

Publication pressure threatens the integrity of palaeontological research

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Publication pressure threatens the integrity of palaeontological research

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Publications are the de facto currency of academia. Academics, palaeontologists included, are often judged by publication metrics, which usually include the impact factor of the journal in which they publish, the number of publications and the number of citations. However, in the race to publish in high-impact journals and the pressure to increase research productivity, sometimes corners are cut, leading to an increase in scientific and other types of misconduct. In this paper, we demonstrate how ethical, and even legal, transgressions within palaeontology, particularly regarding the provenance of fossil specimens, are inherently related to the pressure faced by academic researchers to publish “novel” studies in high-impact journals. We note how papers in high-impact journals follow a consistent theme of either showcasing novel evidence or methods, or describing charismatic or unusual specimens, often dinosaur-related. We examine notable recent examples of these papers that have been linked to ethical and legal problems, which have ironically been brought to light by virtue of the paper being widely publicised as highly “impactful”. Finally, we discuss the importance of developing an ethical framework for scientific publishing, which currently does not exist; only a handful of professional palaeontological bodies, including societies and journals, have independently developed policies to combat these issues. While the culture of “publish or perish” lingers in palaeontology, there will be no incentive for more ethical research that better serves both science and society to prevail.

publication pressure | research ethics | paleontology | academia | scientometrics

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Publication pressure in academic circles

“Publish or perish” has become the expression that describes modern academic culture where academics, palaeontologists included, face increased pressure to boost their research output in the form of publications (1–4). Publications have become the de facto currency of academia, however, not all publications are made equal: there are several factors that come into play when deciding what gets to be published and where.

The journal impact factor (JIF; the yearly mean number of citations received by publications published in a given journal over the two previous years) has been the staple of the academic publishing industry since 1975 (5). JIF is one of the metrics used to rank academic journals, with journals such as *Nature* and *Science* appearing at the top, and by extension, often being used as a measure of scientific merit or quality (6, 7). JIF is not only used to decide where to submit research publications but also by funding or institutional committees, together with the h-index (a similar metric that

measures both the productivity and citation impact of a scientist’s publications), to make decisions on jobs, promotions or grants (8–11). Applicants with publications in high-impact journals tend to receive better scores than those with publications in middle or low-impact journals, despite the fact that the delineation between high, middle and low tiers is arbitrary (11). As a result, early-career researchers are advised not to focus their attention on low-impact publications as this may affect their future job prospects where high-impact publications are typically one of the criteria used to judge applicants (8, 12, 13). In many European and North American institutions, a list of journals and their JIFs is usually provided to hiring committees to evaluate candidates (14). Metrics such as the JIF offer a convenient way to judge applicants, but are inherently flawed with respect to quality and influence (12). To start with, JIF was never originally intended to be used to judge individual researchers, but rather to understand the impact of a journal as a whole over a certain period (9). Generally, the number of citations of publications in a given journal follows a highly skewed distribution, with the number of citations of a specific publication being generally lower than the journal’s impact factor. As such the JIF does not fully portray the number of citations a particular publication may receive (15). While JIF-free assessments exist, these have yet to be established in the wider academic community (16).

Worryingly, this pressure to publish high-impact papers can result in the publication’s projected “impact” trumping other important considerations. Until recently, Chinese universities awarded bonuses to researchers publishing in high-impact journals—a policy that is said to have incited researchers to focus on quantity over quality, and to commit malpractices such as plagiarism or citation inflation (17). In fact, there is a positive correlation between the journal impact factor and the number of retractions for any given time period, i.e. journals with higher impact factors generally face more retractions (18, 19). The primary reason for retractions in scientific disciplines over the last two decades have been scientific fraud (fabrication, falsification, plagiarism) or other kinds of misconducts (e.g. fake peer review) (20). Pressure to publish “novel” results in high-impact journals has previously been linked to decreased ethical standards (21, 22), and may explain how some authors place “publication prestige” above other aspects of their work, such as research ethics and legality.

