Archaean photosynthesizing bacteria did 3.5 million years ago. The anthropocene is more than just a new geological era: the archaeologist's lens reveals it to be a cosmological phenomenon.

References

Adams, D. 2002 [1979]. *The Ultimate Hitchhiker's Guide to the Galaxy.* New York: Ballantine Books.

Asimov, I. 1986 [1956]. "The Last Question" in *Robot Dreams,* by I. Asimov, 234–246. New York: Berkley Publishing Group.

Bédard, D. G., A. Wade, D. Monin and R. Scott. "Spectrometric Characterization of Geostationary Satellites." Paper presented to the AMOS (Advanced Maui Optical and Space Surveillance Technologies) conference, Hawai'i, 2010. Available online: www.amostech.com/TechnicalPapers/2012/POSTER/BEDARD.pdf

Bradbury, R. 1997–2000. Matrioshka Brains. Available online: www.gwern.net/docs/1999-bradbury-matrioshkabrains.pdf, accessed August 1, 2013.

Clark, N. 2005. "Ex-orbitant Globality." *Theory, Culture and Society* 22(5): 165–185. http://dx.doi.org/10.1177/0263276405057198

Davis, M. 1996. "Cosmic Dancers on History's Stage? The Permanent Revolution in the Earth Sciences." *New Left Review* 217: 48–84.

Dyson, F. J. 1960. "Search for Artificial Stellar Sources of Infrared Radiation." *Science* 131: 1667–1668.

Gorman, A. C. 2009. "The Gravity of Archaeology." *Archaeologies: The Journal of the World Archaeological Congress* 5(2:) 344–359

Lovbrand, E., J. Stripple and B. Wiman. 2009. "Earth System Governmentality. Reflections on Science in the Anthropocene." *Global Environmental Change* 19: 7–13.

Milani, A. and A. Nobili. 1992. "An Example of Stable Chaos in the Solar System." *Nature* 357: 569–571. http://dx.doi.org/10.1038/357569a0

NASA Orbital Debris Program Office. 2012. Orbital Debris Frequently Asked Questions. Available online: http://orbitaldebris.jsc.nasa.gov/faqs.html#3, accessed August 1, 2013.

Odishaw, H. 1958. "International Geophysical Year." *Science* 128: 1599–1609.

Smolin, L. 1997. *The Life of the Cosmos*. London: Weidenfeld and Nicolson.

Teilhard de Chardin, P. 1959. *The Phenomenon of Man.* New York: Harper and Row.

Vince, G. 2011. "An Epoch Debate." *Science* 334: 32–37. http://dx.doi.org/10.1126/science.334.6052.32

Ward, B. 1966. *Spaceship Earth*. New York: Columbia University Press.

The Anthropocene and Transdisciplinarity

Jason M. Kelly
Indiana University-Purdue University Indianapolis, USA
jaskelly@iupui.edu

From the early 2000s, the term "anthropocene" circulated widely in both academic and journalistic circles. By 2008, a group of scientists argued that the anthropocene was a useful concept for denoting the measurable impacts of humanity on the planet. They submitted a proposal to the Stratigraphy Commission of the Geological Society of London, lobbying for an official geological designation (Zalasiewicz *et al.* 2008). The Earth, they argued, had emerged from the Holocene; humanity was now living in the anthropocene.

Scholars from across the disciplines quickly discovered the term to be pliant, popular, and therefore useful for a host of different claims and theoretical constructs. Consequently,

Journal of Contemporary Archaeology 1.1 (2014) 73–132
ISSN (print) 2051-3429 (online) 2051-3437 DOI:10.1558/jca.v1i1.73

rather than speaking of "the anthropocene," it might be more appropriate to speak of "anthropocenes." Doing so captures the fragmentary discourses emerging from this debate and sharpens focus on the socio-political stakes in defining the term. This essay argues for a transdisciplinary approach to studies of the anthropocene and concludes by summarizing one example of what a transdisciplinary collaboration might look like.

