



*PrePrint Feb 16 2021: Pico, Tamara: "Linking Past to Present in a Postcolonial Field Science" (in review, Catalyst: feminism, theory, technoscience)*

29 Four years into an Earth Science PhD at an Ivy League institution, I was drawn into feminist  
 30 studies. I was eager for a framework to understand what made me weary of the field: issues of  
 31 underrepresentation, hostile environments, and strong cultures of masculinity. Outside of my  
 32 primary research on past ice sheets and sea level, I began to engage with feminist theory and  
 33 history of science, in an effort to understand the patterns of exclusion that I regularly  
 34 experienced and witnessed.

35

36 I am a white-presenting Jewish Latina American woman. My mother is Argentine and Jewish,  
 37 and my father is American, of Mexican Californio and Jewish Romanian descent. I received my  
 38 PhD promptly at 26 years old, and hold a tenure-track position in Earth Science at a public  
 39 research university. I am a computational geoscientist studying past ice sheets and sea level by  
 40 modeling how the solid Earth deforms under the weight of massive ice sheets, which grow and  
 41 melt over tens of thousands of years. I am not a field geologist, however my entry into  
 42 geoscience was inspired by participating in field geology research and training. As an able-  
 43 bodied pale-skinned geoscientist, I often was afforded the opportunity to blend in.  
 44 Nevertheless, I was increasingly aware of exclusionary practices within geoscience culture, such  
 45 as aggressive masculinity or tough and rugged expectations.

46

47 Prodding at these issues I found the roots lodged much deeper: the contemporary culture of  
 48 United States geology owes its central values to early 19<sup>th</sup> century US geology. I could only see  
 49 the visible and tangible symptoms splayed out at the surface, reflecting a web of connections  
 50 between society and geology running deep and wide, perpetuating a vehicle of exclusion that  
 51 acts on racialized and gendered lines.

52

53 Field geology is a subdiscipline within the Earth sciences that can apply to anyone making  
 54 measurements to understand the Earth system and its history. Because nearly every research  
 55 discipline in Earth sciences can trace its origin to early 19th century field geology, I find that  
 56 focusing on cultures within field geology is useful in connecting historical practices to modern

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57 ones. Moreover, field geology still serves as a beacon for the Earth sciences, drawing in the next  
58 generation of scientists and serving as a symbol of "true" geology.

59  
60 Despite the origin of US field geology in imperialist and colonialist projects, prior scholarship  
61 has not analyzed this discipline from a critical feminist anticolonial perspective. This essay  
62 explores how field geology as a discipline acts as a marginalizing vehicle both within and  
63 outside of the geoscience community. It is not my intention to provide prescriptive fixes, rather,  
64 I aim to describe the power dynamics at play in modern field geology and explore their links to  
65 the discipline's history. From undergraduate training to researchers' impact on local  
66 communities where fieldwork is situated, modern practices replicate existing power structures  
67 that can be traced to early geology in the United States. Field geology attracts and trains the  
68 next generation of field geologists. This training then determines how these scientists interact  
69 with the external communities where fieldwork is conducted. In particular I will focus on the  
70 connection between comfort/interest in the outdoors and the recruitment of students into field  
71 geology. I will draw upon modern and historical practices of race-based exclusion from outdoor  
72 space to argue that field geologists ignore an important legacy of racism that is crucial to  
73 acknowledge in training a diverse set of future scientists. Furthermore 19<sup>th</sup> century US  
74 American geologists instituted imperialistic practices of producing knowledge that subjugated  
75 marginalized populations. I will argue that field geologists continue to use these tactics today,  
76 and the training of field geologists participates in imperialistic knowledge production.