The discipline of palaeontology is not exempt from such malpractices, although retractions are rare—only five out

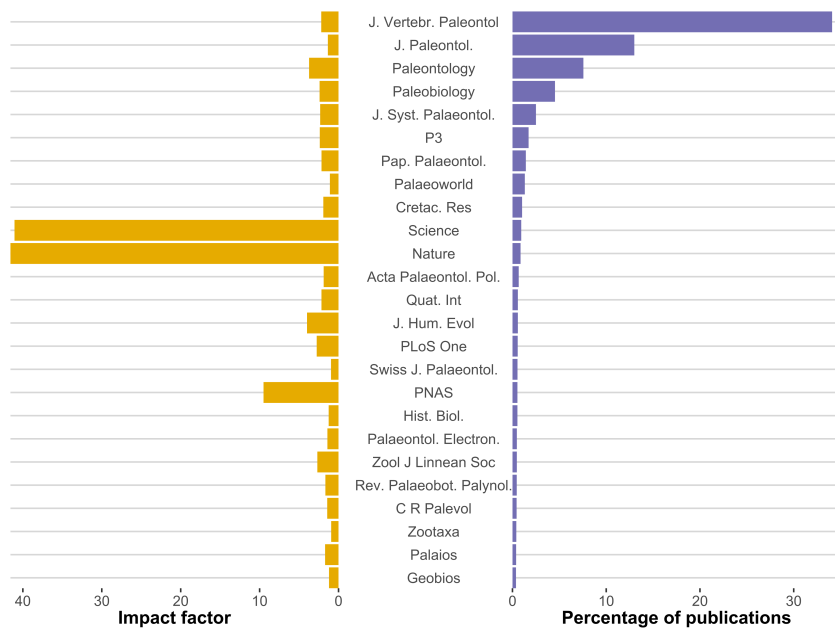


Fig. 1. The top 25 journals in palaeontology with their impact factors and the percentage of indexed palaeontological publications published within them. Based on data from the Web of Science (using the following keywords in the search: “paleontology OR palaeontology OR paleobiology OR palaeobiology”). Abbreviations of journal names: J. Vertebr. Paleontol., *Journal of Vertebrate Paleontology*; J. Paleontol., *Journal of Paleontology*; J. Syst. Paleontol., *Journal of Systematic Palaeontology*; P3, *Palaeogeography, Palaeoclimatology, Palaeoecology*; Pap. Palaeontol., *Papers in Palaeontology*; Cretac. Res, *Cretaceous Research*; Acta Palaeontol. Pol., *Acta Palaeontologica Polonica*; Quat. Int., *Quaternary International*; J. Hum. Evol., *Journal of Human Evolution*; Swiss J. Palaeontol., *Swiss Journal of Palaeontology*; Hist. Biol., *Historical Biology*; Palaeontol. Electron., *Palaeontologia Electronica*; Zool J Linnean Soc, *Zoological Journal of the Linnean Society*; Rev. Palaeobot. Palynol., *Review of Palaeobotany and Palynology*; C R Palevol, *Comptes Rendus Palevol*.

of 23,000 publications were retracted during the period 1990–2021, three of which were published in *Nature* and one in *PNAS*, according to PubMed.gov. Despite the rarity of retractions in palaeontology, several publications in high-impact journals have actually increased the visibility of certain malpractices that occur within the discipline of palaeontology (23). In this paper, we demonstrate how ethical, and even legal, transgressions within palaeontology are inherently related to the pressure faced by academic researchers to publish “novel” studies in high-impact journals.

Publication trends in palaeontology

Traditionally, palaeontological research has focused on the discovery, description, and form and function of fossil organisms. In more recent decades, palaeontological research has shifted to also encompass broader scale macroevolutionary and palaeobiological analyses of diversity, evolution and extinction through deep-time, particularly following the computational work of David Raup and Jack Sepkoski (24, 25). Palaeontological research is most often published in palaeontology-specific journals, for example *Journal of Vertebrate Paleontology* and *Palaeontology* (Fig. 1). These journals, while they publish a wide range of palaeontological research from species-specific taxonomic descriptions to broadscale macroevolutionary studies, typically have a JIF of less than 5 and may be considered “low-impact” journals (Fig. 1). On the other hand, palaeontological studies published in journals with the highest JIFs, i.e. *Nature* and *Science*, are most likely to document a newly-acquired fossil specimen or uncover “new evidence” of some aspects of a group’s evolutionary history, as illustrated by the titles of these publications (Fig. 2), which reflect their editorial criteria to publish on “outstanding” or “influential” scientific topics (26, 27). Unsurprisingly, the most “popular” papers in these high-impact journals are on dinosaur specimens, as re-