At first glance, the claim that there are multiple anthropocenes may not be apparent. From one perspective, there either are or are not significant, measurable anthropogenic traces in the geological record. And, consequently, there is or is not an age of the anthropocene. For example, human-induced salinization, arheism, chemical contamination, and a host of other riverine syndromes can be described and measured through historical data sets (Meybeck 2003). And, human transformations of river systems through technology, such as dams, are measurable, contributing to significant transformations of the geomorphology of river deltas and even continental shelves (Syvitski and Kettner 2011). Multiple data points suggest not only increased anthropogenic changes to the planet during the last 250 years, but recognizable global transformations of Earth systems since 1950—a period some term the "Great Acceleration" (Steffen 2005; Steffen *et al.* 2011; Steffen, Crutzen and McNeill 2007; Steffen *et al.* 2008).

However, the introduction of the term into the scholarly and popular lexicon was never going to be a value-neutral proposition. The anthropocene is laden with meaning because it is a historical category. It tells a story, embodies assumptions, and expresses desires about the meaning of the past and the making of the future. The dominant metanarrative is one of modernity—a narrative in which energy- and resource-intensive industrialization and capitalism have been accompanied by population booms, increased flows of goods and peoples, the central role of nation-states, and demands for improvements in quality of life. It is a story in which humans have exploited the environment at unprecedented and ever-expanding rates, soon finding that their local actions have consequences on global scales.

In part, the category of the anthropocene is a discursive critique of modernity's excesses (Chakrabarty 2009; Dibley 2012). It imposes on modernity the notion of limits, thresholds, and boundaries—an approach sparked by the Club of Rome's "Limits to Growth" report in 1972 (Meadows *et al.* 1972; Rockström *et al.* 2009). However, the concept still retains many of the intellectual formulations and assumptions associated with modernity. For example, in its critique of nature–society binaries, it assumes that human and natural systems are entangled: humans shape their environments, and their environments shape them. Yet, despite this critique of nature–society dualism, research generally remains anthropocentric. Planetary boundaries are human boundaries—the necessary conditions for stabilizing the planet's systems for human survival. Likewise, while responding to the worst excesses of technologically induced environmental change, the concept retains much of modernity's faith in scientific and technological solutions. And, anthropocene research, especially among scientists, has often expressed an interest in geoengineering or bioengineering solutions in order to mitigate anthropogenic impacts and Earth system feedbacks. By extension, this expresses a hope that humans will remain stewards of the Earth, albeit more responsible stewards than they have been in the past.

Journal of Contemporary Archaeology 1.1 (2014) 73–132
ISSN (print) 2051-3429 (online) 2051-3437 DOI:10.1558/jca.v1i1.73

As a corrective to the assumptions of the anthropocene's dominant metanarrative, criticism has emerged from work by scholars of environmental ethics, environmental justice, and ecocriticism. These critiques focus on the anthropocene as a normative category. For example, the anthropocene, like the concept of modernity, is laden with Eurocentric assumptions against which large swathes of land and humanity are measured and excluded. As such, research in the anthropocene is often more focused on the environmental effects of industrial and consumer capitalism than on the underlying socioeconomic and political relations that make them possible. Moreover, environmental justice research delves into the reasons why global environmental resources have been used and shared unequally and how anthropocene changes to the planet often affect the most disadvantaged. Consequently, a counter-narrative of the anthropocene has emerged—what we might term the "subaltern anthropocene" (Mosley 2006; Sze and London 2008; Ottinger and Cohen 2011; Pulido 1996; Timmons Roberts 2007; Egan 2002).

Despite the fluidity of the term, the anthropocene does speak to a number of key issues. At the heart of most arguments about the anthropocene is a progressivism that seeks to mitigate or reverse anthropogenic environmental change. To varying degrees, anthropocene research addresses global inequalities, whether the approach is framed through neoliberal, postcolonial, or neo-Marxist analyses. It is also policy oriented, and researchers and working groups often work in an advisory capacity to governments and NGOs.

Given the power of the anthropocene as a discursive category, which drives research agendas, policy discussions, and popular perspectives, scholars from across the disciplines have a responsibility to critique its underlying assumptions and claims. One area where criticism might be constructive focuses on transdisciplinarity.

