

# Ethnogeology: The State of Interdisciplinary Engagement within Studies of Indigenous Knowledge

Heather Collins

*B.A. Candidate, Department of Anthropology, Geography, and Environmental Sciences  
California State University Stanislaus, 1 University Circle, Turlock, California 95382*

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## Abstract

By weaving myths and observations together, Indigenous cultures around the world have developed rich understandings of the Earth's landscapes which surround them. Not only did this knowledge serve them in terms of locating and identifying lithic and mineral resources (Miller & Siegfried, 2017), but it also allowed them to live near some of the Earth's harshest geological processes, and the environments that they create. The term ethnogeology has been referenced a handful of times, but the earliest definition put forth was by geologist John James Murray, referring to the valid scientific observations and ideas that were incorporated and reflected within Indigenous knowledge of geological features and processes (1997). Despite the perspective that is implied with the *ethno-*, most of the work done in this small subfield has been conducted by geologists and geoscientists. Lacking is the anthropological perspective that I believe is necessary for future studies of this subject. Through an integrative literature review, I demonstrate the continued necessity of interdisciplinary approaches to understandings of Indigenous knowledge systems. This project is dedicated to honoring traditional knowledge systems through the amplification of Indigenous voices, which is achievable by highlighting the work of Indigenous anthropologists and geoscientists who have already contributed to these fields. By focusing on the ways in which Indigenous communities understand and steward the geological landscapes which they call home, I aim to highlight their potential applications within applied environmental anthropology.

*Keywords:* Ethnogeology, Traditional Knowledge, Indigenous Knowledge, Native Communities, Interdisciplinary Approaches, Applied Collaboration

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## Introduction

By weaving myths and observations together, Indigenous cultures around the world have developed rich understandings of the Earth's landscapes which surround them. Not only did this knowledge serve them in terms of locating and identifying lithic and mineral resources (Miller & Siegfried, 2017), but it also allowed them to live near some of the Earth's harshest geological processes, and the environments that they create. The term ethnogeology has been referenced a handful of times, but the earliest definition put forth was by geologist John James Murray (1997), referring to the valid scientific observations and ideas that were incorporated and reflected within Indigenous knowledge of geological features and processes. Despite the perspective that is implied with the *ethno-*, most of the work done in this small subfield has been conducted by geologists and geoscientists; fields that are not necessarily trained in humanistic and holistic research approaches. Lacking, is the anthropological perspective

that I believe is necessary for future studies of this subject. Through an integrative literature review, I assess the current state of interdisciplinary collaboration in the study of traditional Earth knowledge. Interdisciplinary approaches, which must include Indigenous/Native collaborators, offer a more holistic and applied perspective to the ongoing narrative surrounding Indigenous knowledge and the ways in which it must be protected. This project is dedicated to honoring traditional knowledge systems through the amplification of Indigenous voices, which is achievable by highlighting the work of Indigenous scholars and authors who have already contributed to these fields. By focusing on the ways in which Indigenous communities understand and steward the geological landscapes which they call home, I aim to highlight their potential applications within applied environmental anthropology.

## Background

Ethnogeology seeks to understand the traditional Earth knowledge from Native and Indigenous

communities, to create more holistic and culturally relevant models of environmental and ecological knowledge. There are many facets of Traditional Earth Knowledge (TEK) which fall under the definition put forth by Murray, including, but not limited to: geomythology, toponomy, Scientia, and the countless ways in which humans have interacted with geological processes and features through time.

Ethnogeology has roots in an earlier field known as geomythology. Introduced and developed by geologist Dorothy B. Vitaliano (1968), it is the study of the oral traditions of prescientific cultures to explain geological phenomenon (Mayor, 2004). Utilizing a multidisciplinary approach, it aims to interpret mythological explanations of catastrophic events, geological features, and landscapes. Since this field was introduced, various disciplines have approached geomythology, often with multidisciplinary collaboration. Geologists have teamed up with environmental sociologists to understand how geomythology can be factored into conservation efforts (Unjah & Halim, 2017). Volcanologists have examined geomythology in order to gain a deeper understanding of responses to volcanic events and disaster mitigation strategies (Cashman & Cronin, 2008). Additionally, philosophers of science have explored the role of geomythology as a form of science communication (Nocek, 2018). Anthropologists have also contributed to this field. Walsh et al. (2017) utilized geomythology within the context of archeological and paleoenvironmental frameworks. Archaeologists have applied the studies of geomythology within the assessment of disaster archaeology, to culturally contextualize the data from archaeological sites within known natural disaster zones (Liritzis et al., 2019). While geomythology may be the precursor to ethnogeology, it has its limitations. This field solely focuses on geology within the framework of mythology, with heavy inclinations towards catastrophic events and landscape-defining geological features. It excludes Indigenous knowledge of passive geology, such as lithic or mineral identification and location knowledge. The literature also contains a bias towards the mythology of ancient civilizations, focusing more often on the stories rooted in Greek, Norse, and Egyptian cultures.