77  
78 Drawing on this theme, I will turn to how US field geologists interact with the communities  
79 inhabiting the physical space studied, in particular in postcolonized spaces. I will argue that  
80 geologists apply an intellectual framework that divides the physical geology from the people  
81 that live in this space, and that this framework provides a justification for separating Indigenous  
82 (or local) knowledge from the western (read: universal) knowledge the geologists will produce.  
83 Through an analysis of knowledge production and training practices in field geology, I trace the  
84 imperialistic legacy of 19<sup>th</sup> century US geology to the present day. I build upon theories in

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85 feminist and postcolonial science studies and postcolonial theory to illuminate the social  
86 culture of field geology through a feminist lens.

87

## 88 **Part 1: Recruitment and training of field geologists**

89

### 90 *The outdoors and geology recruitment*

91

92 Who decides to be a geologist and why? As in other disciplines, geologists as a community  
93 share a set of values that serve to identify and train the next generation. One of these values is  
94 passion for the outdoors. Of the natural sciences, geology may have the largest proportion of  
95 courses with field trips. At many institutions, the abundance of camping opportunities on  
96 course field trips is cited as a principal reason for choosing the major. Nationwide studies that  
97 analyze factors for undergraduates in choosing geology cite outdoor opportunities, travel, and  
98 environmental interest among top influences in developing an interest in geology (Hoisch &  
99 Bowie, 2010). Indeed, research has found that "family, engagement in outdoor recreation, and  
100 personal experiences with local geology underscores the importance of informal science  
101 experiences" for participation in geology careers. The homepage for geoscience at a large US  
102 research university sums it up succinctly: "If you like science, care about the earth, are  
103 fascinated by the natural world, like working outdoors, consider geology" ("Why Study  
104 Geology," n.d.). A large number of geologists were attracted to the field by previous exposure  
105 to geology or outdoor experiences.

106

107 Field work is emphasized as crucial to a geology education (Sharp, 1988), and in many  
108 departments, it is explicitly required. By claiming that the field is integral to geology, the  
109 discipline makes a statement about who is invited. I will explore how different aspects of  
110 historical geologic field work as well as modern cultures around outdoor recreation may act to  
111 exclude people of color from joining the ranks of field geologists. In the United States less than  
112 7% of undergraduate geoscience degrees are awarded to underrepresented minorities (Stokes,

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113 2013). Through historical and modern practices, I consider the connection between an interest  
114 in the outdoors and the dire underrepresentation of people of color in geology.

115

116 *History of scientific racism in geology*

117

118 In Earth science courses, both introductory and advanced, the glorification of US American 19<sup>th</sup>  
119 century geologists is common practice. These characters were foundational in gaining national  
120 recognition for the field of geology, as well as power in the US government through creation of  
121 the United States Geologic Survey (USGS). These same geologists were entrenched in  
122 imperialistic and nationalistic endeavors, both through and outside their geologic research. For  
123 example, John Wesley Powell, a geologist famous for leading a government-sponsored  
124 expedition to raft down the Colorado River into the Grand Canyon, also conducted  
125 ethnographic work on Native American tribes in the regions he was mapping out (Stegner,  
126 1954). With a powerful role in government decisions around Native American affairs as the  
127 director of the USGS and head of the Bureau of Ethnology at the Smithsonian, Powell was  
128 commissioned by the Bureau of Indian Affairs to report on the status of Native American tribes  
129 in the Canyonlands and make recommendations on how to integrate these peoples into white  
130 American society (Stegner, 1954). Powell collaborated with Nathaniel Southgate Shaler, a  
131 Harvard professor in geology who, at the turn of the 20<sup>th</sup> century, wrote volumes detailing how  
132 North American topography is unfit to produce civilized peoples, yet perfectly suited for the  
133 institution of slavery (Shaler, 1897). At Harvard, Shaler was one of numerous faculty involved in  
134 research with strong bends of scientific racism that contributed to the eugenics movement.  
135 Louis Agassiz, a professor in Zoology who is frequently discussed in geology courses for his  
136 contributions to glacial geology, is especially famous for his work in eugenics research (Menand,  
137 2001). By omitting these contributions of early US American geologists to the oppression of  
138 marginalized communities, geology instructors retain a simple narrative that sanctifies these  
139 geologists as heroes, polishing them off every time the story is retold (Pico, 2019).