flected in the number of social media posts and media reports based on these publications (Fig. 3). This is unsurprising given that they are one of the most famous groups of ancient animals among scientific and non-scientific audiences alike (28). However, the winning combination in terms of popularity comes in the form of dinosaur related specimens preserved in amber (Fig. 3), particularly amber from Kachin State, in the northern region of Myanmar. One particular publication in *Nature Communications* that described the feeding behaviour of insects on dinosaur feathers (29) was picked up by 68 media outlets in multiple countries, and was shared by more than 500 users on Twitter as of May 2021. However, as discussed further in the next section, not all press is good press. The popularity of some high-impact publications in the media has led to the exposure of certain ethical and legal transgressions (30).

As the prestige of an academic journal depends, at least partly, on how often the research articles it publishes are cited, “novel” or surprising scientific findings are viewed as more desirable by journals (7). This publication bias is pervasive across all scientific disciplines (7, 31), but is especially prevalent in highly competitive fields (32). In palaeontology, there is a pressure to publish in high-impact journals such as *Science*, *Nature*, and *PNAS*, but only a small proportion of palaeontological studies appear in these journals (Fig. 1). The quest for novelty in scientific studies can not only encourage authors to commit various transgressions, but is also a major obstacle to addressing gaps in the literature. In palaeontology, this translates to the increasing rarity of classic taxonomic and systematic work i.e. the description and classification of species, especially of less “charismatic” organisms. This work is essential for nearly all studies in palaeontology, as well as natural sciences more broadly, since species are fundamental units in analyses of evolution, diversity, and extinction (33, 34). Taxonomy and systematics pa-

- Includes "dinosaur" in title
- Does not include "dinosaur" in title

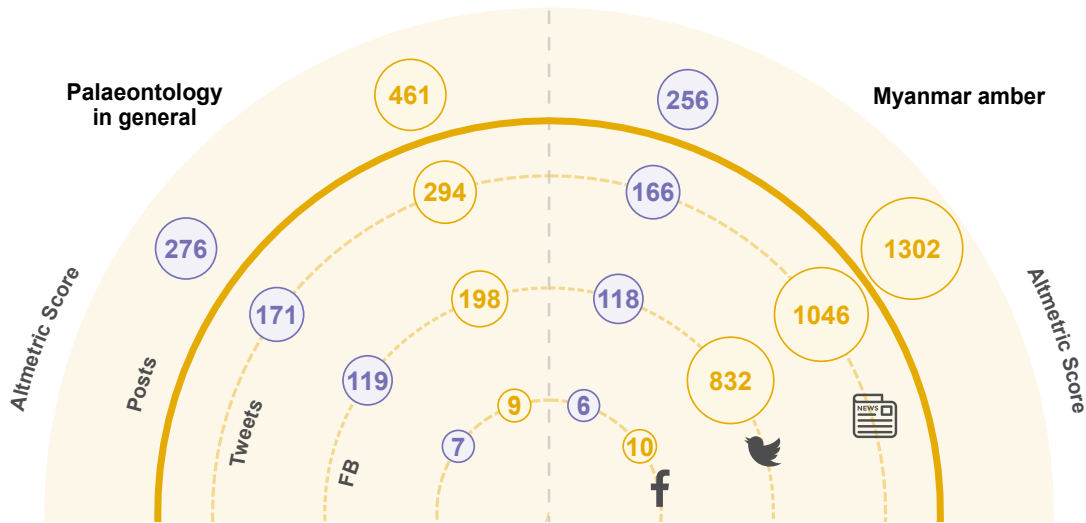


Fig. 3. Altmetric scores and the number of blog posts, tweets, and facebook (FB) posts (as of December 2020) belonging to all palaeontological publications (left) and those on Myanmar amber only (right), published in the *Nature* group and *Science* journals during the period December 2015 - November 2020. The altmetric score is a weighted score of the attention a publication has received in the news and on social media.

in Myanmar started their campaign to take over the amber mines in the Kachin State (44). This letter was criticised by several members of the palaeontological community (45–47), but was also received positively by some journals such as the *Journal of Systematic Paleontology* (48) and *Acta Palaeontologica Polonica* (49), which are both popular palaeontology journals (Fig. 1).