Murray (1997) was one of the first geologists to begin using the term ethnogeology, referring to the “science of our planet that comes out of, and speaks specifically to, aboriginal people”. He recognized that traditional knowledge is not neutral; rather it is filtered through the shared experiences, cultural values/traditions, and history of a community. Taking a more comprehensive

approach than geomythology, ethnogeology attempts to understand TEK through whichever Indigenous lens may have been applied. Murray applied ethnogeology within the geoscience curriculum taught in Aboriginal communities; an applied focus that continues today.

Steven Semken is a geologist who has furthered this applied focus in the American Southwest, with a particular emphasis on ethnogeology as a place-based study of traditional knowledge (Semken & Morgan, 1997; Semken, 2005; Semken & Freeman, 2008; Apple et al., 2014). His work incorporates place-based systems of traditional knowledge with current models of geoscience curriculum, producing materials and activities that holistically represent the geological history of any specific region. He has done some of the most comprehensive and recent work in this field.

Narrower definitions and approaches have been attributed to ethnogeology over time. Mark Harvey (2016), an anthropologist and linguist, defined ethnogeology as Aboriginal stone knowledge and terminology. Benjamin Wilkie et al (2020) defined it as “Aboriginal explanations of geological events and features”, while implying that elsewhere in the world, geomythology would be the corresponding term. It should not be surprising that ethnogeology is so closely associated with the Aboriginal studies of Australia, given that Murray included this in his early definition. However, Semken has more than demonstrated ethnogeology as a relevant study in any region that is rich in both geology and traditional knowledge; a much broader and more inclusive perspective.

My background review found lacking any anthropological studies which utilize the term ethnogeology, outside of Harvey’s (2016) narrow definition. This same background review has also failed to produce any interdisciplinary studies conducted jointly by geologists and anthropologists. Acknowledging that anthropology has indeed contributed extensively to our overall understanding of traditional knowledge systems, it is assumed that these studies are not being cohesively incorporated into current studies of ethnogeology. Geology and anthropology are utilizing different scholarly language and frameworks to discuss TEK, leaving space for an interdisciplinary approach to bring these two fields together under the umbrella of ethnogeology. Interdisciplinary collaboration between Earth scientists, social scientists, and Indigenous collaborators can lead to the co-production of knowledge; which in turn, can potentially be applied to a variety of complex climate and environmental challenges. When we create space for the co-production of knowledge, on both local and global

scales, we open the door to innovative solutions and approaches to challenges faced by both Indigenous/Native populations and the greater global community.

## Methods

I conducted an integrative literature review, utilizing an interdisciplinary approach. Examining scholarly works (n=30), across a variety of disciplines (n=4), my goal was to explore the contributions to ethnogeology that have yet to be recognized within this field of study. I began by identifying twenty keywords that are commonly associated with TEK. I then identified one hundred published articles that included one or more of these keywords in their searchable keyword list. From this pool of articles, I took a random sample of thirty to utilize within this literature review. In three cases, the discipline of the author was unclear, and the article was excluded from the study; replaced by another article from the starting pool at random. The publication year of the selected articles ranged from 1968 - 2021; with 90% of the articles published in the last twenty years.

By collecting quantitative data on the field of study of both the author and journal in which their work is published, I was able to determine whether any attempts have been made at interdisciplinary approaches to this field. The selected papers were sorted into three classifications: singular discipline, multidisciplinary, and interdisciplinary. For this review, I defined singular discipline as a single author publishing within their own discipline, or multiple authors from the same discipline publishing together. I defined multidisciplinary as either a singular author publishing outside of their discipline, or multiple authors representing a total of two disciplines publishing together. Interdisciplinary was defined as multiple authors representing three or more fields, publishing together for a greater academic audience than that of any singular discipline.