140

141 *Nature as divine: people as primitive*

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142

143 A common metaphor in scientific reports or expedition narratives written by these geologists is  
144 that of celestial or divine objects. Powell described his descent into the Grand Canyon as a  
145 descent into hell, likening the stratigraphy to pages in a bible (Powell, 1895). This language fits  
146 into a larger trend in the 19<sup>th</sup> century, where wilderness was depicted as containing the  
147 supernatural just behind the surface (Cronon, 1995; Merchant, 2003). In the mid-19<sup>th</sup> century,  
148 landscapes inhabited by Indigenous peoples were thought to represent untouched nature, and  
149 these places, uninhabited by white US Americans, became idolized as sites of national identity  
150 (Finney, 2014). Through the institution of slavery, Black people were similarly rendered a part  
151 of a primitive nature scene "treating them with the same mixture of contempt, false reverence,  
152 and real exploitation that also marks American environmental history"<sup>i</sup>. As Caroline Finney  
153 develops in *Black Faces, White Spaces*, this legacy makes it challenging for people of color to  
154 take part in a simple relationship to the natural outdoor world.

155

156 *Modern representation of people of color in the outdoors*

157

158 Students of color in geology courses may find themselves wrapped into a modern version of  
159 this stereotype, where people of color are typed as primitive. As Finney illustrates, modern  
160 popular culture still contains references to Black people as primitive, for example when Glen  
161 Beck, a conservative political commentator, called Obama's America a "planet of the apes", or  
162 when basketball player LeBron James was depicted similarly, as King Kong, in Vogue magazine  
163 (Finney, 2014).

164

165 Furthermore, students of color will simply find their face absent from modern depictions of  
166 who participates in outdoor culture, and therefore geology. In a study of images including  
167 people in the outdoor recreation magazine *Outside*, Black people were represented in only 103  
168 of 4602 images, and these were mostly in advertisements for sporting goods in urban settings  
169 (Finney, 2014). If participation in outdoor recreation is strongly linked to an interest in a career  
170 in geology, then the exclusion of people of color from these activities, signaled through who is

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171 represented in these spaces, might help to explain the challenge for geology to recruit a racially  
172 diverse student body. Furthermore, an analysis of images in geoscience textbooks showed that  
173 people of color were rarely featured, except in sections warning about climate change and  
174 overpopulation. Only 45 of 528 photos analyzed contained non-Western images, and 10 of 12  
175 images portraying Black people were used to represent the threat of overpopulation (Phillips &  
176 Hausbeck, 2000).

177

178 *Safety outdoors in the United States today*

179

180 In considering the role of the outdoors for attracting geology majors, an important aspect is the  
181 perceived and real safety for geologic field research or teaching sites. The outdoor wilderness is  
182 a historical site of violence, given the number of lynching incidents that occurred in the woods.  
183 Memories of black families driven off of city or state parks by threatening mobs continue to  
184 shape how Black people view their position in outdoor spaces (Finney, 2014). Today, many of  
185 these natural outdoor sites remain outside the realm of safety for Black people. As a piece  
186 published in the New York Times explains the hesitation for a family trip to Montana: "Four  
187 black folks from Oakland, California cruising the back roads of Montana. Are you nuts?" (Finney,  
188 2014).

189

190 Many field courses are conducted in rural regions of the United States, areas which are  
191 frequently openly hostile towards non-white US Americans. A recent video published by a  
192 geoscience undergraduate student recounted the constant racial tension he experienced as a  
193 Black person working in the field in the heart of the United States, including being stared down,  
194 being ignored by locals who spoke past him to his white colleagues, and threatening run-ins  
195 with people that had white supremacist and neo-Nazi symbols on vehicles or tattoos (Josh  
196 Anadu, n.d.). During my month-long field camp in graduate school near Death Valley, California,  
197 every time we drove out of our base camp we passed a water tower vandalized with Latinx  
198 slurs.