Earth system science has consistently made the claim that humans play a central role in the complex interactions between the atmosphere, hydrosphere, lithosphere, and biosphere. To understand these interactions, scientists have to pay close attention to anthropogenic biophysical systems, which they often refer to as the anthroposphere, designating humanity's central role in the Earth system (Schrader 1919; Steffen *et al.* 2011). It has become common for Earth system scientists to argue for the importance of integrating human systems into Earth system modeling. And, more and more scientific projects include environmental sociologists, archaeologists, or historians on the team. Taking the lead in interdisciplinary approaches is IHOPE, the Integrated History and Future of People on Earth, which is a project of the International Geosphere and Biosphere Programme (IGBP). Since being established in 2003, scholars involved in IHOPE have consistently articulated the position that social scientists and humanists need to be more fully involved in Earth system science (Costanza, Graumlich and Steffen 2007; Costanza *et al.* 2012; Davies and M'Mbogori 2013; Hibbard *et al.* 2010; Hornborg and Crumley 2006; Mosley 2006; Sörlin 2012). Likewise, UNESCO's International Hydrological Program has commissioned a series of studies on water that promise to integrate a broader range of disciplinary approaches (Hassan 2011). In 2012, a report, RESCUE, which was commissioned by the European Science Foundation, Strasbourg and European Coopera-

tion in Science and Technology, Brussels, lamented the lack of interdisciplinary research collaborations and articulated the need for conceptual and methodological disciplinary integration from the earliest stages of new research projects (Jäger *et al.* 2012).

As recognized in the RESCUE report, the social sciences and humanities have typically been auxiliary to the core agendas of scientific environmental research—despite the fact that the environmental social sciences and humanities have been around for decades. For their part, the social sciences have been easier to integrate into scientific research. After all, human population patterns, economies, and governance frameworks are measurable and quantifiable. Likewise, historical and archaeological research have provided quantitative and qualitative data on environmental phenomena for developing and testing scientific theses (Carey 2012). On the other hand ethnography, social and cultural history, environmental ethics, and postcolonial literary criticism have been tangential to environmental science.

This disciplinary divide hampers transdisciplinary environmental research. Not only can the social sciences and humanities correct and amplify scientific knowledge by demonstrating the limits and false assumptions of quantitative work, but they can also provide valuable qualitative research, inaccessible through quantitative methods. Moreover, focused as they are on human agency at both the individual and community levels, they can explicate deep sociocultural constructs. Rather than measuring the effects of human actions on ecology, they seek to understand why humans act the way they do in different cultural, material, and historical environments. Furthermore, in addition to descriptive analysis, the humanities and social sciences bring rich traditions of analytical and critical theory, which make clear the socio-economic and political dimensions of epistemological and institutional expectations and practices. In effect, they play a necessary self-reflexive and critical role in research and policy.

One research project that has adopted a transdisciplinary framework from the outset is the Rivers of the Anthropocene project (rivers.iupui.edu), a collaboration between Indiana University-Purdue University Indianapolis (IUPUI) and Newcastle University. Rivers of the Anthropocene is a comparative study of global river systems since 1750. The project approaches rivers and their landscapes not simply as natural phenomena, but as human artifacts—a human–environment entanglement (Edgeworth 2011).

During the first phase of the project, the focus is on examining the Ohio River and the Tyne River in a global context. It brings together a team of researchers, policy experts, policy makers, teachers, and community organizations to focus on creating a methodological and conceptual model for analyzing anthropocene river systems. The Rivers of the Anthropocene research group follows the recommendations of IHOPE and RESCUE, focusing first on building a transdisciplinary framework, which can be applied to other environmental systems.

Unlike many other environmental research projects, Rivers of the Anthropocene integrates individuals who are embedded in education, policy, and community organization from the outset. These individuals will help shape research methods, but they will also create the framework for educational and community outreach programs. During the first phase of

ISSN (print) 2051-3429 (online) 2051-3437 DOI:10.1558/jca.v1i1.73

the project, Rivers of the Anthropocene is working with middle school teachers, teaching development programs, and governmental institutions to create an online interface for middle school and secondary school teachers and students. These groups are embedded in the research project from the outset, and will help translate research and develop curricula. Additionally, the IUPUI team is working with local organizations to develop a community-based service learning project targeted at the White River, part of the Ohio River system.