Next, I collected data on the terminology that is being used to reference traditional Earth knowledge to show that all of these fields are utilizing different scholarly language and terminology to discuss the same topic, leaving room for an interdisciplinary approach. I began with the twenty keywords that I had identified as representing TEK, and then included any other words/terms that were found within the body of the articles themselves.

I also collected data on the frequency with which Indigenous scholars are being cited, allowing me to explore the ways in which Indigenous voices are being

amplified within the various fields that are exploring the subject of TEK.

Table 1  
Data Collected From Selected Articles

1	Field of study of the Author(s)
2	Field of study of the Journal
3	Terminology/language used to identify TEK
4	Frequency of Indigenous/Native citations

## Results

My first data point focused on the academic discipline of the first author listed for each selected publication included in this literature review. This information was determined by considering both the discipline of the highest degree achieved by the author, as well as the way in which they self-identify the work they have done in their career. Table 2 shows the distribution of first authors within their respective fields.

Table 2  
Distribution of the Discipline of the First Authors

<u>Discipline</u>	<u>Percentage</u>
<u>Social Sciences &amp; Humanities:</u> Anthropology, Sociology, Geography, Philosophy, History, English	33%
<u>Earth Science:</u> Geology, Hydrology, Meteorology, Physics	27%
<u>Environmental Science:</u> Ecology, Environmental Conservation, Biological Conservation, Natural Resource Management, Sustainability Science, Climate Change	27%
<u>Indigenous Studies:</u> Indigenous Scholars, and non-indigenous experts in Indigenous Studies	13%

This distribution demonstrates that there are a variety of fields exploring TEK that could contribute to future collaborative studies of ethnogeology. 54% of the authors identified within the Earth or environmental sciences, fields that do not always prioritize holistic and humanistic methodologies in the way that the social sciences do. Many of these fields would benefit greatly from the cultural brokering skills that anthropologists are uniquely equipped with. I did not find any collaborative work concerning TEK conducted jointly by

anthropologists and environmental/Earth scientists within the scope of this literature review.

The next set of data that I collected focused on the field of study of the authors listed after the first author (if any), as well as the discipline of the journal in which the article was published. For the sake of this review, I identified three degrees of collaboration, by which the articles would be classified. Singular approaches included articles written by a single author publishing within their own discipline, as well as multiple authors from the same discipline publishing in a journal that falls within their respective fields of study. Multidisciplinary approaches were defined as a single author publishing outside of their field of study, as well as two or more authors representing two distinct disciplines and publishing in a journal from one of those two fields. Interdisciplinary approaches were defined as multiple authors representing three or more disciplines publishing together to a broad scientific or academic audience. Table 3 illustrates the percentage of articles that fell within each of these classifications.

Table 3  
Degree of Collaboration Between Disciplines

Classification	Percentage
Singular	23.3%
Multidisciplinary	46.7%
Interdisciplinary	30%

This review has failed to find any collaborative work conducted jointly by geologists and anthropologists. Acknowledging that anthropology has contributed extensively to our overall understanding of traditional knowledge systems, it is assumed that these frameworks are not being cohesively incorporated into current studies of ethnogeology. Thirty percent of the articles included in this literature review took a truly interdisciplinary approach, further demonstrating that interdisciplinary collaboration in studies of TEK are not yet the norm.

This project also focused on data concerning the keywords that were used to identify TEK within each publication. These words were identified early in the project to generate the pool of articles that were selected from for the literature review. Once the thirty articles were randomly selected, I recorded the frequency in which these terms were found throughout the articles. Figure 1 is a word cloud that demonstrates the frequency with which these terms were used, with larger and bolder words appearing more frequently throughout the review than the smaller words in the cloud. There are a wide variety of words and terms that are being utilized to reference the Traditional Knowledge that a Native or Indigenous community holds about their local surroundings. Different fields are utilizing different scholarly language and frameworks to discuss the same subject, leaving space for an interdisciplinary approach to bring these fields together under the umbrella of ethnogeology.