As the palaeontological community continues to debate whether (and how) ethical issues such as human rights abuses should be considered within the scope of research ethics, issues of legality around fossils have been extensively documented e.g. Liston & You (50) and Meijer (51). Over the last two decades, several countries, such as Brazil, China and Mongolia have been cracking down on violations of their existing fossil laws that restrict or outright ban exports of fossil specimens (30). Brazil has banned the export of fossils uncovered on Brazilian soil for over half a century since 1942, and since 1990 requires foreign researchers to work in collaboration with a local scientific institution. As such, when the description of a new Brazilian fossil, *Tetrapodophis amplectus*, was published in *Science* (52), questions were raised regarding its provenance, as the specimen was reportedly repositied in a private collection in Germany. The study had also not involved any Brazilian researchers or institutions, and a legal investigation was launched (51–53). More recently, a Brazilian dinosaur specimen named “*Ubirajara jubatus*”, which was described in a publication in *Cretaceous Research* on 13 December 2020 came under scrutiny for similar reasons, and was temporarily retracted (and remains retracted at the time of writing) while an investigation is underway (54). Another controversial specimen, this time a ray-

like shark specimen from Mexico named *Aquilolamna milarcaae*, was published in *Science* in March 2021 (55). This fossil sparked controversies because it had been purchased and, at the time of its publication, was being housed in a private collection (until a new museum is built). Both the purchase of fossil material and housing fossils in private collections are prohibited under Mexican fossil laws (30, 56). After the initial publication, the authors resolved both issues, firstly by moving the specimen to a museum where it will apparently be accessible to other researchers (again, until the new museum is ready) (57) and secondly, by removing information about the specimen having been purchased to the supplementary materials (58), likely in an attempt to disguise this violation (30).

Myanmar amber is also controlled by the national legislature, but loopholes in the law can and do allow for rampant exploitation. Any fossil specimen leaving Myanmar (e.g. for study or temporary display) requires permission from the necessary authorities and cannot be marketed according to the 1957 Antiquities Act, revised as the The Protection and Preservation of Antique Objects Law in 2015 (23). Amber is classified as a gemstone under the Myanmar Gemstone Law and thus can be sold and exported with the appropriate permits. However, neither the Antique Objects Law nor the Gemstone Law addresses the presence of fossils in amber, leaving the acquisition of amber specimens with fossil inclusions within a so far unaddressed complex legal greyzone (23). In many circumstances, this legal loophole is used by researchers to affirm that their amber specimens were legally acquired and that no legal issues exist with regards to Myanmar amber specimens (23, 40, 42). However, until this is

addressed specifically by the Myanmar government - a very difficult feat given the military coup in the country in February 2021 - researchers remain liable for not abiding to national fossil laws in Myanmar whose penalties include fines and even imprisonment. Until a legal precedent is set, researchers should thus abide by national laws regarding fossils, which state that specimens must be reported to the authorities and repositied in a national repository, or if being exported for study or display, a permit should be acquired.

Towards building an ethical framework

Research ethics are not new to palaeontology. Palaeontologists, like other scientific researchers, have a responsibility to uphold certain ethical requirements during their research to avoid scientific misconduct. However, what is unclear is what falls under the term “scientific misconduct” within palaeontology. While falsified research or plagiarism unanimously would come under this umbrella, other considerations such as socioeconomic and political issues are less definitive. Many professional societies, such as the Paleontological Society and the Society for Vertebrate Paleontology now have codes of conduct that their members must abide by, covering professional and personal conduct as well as the provenance of fossil material, among other considerations (59, 60). However, these societies seem to be among the very few that have such policies for their members. It must also be noted that these professional societies operate on an honour system and cannot legally enforce these policies.