199

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200 The issue of safety during fieldwork has previously been considered in studies that show high  
 201 rates of sexual harassment and sexual assault in these environments (Clancy, Nelson,  
 202 Rutherford, & Hinde, 2014). Such studies indicate that women of color are at particularly high  
 203 risk for incidents of sexual harassment (Clancy, Lee, Rodgers, & Richey, 2017). Instructors in  
 204 field geology should carefully consider the safety of the location where field camps are  
 205 conducted in regards to the intersectional identities of students in terms of race, gender, and  
 206 sexual orientation. Furthermore, leaders in the field can purposefully incorporate race in  
 207 planning through clear expectations and prioritizing the safety of students of color (J. Anadu,  
 208 Ali, & Jackson, 2020).

209

210 *Epistemic injustice*

211

212 The exclusion of discussion surrounding the racist nature of foundational geology or the  
 213 historical and modern relationship between people of color and the outdoors in the United  
 214 States leaves an absence in knowledge that would allow a student of color to contextualize  
 215 their experience in geology. This absence in knowledge regarding a significant part of this  
 216 student's social experience is an example of systemic hermeneutical injustice, a term coined by  
 217 Miranda Fricker to refer to structural prejudice that limits access to shared resources for  
 218 interpreting social experiences (Fricker, 2007). Without access to an intellectual framework  
 219 through which to understand their lived experiences in geology, students are disconnected  
 220 from epistemic resources that would aid them in understanding which parts of their social  
 221 experience are shared or isolated.

222

223 Undergraduate geology programs have a small number of majors that are students of color.  
 224 Therefore, these students are less likely to have their experiences validated by others with  
 225 similar experiences. Furthermore, students of color may not be successful in having their  
 226 voices heard. As Kristie Dotson describes, because the audience (leaders in geology  
 227 departments) may not identify the speaker (a student of color) as a knower, their epistemic  
 228 authority may be questioned (Dotson, 1998). This epistemic silencing limits the ability of

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229 students to be supported or even to testify to their own race-modulated experiences.  
230 Furthermore, Dotson defines the idea of "testimonial smothering", where a speaker may  
231 identify limitations in the audience's willingness or ability to appropriately understand the  
232 testimony of their experience. Testimonial smothering results in the speaker curating their  
233 testimony, such that it only contains content that the audience is deemed competent to grasp  
234 (Dotson, 1998). Thus, students of color, realizing the limits of their leadership, may offer  
235 abridged palatable versions of their experiences – such that leaders will inherently be limited in  
236 knowing how race modulates students' experiences.

237

238

## 239 **Part 2: Field practices that subjugate the local for the global**

240

241 By training the next generation of geologists without regard to a history of imperialist and  
242 eugenic practices by foundational US American geologists and by ignoring the safety or  
243 representation of people of color in spaces where field geology is conducted, the discipline  
244 perpetuates these same practices of exclusion. I now turn to research practices in field geology  
245 today. I wish to analyze how these practices mimic the marginalizing imperialism imposed by  
246 19<sup>th</sup> century US American geologists. First, I consider how field sites are chosen without regard  
247 to how scientists will interface with inhabitants of these spaces. I examine how field geologists  
248 privilege sites that are considered remote or untouched by Western scientists. Next, I dissect  
249 how field geologists build an intellectual framework that produces value for scientific  
250 knowledge created by Western scientists while devaluing the contributions of local knowledge  
251 in geology research. Finally, I turn to field research goals, underlining how these rarely serve the  
252 interests of communities where research is conducted, and whose inhabitants provide essential  
253 resources.