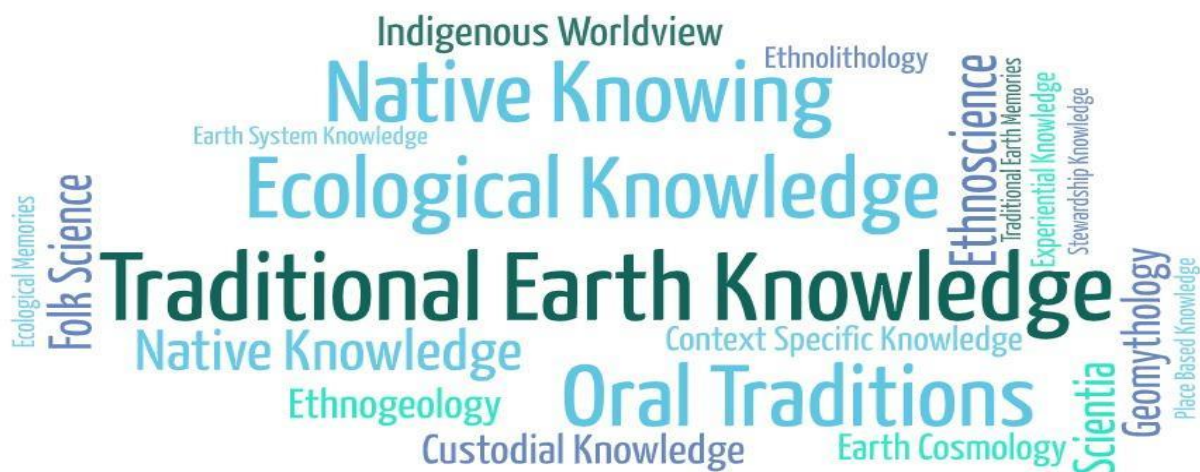


Figure 1: Word Cloud Illustrating the Frequency of Terminology Found

The final data point collected concerned the amount of Indigenous scholars and Indigenous first authors that are being cited in the publications included in this review. This was a painstaking endeavor of research; though it was necessary to determine the degree to which Native and Indigenous voices are being amplified in the study of TEK. There were a total of 1,884 references cited throughout the selected publications included in this review. Of this total, 208 (11%) of these citations included an Indigenous/Native-identifying scholar(s) and/or author(s); with only 119 (6%) of these citations referencing an Indigenous/Native first author. These results have been disappointing, often with a “token” Indigenous publication included in the reference list as a demonstration of inclusion; more often with little cultural relevance to the community being discussed in the publication.

## Discussion & Conclusion

This literature review demonstrates the lack of interdisciplinary collaboration in the study of traditional Earth knowledge. Anthropologists have historically examined this subject in Native communities using relatively extractive practices. Meanwhile, geologists are exploring ethnogeology in order to incorporate these themes into the local science curriculum. My work argues that collaboration is needed between these fields, and that interdisciplinary approaches open a wide range of applied applications, such as: disaster mitigation, land-back movements, resource sovereignty advocacy, and bridging the gap between Indigenous stewardship practices and Western conservation models. This co-production of knowledge can best be described as a process of weaving; wherein all parties approach the knowledge systems of one another with mutual respect and determine goals that seek to incorporate knowledge systems together, rather than to replace or explain away the knowledge of one another (Verran & Christie, 2007). This work is also beginning to show that Indigenous scholars and representatives are not being included in these studies to the degree that we should be striving for as a field. A primary goal of this project has been to demonstrate to other scholars the importance of interdisciplinary models and the necessity to include Indigenous voices in these bodies of work. I aim to encourage the scholars from the variety of fields included in this review to consider the contributions that are possible when we create a space that encourages the co-production of knowledge

between academics and Native communities. I also hope to encourage them to familiarize themselves with Native scholars who are defining methodologies on Native terms, and who are doing the most poignant work in the studies of traditional Earth knowledge. Many of our fields have been incredibly extractive of Native communities, solely for the sake of contributing to the greater body of knowledge. Indigenous scholars are re-defining boundaries around this knowledge, and it is only through the study of their work that we can begin to approach these topics from more ethical perspectives; seeking to position our academic fields as allies to their communities.