Similarly, many journals have ethical considerations for their authors, usually informed by, but not restricted to, the Committee of Publication Ethics (COPE), whose aim is to educate and support publishers and editors on publication ethics (61). As of 16 May 2021, only a handful of palaeontological journals, including *Cretaceous Research*, *Palaeontology* and the *Swiss Journal of Palaeontology* and broader (and high-impact) journals including *Nature* and *Science* are members of COPE. However, the COPE’s core practices only cover ethical issues when the subject of research requires ethical considerations, such as research on animal or human subjects, but not when research is linked to human rights abuses (unrelated to the subject of research) or for matters of legality. Many palaeontological journals however have their own editorial policies, at least regarding the latter. For example *Palaeontology* and *Papers in Palaeontology* require “clear provenance information to ensure full transparency of the research methods” and that specimens collected “from protected sites should include information regarding the requisite permission obtained” (62). The journals *Journal of Vertebrate Paleontology* and *Journal of Systematic Palaeontology* explicitly state that they do not accept manuscripts based on specimens in amber from Myanmar (44, 48). Editorial policies at *Cretaceous Research* state that “fossil material of uncertain or dubious provenance will not be accepted for publication” (63). This points to the fact that these policies are being individually developed without any central ethical framework across the discipline. In the case of *Creta-*

ceous Research, these policies are not being upheld, judging by the number of publications on Myanmar amber that have appeared in this journal (54 in 2021 as of 16 May 2021, based on a search using the keywords “Myanmar amber OR burmese amber OR kachin amber”), even after the controversies around the material was openly known. Until all journals catering for palaeontological research enforce similar policies with regards to ethics and legality, there will always be an avenue for work involving unethical or illegal research practices.

Similarly, research institutions and funding organisations, just like professional societies and journals, should also be committed to high standards of ethics. Palaeontological departments and institutions should provide training to their staff and students regarding ethical issues within the discipline, especially as these become more well-known and acknowledged. Palaeontology has long operated outside the ethical lens, mainly due the nature of the discipline itself which focuses on ancient life since the time before humans existed. However, this does not mean that palaeontology is in any way exempt from ethical considerations. The examples we provide here do not represent the full extent of ethical issues within the field of palaeontology and geosciences. Parachute science, lack of diversity, sexual harassment, racism, ableism, and bullying are just some of the other issues that need to be addressed by the discipline (64–70). Often, the reaction of academic institutions to misconducts committed by members of their staff is inadequate, especially when these people tend to be in powerful and influential positions (71, 72). Due to their competence in publishing in high-impact journals and winning large grants, thus providing more visibility and resources for the institution, there is considerable institutional support shown to these individuals. Similarly, funders should be more critical of ethical and legal problems persisting in palaeontology. Funding frequently comes from national agencies through taxes. As such, increased transparency from individuals, groups or institutions receiving public funding should be a fundamental requirement. In the case of Myanmar amber, for example, public funding may be contributing to armed conflicts and human rights abuses in the Kachin State through the commercialisation of amber, which is a known source of revenue for the armed military forces inflicting these injustices on the ethnic minorities in the country (73).

Eliminating the “publish or perish” culture

As long as the culture of “publish or perish” remains ubiquitous in palaeontology, researchers will continue to place publication prestige ahead of ethics and other concerns. Publication metrics should not be the primary criteria by which scientists are judged for career progression, awards, and research grants. An increasing number of publications include spin or “science hype” in their titles, such as the overuse of the words “new” or “novel”, to make them more attractive to high-impact journals (Fig 2) (74, 75). The pressure to publish “novel” or surprising results in high-impact journals is also