254

255 *Field sites: entering and exiting*

256

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257 Can we set field geologists today apart from their imperialist 19<sup>th</sup> century counterparts? I am  
 258 inspired by Donna Haraway's assertion that is difficult to imagine "the possibility of new stories  
 259 not strangled by the same logics of appropriation and domination" (Haraway, 1989). Modern  
 260 geologic fieldwork shares some themes with 19<sup>th</sup> century nationalist-driven geology. The  
 261 history of military involvement in nationally sponsored geography and geology expeditions  
 262 leaves the field as a site of conquest, centuries later, since geologists are trained with similar  
 263 approaches to fieldwork. As examined by Matthew Sparke in "Displacing the Field in  
 264 Fieldwork", fieldworkers are free to enter and leave their field site, a position that communities  
 265 inhabiting this space cannot claim (Sparke, 1996). In this way, field geologists mimic the military  
 266 in how they enter a site unexpectedly, dominate this space and acquire resources, and remove  
 267 themselves when their goal is complete. The status of the fieldworker plays an important role in  
 268 acquiring this level of power. The position of gender and race mark the fieldworker in the new  
 269 field space, and modulate access to power over resources in this space (Henderson, 2009;  
 270 Vanderbeck, 2005). Guides, which rarely exist, about how to conduct field work are void of any  
 271 content regarding how individuals would interface with different cultures. Unlike other  
 272 disciplines that conduct field work, there is rarely a required ethics training. Field geologists  
 273 rarely consider the population inhabiting the physical space they are targeting. Rather, they  
 274 consider the geologic questions to be of primary interest, and the principal motivation for  
 275 choosing a field site.

276

277 *Field sites: valuing the remote*

278

279 Geologists place especially high value on field work in remote-to-access areas. In scientific talks  
 280 it is common to show photographs from the field that highlight an especially dangerous aspect  
 281 of field work (crossing a river rapid, scaling mountains in a blizzard, or camping near polar  
 282 bears). These stories from the field elicit awe and honor, and act to reify the notion of the  
 283 tough and rugged geologist. Indeed, these narrative fits snugly into the "hero-scientist" role,  
 284 which, as Mary Terrall analyzed in "Heroic narratives of quests and discovery", required "risk-  
 285 taking and physical toughness, to accompany the intellectual brilliance required of the

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286 successful man of science" (Terrall, 1998). These actions linked to masculinity, as "men sought  
 287 glory through the emulation of soldiers", which rendered science a means for seeking honor. In  
 288 a similar vein, by choosing (and bragging about) dangerous field sites, these geologists prove  
 289 character through sacrifice, a theme analyzed by Rebecca Herzig in *Suffering for Science* (Herzig,  
 290 2005). As Herzig illustrates, the suffering by scientists which legitimizes their place as heroes  
 291 can only be accessed by some bodies. For example, the Peary expedition to the Arctic glorifies  
 292 the suffering of the two white men explorers, extolling how their brilliant discoveries rested on  
 293 these sacrifices, while diminishing and silencing the contributions of the Matthew Henson, the  
 294 black male explorer who was "arguably the most crucial member of the team" (Herzig, 2005).

295  
 296 How are these honor- and character- building rites sanctified? Field sites seen as remote or  
 297 difficult-to-access are privileged because they are considered pure and untouched knowledge  
 298 vessels by Western scientists. Geologists will explain that "no one" has mapped this region  
 299 since pre-plate tectonics theory (1970s) or that there are no measurements of X technique in  
 300 this region, to justify why the site should be studied. These sites are in remote regions of  
 301 postcolonized spaces, in Africa, South America, and Asia, for example in the mountains of Peru,  
 302 the shorelines of Madagascar, or valleys in the Himalayas. Challenges accessing a field site, such  
 303 as trekking through mountains for days with little (or rotten!) food, or hitchhiking on  
 304 motorbikes, become an aspect of scientific rigor, and the more remote or untouched by other  
 305 scientists, the more prestigious the work. These challenges are safer for certain identities: my  
 306 colleagues who are white men have even told tales of lodging at brothels (perhaps due to  
 307 budget constraints or poor planning), which could be dangerous for women-identifying and  
 308 non-binary identifying people.