## References

- Apple, J., Lemus, J., & Semken, S. (2014). Teaching Geoscience in the Context of Culture and Place. *Journal of Geoscience Education*, 62(1), 1-4.
- Cashman, K. V., & Cronin, S. J. (2008). Welcoming a Monster to the World: Myths, Oral Tradition, and Modern Societal Response to Volcanic Disasters. *Journal of Volcanology and Geothermal Research*, 176, 407-418.
- Gadgil, M., Berkes, F., & Folke, C. (2021). Indigenous Knowledge: From Local to Global. *Ambio*, 20, 967-969.
- Harvey, M. (2016). Stones and Grinding: Wagiman Ethnogeology. *Australian Aboriginal Studies*, 1, 12-23.
- Lirizis, I., Westra, A., & Miao, C. (2019). Disaster Geoarchaeology and Natural Cataclysms in World Cultural Evolution: An Overview. *Journal of Coastal Research*, 35(6), 1307-1330.
- Maldonado, J., Bull Bennett, T. M., Chief, K., Cochran, P., Cozzetto, K., Gough, B., Redsteer, M. H., Lynn, K., Maynard, N., & Voggesser, G. (2016). Engagement with Indigenous Peoples and Honoring Traditional Knowledge Systems. *Climate Change*, 135, 111-126.
- Mayor, A. (2004). Geomythology. In R. Selley, R. Cocks, & I. Palmer (Eds.), *Encyclopedia of Geology* (pp. 644-647). Elsevier.
- Miller, Andrew M., and Evelyn Siegfried. (2017) "Traditional Knowledge of Minerals in Canada. *Canadian Journal of Native Studies*, 38(2), 35-60.
- Murray, J. J. (1997). Ethnogeology and Its Implications for the Aboriginal Geoscience Curriculum. *Journal of Geoscience Education*, 45(2), 117-122.
- Nocek, A. J. (2018). Geology, Myth, Media. *SubStance: A Review of Theory and Literary Criticism*, 47(2), 84-106.
- Semken, S. (2005). Sense of Place and Place-based Introductory Geoscience Teaching for American Indian and Alaska Native Undergraduates. *Journal of Geoscience Education*, 53(2), 149-157.
- Semken, S., & Butler Freeman, C. (2008). Sense of Place in the Practice and Assessment of Place-based Science Teaching. *Science Education*, 92, 1042-1057.
- Semken, S. C., & Morgan, F. (1997). Navajo Pedagogy and Earth Systems. *Journal of Geoscience Education*, 45, 109-112.

Unjah, T., & Halim, S. A. (2017). Connecting Legend and Science Through Geomythology: Case of Langkawi UNESCO Global Geopark. *Kajian Malaysia*, 35(1), 77-89.

Verran, H. & Christie, M (2007). Using/Designing Digital Technologies of Representation in Aboriginal Australian Knowledge Practices. *Human Technol*, 3, 214-227.

Vitaliano, D. B. (1968). Geomythology: The Impact of Geologic Events on History and Legend with Special Reference to Atlantis. *Journal of the Folklore Institute*, 5(1), 5-30.

Walsh, K., Brown, A. G., Gourley, B., & Scaife, R. (2017). Archaeology, Hydrogeology, and Geomythology in the Stymphalos Valley. *Journal of Archaeological Evidence: Reports*, 15, 446-458.

Wilkie, B., Cahir, F., & Clark, I. D. (2020). Volcanism in Aboriginal Australian Oral Traditions: Ethnographic Evidence from the Newer Volcanics Province. *Journal of Volcanology and Geothermal Research*, 403, 106999