likely to be exacerbated by the precariousness of scientific careers (76), which is particularly pertinent in the wake of the COVID-19 pandemic. Academic metrics also discriminate against marginalised groups that, on average, have fewer publications due to systemic biases and other duties, such as higher teaching load, higher mentorship load, and caring responsibilities (77–80). These factors are rarely taken into consideration during assessments for jobs, awards, and grants. The culture of continuously seeking high-impact publications can also lead early career researchers to narrowly focus their work on output that is most suited for these publications. Creativity in research, which can lead to innovative methods and discourses, does not always have a place in modern scientific environments (81). The academic job market has become rigid and narrow, prescribed by the same requirements made by different departments and overly focused on publications and grants, that academics have no choice but to conform to these standards in order to secure a tenured academic position, which is already limited in terms of number of available permanent positions (82). Funders also frequently have certain restrictions on grants provided, such as the number of years after PhD for starting grants e.g. the European Research Council (83). This system puts those who might have taken a academic break for personal or professional reasons at a disadvantage, and in some cases, may even exclude them from any further academic pursuits. As a result, many researchers are now turning to alternative non-academic platforms not only to voice their concerns regarding the current uncompromising structure of academia, but also to engage in academic discourses in creative ways that traditional academic jobs do not typically allow.

The social media platform Twitter has become a popular space for academics to keep up to date with research, for public engagement and to build support networks beyond their lab group or department (84). As these topics are still not considered a priority for many institutions or organisations, many critical conversations in academia, and palaeontology specifically, are being carried out on Twitter, for example, those related to mental health (e.g. #100Voices, @PhD_Balance, #AcademicMentalHealth), decolonisation and social justice (85–87), and diversity and inclusion, particularly in relation to fieldwork (e.g. @AbleismAcademia, @AccessibleGEO, @aapigeosci, @GeoLatinas, #BlackInStem, @mothersinsci, @sacnas). Twitter is now even being used as an alternative to in-person conferences, where “presentations” are in a series of tweets with accompanying graphics and videos and the official conference hashtag (e.g. #ExOncTC, #WSTC2, #PATC1) (88). Such alternative forms of academic discourses prove that scientific communication beyond publications not only appeals to academic audiences, but can also be more effective in terms of public engagement and learning (89). In fact, it is through social media platforms, especially Twitter and Facebook, that many legal issues within palaeontology have come to light. One recent example is that of the illegal status of the “*Ubirajara jubatus*” specimen through the #UbirajaraBelongsToBR hashtag on Twitter (30).

A researcher should be appraised on the quality of their work, regardless of where it was published. This is one of the general recommendations of the Declaration on Research Assessment (DORA; <https://sfedora.org/>), whose aim is to improve the ways in which research and researchers are evaluated. As of 17 May 2021, 19,612 individuals and organisations, including academic publishing groups, are signatories of DORA worldwide. DORA also notes that research output is not only in the form of scholarly articles, but also as dataset production, software development, science communication, and impact on policy, which are all highly relevant to palaeontology. Other factors such as openness and transparency should also play a role in career advancement. This is also imperative for PhD programs where there is an early emphasis on publication number as a measure of success, which can be detrimental to students’ wellbeing and career satisfaction (13). While DORA will not fully solve the over-reliance on JIF and other metrics due to the increased labour for those performing the evaluations, the proposed alternatives would place on hiring committees or reviewers (90), it is nonetheless a system that would better serve both science and society.

The increasing visibility of ethical and legal transgressions within our field not only illustrates the fundamental flaws in our academic system, but also how deeply these practices are rooted in colonialism and how they have remained unchanged for centuries (30), which benefits the already powerful and privileged. As we have shown, these transgressions are also inherently encouraged by the current system, which relishes publications over other academic endeavours and where good science is being equated with journal prestige. The ongoing earnest discussions about issues of ethics and legality within palaeontology have only highlighted just how much work we have yet to do; there needs to be a systemic change in the way that palaeontologists operate. Some journals and societies are already ahead of the curve and have been implementing measures to address certain issues. As more and more organisations follow their lead, there will no longer be a tolerance for these illegal and ethical transgressions. In this rapidly evolving climate, transgressors persisting with their unethical and illegal practices will be the first to fall into the “publish and perish” trap.

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DATA AVAILABILITY STATEMENT

Data and code for the analyses are available from: <https://github.com/paleoscientometrics/paleopubs2021>

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