309  
 310 In an eerie flashback to 19<sup>th</sup> century geology, spaces deemed wild, natural, and primitive are  
 311 privileged for field work, and one feature of these spaces is their inhabitation by Indigenous  
 312 populations. Thus, the field sites most valued by geologists are those where the Indigenous  
 313 population forms a part of this nature scene, rendering communities of color invisible as  
 314 humans, and camouflaged into the landscape. Geologists are therefore drawn to conducting

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315 research in these areas to gain legitimacy through the heroic explorer scientist trope, forcing  
 316 the geologists into a position where they must interface with largely communities of color. The  
 317 white US geologist then creates the inescapable power structure between the outside  
 318 postcolonial Westerners and the local postcolonial non-Westerners. Unaware, or unable to  
 319 articulate these power dynamics, the US geologist mimics the same oppressive practices  
 320 performed by 19<sup>th</sup> century colonialists, exploiting natural and human resources to attain their  
 321 scientific goals.

322

323 I wonder if field geologists form an intellectual wall between the physical geology they are  
 324 studying from the humans that inhabit this space, or whether geologists in somehow view this  
 325 population as part of the existing toolset at their field site. If the prior, geologists'  
 326 determination to separate the geology from the people mirrors other scientific disciplines that  
 327 impose strict boundaries between the scientific and the social (Harding, 2008). However, the  
 328 alternate case recalls 19<sup>th</sup> century geologists who wrote about Indigenous people in their same  
 329 reports about rocks, imagining them as a primitive part of the landscape they studied, even  
 330 going as far as to using the ancientness of landscapes to make claims about the primitiveness of  
 331 Indigenous people on this land (Chakrabarti, 2019). In this latter case, the field site blends  
 332 natural and human resources.

333

334 *Universal versus local knowledge: capitalizing on Indigenous knowledge*

335

336 Geologists rely on community resources for their work, by hiring field assistants or guides, or  
 337 simply for advice on how to navigate community dynamics. Those who provide this work or  
 338 knowledge rarely receive credit or compensation commensurate with value ultimately  
 339 produced. In placing value only on knowledge produced by Western geologists in non-Western  
 340 spaces, these scientists partake in the capitalization of local knowledges. Field geologists rely on  
 341 these local knowledges for their scientific work: they must gain access regions of interest and  
 342 they must acquire as much local knowledge of the physical geography as possible. This  
 343 knowledge forms a crucial component of field geology. However, locals that provide this

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344 knowledge rarely receive sufficient compensation, whether in the form of monetary value or  
 345 intellectual credit. Nevertheless, "universal" knowledge produced by US geologists in these  
 346 countries creates value back home, both monetarily, in terms of funding for the scientists, and  
 347 status-wise, increasing the prestige of the scientist.

348

349 My impression is that US geologists feel little accountability to properly compensate local  
 350 assistants or colleagues. My discussions with field geology colleagues imply that inclusion of  
 351 these local assistants or colleagues as intellectual contributors is a nicety rather than an  
 352 obligation. It is not standard to include these intellectual contributions as coauthorship, and I  
 353 think this practice may result from Western scientists viewing these individuals as less powerful  
 354 in US-dominated geoscience world. Yet the labor and knowledge that local communities share  
 355 with field geologists produces real value. As Mohanty suggests in *Feminisms without Borders*:  
 356 "It is the colonialist and corporate power to define Western science, and the reliance on  
 357 capitalist values of private property and profit, as the only normative system that results in the  
 358 exercise of immense power" (Mohanty, 2003). Western geologists, trained with these values,  
 359 approach the field in a desire to produce scientific knowledge, and therefore profit off this  
 360 physical space by creating important scientific value. This valuable scientific knowledge  
 361 advances the field geologist, who ignores or undervalues the contribution of local workers in  
 362 order to amass scientific prestige and power.