The power of the anthropocene as a descriptive category can sometimes hide the fact that it is a contested framework for understanding the environment. By focusing on "anthropocenes," we can elucidate discursive constructs that may limit research agendas. One approach to this would be through transdisciplinary research, which integrates the strengths of the sciences, social sciences, and humanities to constructively question, challenge, and amplify the others' approaches. Furthermore, following the framework of Rivers of the Anthropocene, which integrates policy makers, secondary school teachers, and community organizations, there is the potential for immediately expanding the reach and local impact of environmental research projects.

References

Carey, M. 2012. "Climate and History: A Critical Review of Historical Climatology and Climate Change Historiography." *Wiley Interdisciplinary Reviews: Climate Change* 3(3): 233–249.

Chakrabarty, D. 2009. "The Climate of History: Four Theses." *Critical Inquiry* 35(2): 197–222. http://dx.doi.org/10.1086/596640

Costanza, R., I. Kubiszewski S. Heckbert, K. A. Hibbard and S. Van der Leuw (main authors). 2012. "Developing an Integrated History and Future of People on Earth (IHOPE)." *Current Opinion in Environmental Sustainability* 4(1):106–114. http://dx.doi.org/10.1016/j.cosust.2012.01.010

Costanza, R., L. Graumlich and W. L. Steffen, eds. 2007. *Sustainability or Collapse?: An Integrated History and Future of People on Earth*. Cambridge, MA: MIT Press.

Davies, M. I. J. and F. N. Kirote M'Mbogori, eds. 2013. *Humans and the Environment: New Archaeological Perspectives for the Twenty-first Century*. Oxford: Oxford University Press.

Dibley, B. 2012. "'The Shape of Things to Come': Seven Theses on the Anthropocene and Attachment." *Australian Humanities Review* 52 (May): 139–153. Available online: http://press.anu.edu.au//wp-content/uploads/2012/08/ben-dibley.pdf

Edgeworth, M. 2011. *Fluid Pasts: Archaeology of Flow*. Bristol: Bristol Classical.

Egan, M. 2002. "Subaltern Environmentalism in the United States: A Historiographic Review." *Environment and History* 8(1): 21–41. http://dx.doi.org/10.3197/096734002129342585

Hassan, F. 2011. *Water History for Our Times, Vol. 2.* IHP Essays on Water History. Paris: UNESCO.

Hibbard, K. A., *et al.* 2010. *Developing an Integrated History and Future of People on Earth (IHOPE): Research Plan*. IGBP Secretariat. Available online: http://www.uvm.edu/giee/pubpdfs/Costanza_2012_Current_Opinion_in_Environmental_Sustainability.pdf, accessed August 15, 2013.

Hornborg, A. and C. L. Crumley, eds. 2006. *The World System and the Earth system: Global Socioenvironmental Change and Sustainability Since the Neolithic*. Walnut Creek, CA: Left Coast Press.

Jäger, J., and G. Pálsson, M. Goodsite, C. Pahl-Wostl, K. O'Brien, L. Hordijk and B. Avril (lead authors). 2012. *Responses to Environmental and Societal Challenges for Our Unstable Earth (RESCUE). European Science Foundation, Strasbourg and European Cooperation in Science and Technology, Brussels*. Available online: http://www.esf.org/fileadmin/Public_documents/Publications/rescue.pdf, accessed August 15, 2013.

Meadows, D. H., D. L. Meadows, J. Randers and W. Behrens III. 1972. *Limits to Growth*. New York: Club of Rome.

Meybeck, M. 2003. "Global Analysis of River Systems: From Earth System Controls to Anthropocene Syndromes." *Philosophical Transactions of the Royal Society of London B.* 358(1440): 1935–1955. http://dx.doi.org/10.1098/rstb.2003.1379

Mosley, S. 2006. "Common Ground: Integrating Social and Environmental History." *Journal of Social History* 39(3): 915–933. http://dx.doi.org/10.1353/jsh.2006.0007

Ottinger, G. and B. R. Cohen. 2011. *Technoscience and Environmental Justice: Expert Cultures in a Grassroots Movement*. Cambridge, MA: MIT Press. http://dx.doi.org/10.7551/mitpress/9780262015790.001.0001

Pulido, L. 1996. *Environmentalism and Economic Justice: Two Chicano Struggles in the Southwest*. Tucson: University of Arizona Press.