## Appendix

### Publications Included in This Literature Review

<u>Author</u>	<u>Title</u>	<u>Year</u>
J. Apple, J. Lemus & S. Semken	Teaching Geoscience in the Context of Culture and Place	2014
J. J. Murray	Ethnogeology and Its Implications for the Aboriginal Geoscience Curriculum	1997
M. Harvey	Stones and Grinding: Wagiman Ethnogeology	2016
B. Wilkie, F. Cahir, & I. D. Clark	Volcanism in Aboriginal Australian oral traditions: Ethnographic evidence from the Newer Volcanics Province	2020
M. Brugnach, M. Craps, & A. Dewulf	Including Indigenous Peoples in Climate Change Mitigation: addressing issues of scale, knowledge, and power	2014
D. Green, G. Raygorodetsky	Indigenous Knowledge of a Changing Climate	2010
D. B. Vitaliano	Geomythology: The Impact of Geologic Events on History and Legend w/ Special Ref. to Atlantis	1968
M. Gadgil, F. Berkes, & C. Folke	Indigenous Knowledge: From Local to Global	2021
K. V. Cashman & S. J. Cronin	Welcoming a monster to the world: Myths, oral tradition, and modern societal response to volcanic disasters	2008
I. Liritzis, A. Westra, & C. Miao	Disaster Geoarchaeology and Natural Cataclysms in World Cultural Evolution: An Overview	2019
J. Maldonado, T. M. Bull Bennett*, K. Chief*, P. Cochran*, K. Cozzetto, B. Gough, M. H. Redsteer*, K. Lynn, N. Maynard, & G. Voggeser	Engagement with Indigenous Peoples and Honoring Traditional Knowledge Systems	2016
A. Mayor	Geomythology	2004
M. McGurl	The New Cultural Geology	2021
A. M. Miller* & E. Siegfried*	Traditional Knowledge of Minerals in Canada	2017
A. J. Nocek	Geology, Myth, Media	2018
J. H. Tepper	Connecting Geology, History, and the Classics Through a Course in Geomythology	1999

K.P. Whyte*, J. P. Brewer II* & J. T. Johnson*	Weaving Indigenous Science, Protocols, and Sustainability Science	2015
K. Walsh, A. G. Brown, B. Gourley, & R. Scaife	Archaeology, Hydrogeology, and Geomythology in the Stymphalos Valley	2017
T. Unjah & S. H.I Halim	Connecting Legend and Science Through Geomythology: Case of Langkawi UNESCO Global Geopark	2017
C. Thrush & R. S. Ludwin	Finding Fault: Indigenous Seismology, Colonial Science, and the Rediscovery of Earthquakes and Tsunamis in Cascadia	2007
R. Hill, C. Adem, W. V. Alangui*, Z. Molnar, Y. Aumeeruddy-Thomas, P. Bridgewater, M. Tengo, R. Thaman, C. Y. Adou Yao, F. Berkes, J. Carino*, M. Carneiro da Cunha, M. C. Diaw, S. Diaz, V. E. Figueroa*, J. Fisher, P. Hardison*, K. Ichikawa, P. Kariuki, M. Karki, P. OB Lyver, P. Malmer, O. Masardule*, A. A. Oteng Yeboah, D. Pacheco, T. Pataridze, E. Perez, M-M Roue, H. Roba*, J. Rubis*, O. Saito, & D. Xue	Working with Indigenous, Local and Scientific Knowledge in assessments of Nature and Nature's linkages with people	2020
S. Semken	Sense of Place and Place-Based Introductory Geoscience Teaching for American Indian and Alaska Native Undergraduates	2005
C. J. Robinson, T. Kong, R. Coates, I. Watson, C. Stokes, P. Pert, A. McConnell, & C. Chen	Caring for Indigenous Data to Evaluate the Benefits of Indigenous Environmental Programs	2021
D. P. M. Lam, E.Hinz, D. J. Lang, M. Tengo, H. von Wehrden, B. Martin-Lopez	Indigenous and Local Knowledge in Sustainability Transformations Research: A Literature Review	2020
S. Aswani, A. Lemahieu, W. H. H. Sauer	Global Trends of Local Ecological Knowledge and Future Implications	2018
E. M. Riggs	Field-Based Education and Indigenous Knowledge: Essential Components of Geoscience Education for Native American Communities	2004
S. Driver	Negotiating Indigenous knowledge at the science-policy interface: Insights from the Xáxli'p Community Forest	2017
I. S. Selemani	Indigenous knowledge and rangelands' biodiversity conservation in Tanzania: success and failure	2020
M. E. Duarte, M. Vigil-Hayes, S. Littletree*, & M. Belarde-Lewis*	"Of Course, Data Can Never Fully Represent Reality": Assessing the Relationship between "Indigenous Data" and "Indigenous Knowledge," "Traditional Ecological Knowledge," and "Traditional Knowledge"	2019
T. R. Maloney & M. Street*	Hot debate: Identifying heat treatment in Australian archaeology using science and modern indigenous knowledge	2020

\* indicates Indigenous/Native authors