363

364 Such practices can be identified as "scientific colonialism", situations where scientific  
 365 knowledge is acquired at a source, but the processing or production of that knowledge occurs  
 366 somewhere else, and the profit resulting from this knowledge production (such as peer-  
 367 reviewed articles, grants, or graduate degrees) is not received by those at the source (Nicholas  
 368 & Hollowell, 2007). The scientific results produced by field geologists help these scientists  
 369 secure further funding in addition to increased standing and prestige in the Western scientific  
 370 community. Through a Marxist perspective, we can see how, despite Western field geologists'  
 371 reliance on the knowledge and labor of local communities, they continue to exert a  
 372 monopolized control over the means of knowledge production, while local communities are

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373 barred or limited to access to controlling the means of production (La Salle, 2010). The strong  
 374 power differential between the US field geologist and the local inhabitant transforms local  
 375 knowledge into a universally-recognized and profitable knowledge.

376  
 377 Scientific knowledge is seen by the geology community as devoid of social forces, especially for  
 378 research subjects such as deep time geology, which operate on non-human timescales. Thus, an  
 379 intellectual separation is formed between the knowledge produced and the practices employed  
 380 for obtaining this knowledge. By cleaving the practice of geology from the science of geology,  
 381 scientists can ignore their work's serious social footprint. Dividing the social and scientific  
 382 enables geologists to devalue knowledge already held by Indigenous communities about the  
 383 landscapes they inhabit (Agrawal, 1995). Through this framework, geologists can justify the  
 384 small monetary and intellectual compensation they provide to local workers who are crucial to  
 385 completing research tasks. Training field geologists with this toolset guarantees that the next  
 386 generation will practice and then transmit practices of imperialist knowledge production.

387  
 388 *Towards community-based methods in geology?*

389  
 390 Geologists invade field spaces and freely use both natural and community resources to answer  
 391 their driving scientific questions. When they do so, geologists hardly acknowledge that the  
 392 community inhabiting their field space is crucial for completing fieldwork, and that research  
 393 questions investigated are rarely driven by community desires. In other disciplines that conduct  
 394 fieldwork, such as sociology or anthropology, it is now common practice to consider  
 395 community-based participatory research practices. From this framework, good research is  
 396 research that includes the community studied at every stage of the process, including research  
 397 priorities (Jordan, Gust, & Scheman, 2005). Scholars have considered what constitutes ethical  
 398 scientific research, and in analyzing research with Native American populations, Kim TallBear  
 399 argues for the need of "strong objectivity" in the field by speaking "in faith", acting in concert,  
 400 rather than for, the given population (Tallbear, 2014). In archeology the adoption of  
 401 community-based practices and collaboration with descendant communities has become

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402 common place, although archeologists' approach to these practices does not always result in  
403 the goal of redistributed research power (La Salle, 2010; Wylie, 2019).

404

405 These community-based participatory research methodologies are not constricted to studies  
406 involving human populations: there is space to bring these methods into field geology. In fact,  
407 geology holds an obvious connection, through research with urgent implications for our  
408 understanding of deadly natural hazards like earthquakes, volcanoes, landslides, and tsunamis.  
409 In many previously colonized regions, poor infrastructure makes natural hazards a particularly  
410 serious threat. Of course, incorporating such methods requires that field geologists abandon  
411 current one-sided practices, and open a two-way dialogue, listening closely to the voices of the  
412 community at the field site. In the field geology community there would first need to be  
413 recognition that the current practice of extracting resources from the community is exploitative  
414 and unequal. As La Salle highlights, to move beyond collaboration, to move beyond  
415 consultation and working side by side, it is necessary to change our roles in research by giving  
416 up control over the research program. Giving up this control would allow "power firmly in the  
417 hands of the people who are most closely affected by what research they choose to do"(La  
418 Salle, 2010). This means not only that a research project might completely change directions,  
419 but also that the project might be abandoned altogether. Thus, geologists would not direct  
420 research programs but may instead work as technicians, helping communities accomplish their  
421 own research objectives.

