so in a sincere attempt to serve the scientific community, a value standing above all others.

Thanks to all who share in that service by entrusting to *American Mineralogist* (and other society-published journals) your best manuscripts—thereby strengthening our society and furthering our mission.