Rockström, J., *et al.* 2009. "A Safe Operating Space for Humanity." *Nature* 461: 472–475. http://dx.doi.org/10.1038/461472a

Schrader, F. 1919. "The Foundations of Geography in the XXth Century." *The Geographical Teacher* 10(2): 44–53.

Sörlin, S. 2012. "Environmental Humanities: Why Should Biologists Interested in the Environment Take the Humanities Seriously?" *BioScience* 62(9): 788–789. http://dx.doi.org/10.1525/bio.2012.62.9.2

Steffen, W. L., J. Crutzen and J. R. McNeill. 2007. "The Anthropocene: Are Humans Now Overwhelming the Great Forces Of Nature?" *Ambio* 36(8): 614–621. http://dx.doi.org/10.1579/0044-7447(2007)36[614:TAAHNO]2.0.CO;2

Steffen, W. L., J. Grinevald, P. Crutzen and J. McNeill. 2011. "The Anthropocene: Conceptual and Historical Perspectives." *Philosophical Transactions of the Royal Society A.* 369(1938): 842–867. http://dx.doi.org/10.1098/rsta.2010.0327

Steffen, W. L., *A. Sanderson, P. D. Tyson, J. Jäger, P. A. Matson,* B. Moore III, F. Oldfield, K. Richardson, H. J. Schellnhuber, B. L. Turner II and R. J. Wasson. 2005. *Global Change and the Earth System: A Planet Under Pressure*. Berlin: Springer.

Syvitski, J. P. M. and A. Kettner. 2011. "Sediment Flux and the Anthropocene." *Philosophical Transactions of the Royal Society A* 369(1938): 957–975. http://dx.doi.org/10.1098/rsta.2010.0329

Sze, J. and J. K. London. 2008. "Environmental Justice at the Crossroads." *Sociology Compass* 2(4):1331–1354. http://dx.doi.org/10.1111/j.1751-9020.2008.00131.x

Timmons Roberts, J. 2007. "Globalizing Environmental Justice." In *Environmental Justice and Environmentalism: The Social Justice Challenge to the Environmental Movement*, edited by R. D. Sandler and P. C. Pezzullo, 285–308. Cambridge, MA: MIT Press.

Zalasiewicz, J., M. Williams, A. Smith, T. L. Barry, A. L. Coe, P. R. Bown, P. Brenchley, D. Cantrill, A. Gale, P. Gibbard, F. J. Gregory, M. W. Hounslow, A. C. Kerr, P. Pearson, R. Knox, J. Powell, C. Waters, J. Marshall, M. Oates, P. Rawson and P. Stone. 2008. "Are We Now Living in the Anthropocene?" *GSA Today* 18(2): 4–8. http://dx.doi.org/10.1130/GSAT01802A.1

The *New Age* of the Anthropocene

Ewa Domanska
Adam Mickiewicz University, Poland
ewa.domanska@amu.edu.pl

The anthropocene (Gr. *anthropos*—human being and *koinós*—new, current) is understood by Paul Crutzen and Jan Zalasiewicz as a new geological epoch/era and a new age of the Earth's history dominated by the human (Zalasiewicz *et al.* 2010; also Davis 2011). This notion is a challenge for thinking about the future of the Earth, human societies and their transformations as well as for reconsidering the goals of knowledge-building and the idea of an academic system adequate to it. It invites me—as a historian—to think about the world (its past, present and future), knowledge-building and the academic system in the frame provided not only by the humanities and social sciences, but also by the natural and life sciences. Thus, next to familiar ideas of living in Eastern Europe in the post-Cold War period, in the era of globalization, I learn that I also live on a "symbiotic planet" (Margulis 1998), in the "geologic now" (Ellsworth and Kruse 2013), in a deep time of a new geological era, as well as in a shorter timescale of a "biological age" (Venter and Cohen 1997; Rose 2013) and in a "neurocentric age" (Becker 2010).

Journal of Contemporary Archaeology 1.1 (2014) 73–132
ISSN (print) 2051-3429 (online) 2051-3437 DOI:10.1558/jca.v1i1.73