422

423 Perhaps I am optimistic, but I can envision a system where networks of geoscientists build  
424 around the desires of communities where fieldwork is conducted to propose novel projects and  
425 collaborations. Field geologists could converse with community leaders in their desired field site  
426 to find out what geo-concerns are most relevant to the population. For example, geoscientists  
427 interested in studying past sea level one-hundred thousand years ago in Madagascar might  
428 listen to the need for research on changing fishery conditions at their desired field site, and  
429 connect the local community with fishery scientists equipped to tackle their questions. While I  
430 have found that humanitarian projects led by geoscientists exist, these kinds of projects

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431 determine the needs of the given population from the exterior, and do not include these  
432 populations throughout the research process ("Geoscientists without Borders," n.d.).  
433 Community-based geoscience research cannot be considered a charity. Rather this is the only  
434 kind of field research we should deem acceptable, as it produces science that, through  
435 conjunction with society, truly meets the needs of people and consciously detaches itself from  
436 exploitative colonialist research practices.

437

### 438 **Conclusion**

439

440 Through this essay I explored how historical and modern practices in US field geology lead to  
441 exclusion within and subjugation outside the geoscience community. The geosciences suffer  
442 from a severe underrepresentation of minorities at all academic levels (Bernard & Cooperdock,  
443 2018). This underrepresentation, in part, may result from an absence of acknowledging the  
444 social context through which the discipline first developed, as well as the discipline's  
445 relationship to marginalized communities today. There is a deep history of race-based exclusion  
446 from outdoor spaces, and this could exacerbate why Black students and other minorities  
447 express less interest in geology as a major. Further, by glorifying figures in geology who were  
448 involved in marginalizing imperialist practices, we rob students of the opportunity to  
449 contextualize their experience with the historical record of geology practices. We cannot ignore  
450 that the real and perceived safety for conducting field geology work is a substantial concern for  
451 people of color, and the high prevalence of sexual harassment in the field exacerbates this issue  
452 for women of color. In addition, the representation of people of color in popular culture images  
453 of outdoor spaces, as well as in geoscience textbooks and faculty lists, leave little space to  
454 imagine a future in this discipline.

455

456 I identify how racist and imperialist methodologies are perpetuated in the training of geologists  
457 through field work practices in postcolonial spaces. Seeking legitimacy through rugged  
458 fieldwork, geologists place themselves in third world countries, entering into a lopsided power  
459 dynamic. These geologists rely on local community resources and knowledge in order to

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460 complete scientific goals. However, the motivation of scientists to amass prestige and power  
 461 through their individual intellectual contributions results in the under compensation of local  
 462 workers. Furthermore, the primary research goals of field geologists rarely consider the  
 463 interests of the community inhabiting their field site, let alone include their participation in the  
 464 development stage of selecting research questions. Inverting the current research process to  
 465 include communities inhabiting field sites in the primary stages of research development has  
 466 the potential to transform the scientific knowledge produced in field geology, uncovering new  
 467 subjects of inquiry. Nevertheless, current training practices act to reinforce and reperform the  
 468 imperialist relationship between the field geologists and the community at the field site.

469

470 I am interested in exploring the relationship between the field geologist, and the physical space  
 471 inhabited, because I believe that lodged somewhere in this space we can begin to understand  
 472 the roots of exclusion and exploitation in geology. I can envision a field geology that opens up a  
 473 space for new faces. This space would be created by explicitly discussing the legacies of  
 474 foundational geologists entrenched in scientific racisms and imperialistic expansion. This space  
 475 would acknowledge the complex relationship between students and the outdoors. This space  
 476 would consciously detach itself from the logic of oppression, drawing upon scientific methods  
 477 that adopt community-based research practices and defetishize the third world as a site of  
 478 rugged and primitive wilderness to conquer. In this space field geology could come to terms  
 479 with its past, and begin to set the stones for the future.

480

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<sup>1</sup> Outka in (Finney, 2014)