# Provenance matters

An update to our policy on reporting requirements for geological and palaeontological materials aims to tackle ethical issues surrounding the collection, traceability and archiving of field samples.

Reproducibility matters in science, but so does replicability[1]. The latter depends, in part, on the ability to trace samples and studied materials back to their origin, and to do so in a clear and consistent manner for others to repeat experimentally. At *Nature Geoscience*, we have always required clear provenance information to be included with primary research articles. However, there is growing awareness that a continuation of colonialist principles can lead to problematic extraction and exploitation of economic as well as scientific resources, as touched on recently in a Comment by Dowey et al. A specific example of related problems is reflected in the controversies surrounding the use of illegally traded amber from Myanmar in palaeontological research — sometimes termed 'blood amber' due to the human cost of lives lost during mining — discussed in a selection of pieces in *Nature Ecology & Evolution*. In the interest of strengthening our commitment to ethically sound research in light of these and similar issues, the Nature Portfolio of journals has recently updated their policies on sample reporting.

Authors submitting to Nature Portfolio journals will now be required to declare on our policy checklist that their samples have been collected (and, where applicable, exported) in a responsible manner and in accordance with local laws and permitting requirements, and that this information is detailed in their manuscript. But following the law is not always enough. Researchers conducting field sampling are also encouraged to educate themselves about the local communities where their work is done — especially if working on lands of significant cultural importance to Indigenous communities. It is important that there is not only transparency on sample provenance, but also transparency with local people regarding what the work is about and how it may affect their community and heritage. If samples are extracted from protected Indigenous lands, then it is right that permission be sought from these communities beforehand — and especially if they are to be deposited or archived elsewhere.

Although it's tempting to believe that the sort of exploitation described above is a legacy of the past, recent examples such as the destruction of Aboriginal rock shelters in Australia by the mining company Rio Tinto are a sobering reminder that these practises still exist, and may even be legal in some instances. Although this action was widely condemned across the geoscience and archaeology communities, it highlights how challenging it often is for researchers to navigate the complex legality of protections. More recently, in only the past few weeks a researcher from the California Institute of Technology was also found to have damaged a sacred Native American petroglyph site under protection of the US Archaeological Resources Protection Act.

In many cases, without local knowledge and help, sample collection in the field may not even be possible, and these contributions should be recognized accordingly. The stance of Nature Portfolio journals is that we expect the inclusion of local co-authors. This problem is particularly acute in the Earth sciences, where less than a third of papers published on topics related to Africa over the last 40 years included an African co-author[2]. Such inclusion is especially important when research is conducted in low- and middle-income regions, to avoid exploitation or exclusion by wealthier research partners — often termed 'parachute science'. Researchers should be clear from the outset of projects whether contributions will amount to authorship, and the burden should not be placed on local researchers to ensure this is delivered.

Ethical sampling and clear provenance information is of course not enough to fully address issues of reproducibility and replicability. Archiving and curation of samples, and ensuring that access is freely available to everyone, will also be needed. Some scientific disciplines have already made great strides towards this. It's long been the case that cell lines and model organisms are tracked using persistent identifiers, and palaeontological and type specimens are deposited in museum archives. Biobanks for human tissues or conservation resources such as Kew's Millennium Seed Bank are other examples.

But how about in the Earth and planetary sciences? There already exist clear protocols and community standards in some fields. The International Ocean Discovery Program is one such example, with efforts to archive sediment cores for future use, and data reporting requirements for studies using their readily accessible materials. However, in a recent Comment, Planavsky et al.[3] call for more geological samples to be permanently archived in a way that makes them available to other researchers.

Standardizing and implementing archival processes, and making them a routine part of the research process, is a major challenge. The physical space available for museum collections to house the vast volume of research samples collected each year, the logistics of sample storage, and the informatics infrastructure required to track them, will require huge research investment. In this issue, a Comment from Li et al. reflects on ongoing efforts in China to incentivize data archiving in the digital realm. However, substantial investment here and elsewhere in the world will also be needed to realize a workable and sustainable infrastructure for physical sample archiving too.

If this investment comes from wealthy nations, it is crucial that local research partners are equitably involved. Archived samples originating from low-income regions should not only meet legal export requirements, but access to them should ideally be free of restrictions for these regions, in much the same way that The Nagoya Protocol for the Convention on Biological Diversity aims to safeguard access to genetic resources, for example.

Our latest policy update is aimed at making geoscience research more equitable, but there is still much to do. Untangling the complex issues hindering this progress will depend on continuing discussions and efforts within the research and publishing communities. ❐

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## References

1. Patil, P., Peng, R. D. & Leek, J. T. *Nat. Hum. Behav.* **3**, 650–652 (2019).
2. North, M. A., Hastie, W. W. & Hoyer, L. *Earth-Sci. Rev.* **208**, 103262 (2020).
3. Planavsky, N., Hood, A., Tarhan, L., Shen, S. & Johnson, K. *Nature* **581**, 137–139 (2020).