

# Gained, Lost, Missed, Ignored: Vernacular Scientific Translations from Agricola's Germany to Herbert Hoover's California

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Although the study of global early modernity has unfolded differently within history and literary studies, and although they apply different methodologies, global history and global literature are both fundamentally concerned with overlap, convergence, and entanglement. However, this emphasis on connection tends to downplay the role of separation in the making of the early modern world. Transoceanic slave trades severed communities in West Africa and throughout the Pacific and Indian Ocean worlds; colonial systems of tribute labor forced Amerindian women and men to leave their homes, ways of life, and kinship networks to work in mines and on plantations; and extractive imperial economies produced dramatic divergences, both within European nations and among Europe, Asia, Africa, and the Americas. In the story of global early modernity, colonial violence, scientific knowledge, and economic forces brought human societies together and tore them apart.

In this essay, as part of this special issue's theorization of multiple global early modernities, I study a case of nonconnection in the vernacular sciences: the nontranslation into English of Georgius Agricola's *De re metallica* (1556), arguably the most important early modern book of mining and metallurgy.<sup>1</sup> In the 1550s and 1560s the work was translated into German, Italian, and Spanish; by the seventeenth century, it was available in Mandarin. But the first English-language translation was not published until 1912, when mining engineer and future US president Herbert Hoover (1874–1964;

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1. I use the phrase "vernacular science" to emphasize fields like mining and metallurgy, where artisan knowledge and embodied experience defied traditional binaries between thinking and doing. See Pamela H. Smith, "Vermilion, Mercury, Blood, and Lizards: Matter and Meaning in Metalworking," in *Materials and Expertise in Early Modern Europe: Between Market and Laboratory*, ed. Ursula Klein and Emma C. Sperry (University of Chicago Press, 2015), 29–49.

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governed 1929–33) collaborated with his wife, geologist Lou Henry Hoover (1874–1944), to translate the twelve-book tome. In contrast, not long after the publication of Andalusian priest Álvaro Alonso Barba's *Arte de los metales* (1640), English admiral Edward Montagu (1625–1672) translated it into English. Montagu's translation of 1670 was so popular that it was reissued in 1672, and it became the source for subsequent European translations of Barba's work.

The rapid translation of Barba and the nontranslation of Agricola invite us to reconsider early modern understandings of scientific and global communities. By translating and reprinting Barba's book, and positioning it as the source for German-language editions, early modern English translators, printers, and editors pulled their readers into a transatlantic community that bound Andean knowledge systems and western European print culture, whereas the nontranslation of Agricola's book created intellectual distance between English and European readers. Agricola cites authorities like Pliny, Columella, Gerber, and Lull, drawing from a scientific foundation that would have been familiar to English readers and practicable in their mines and refineries. Barba's treatise was written in Potosí and steeped in Indigenous knowledge systems that British audiences did not understand, if Montagu's translation is any indication; Barba cites Indigenous collaborators and information networks, and he writes in a hybrid form of Spanish, Quechua, and Aimara.<sup>2</sup> If it is true that early modern science was characterized by a new attention to firsthand experience, it is worth considering why British audiences ignored a work they could apply and instead embraced one that they could not put into practice.<sup>3</sup> By studying scientific translation and nontranslation, we gain a new way of thinking about connection and divergence within the early modern world. This article does that in three parts. The first part reviews the scholarship on world and global history and literature. The second part analyzes the English nontranslation of Agricola in the sixteenth, seventeenth, and eighteenth centuries. The third part studies the interlocking forces of racism, scientific knowledge, and language in Hoover and Hoover's work, setting up a conclusion that reflects

2. Álvaro Alonso Barba, *Arte de los Metales en que se enseña el verdadero beneficio de los de oro, y plata por açogue* [ . . . ] (Madrid, 1640), 29, 39, via the Making of the Modern World (MMW), <https://www.gale.com/primary-sources/the-making-of-the-modern-world>. I analyze Barba's language and translation history in *Mining Language: Racial Thinking, Indigenous Knowledge, and Colonial Metallurgy in the Early Modern Iberian World* (Chapel Hill: Omohundro Institute of Early American History & Culture for the University of North Carolina Press, 2020), 229–321. The book narrates the long arc of the incorporation and erasure of Indigenous mining knowledge in the Atlantic world, whereas this article focuses on the nontranslation of European mining materials.

3. See Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (University of Chicago Press, 2008).

upon the larger stakes of using translation as an analytical method in global early modern studies.

## I. THE WORLD AND THE GLOBAL

### 1. World History and Global History

Early modern world history has been traditionally defined by connections and convergences, as women and men in previously separate regions were knit together into new forms of commercial transactions, extractive imperial politics, and resistance to colonial violence. A classic example is the role of the Iberian silver industry in creating world trade. According to economist Dennis Flynn and historian Arturo Giráldez, sixteenth-century merchants shipped silver from Latin America to East Asia, where it was valued twice as much as gold, relative to rates in Europe.<sup>4</sup> As Iberian traders navigated the Indian Ocean world and the coasts of Africa, they bought and sold people and goods before returning to Portugal and Spain. There, another round of ships departed for the Americas to begin the cycle anew.<sup>5</sup>

By centering the demands of early modern East Asian actors within a historiography of globalization that gave pride of place to twentieth-century Europe, Flynn and Giráldez helped to open up new questions in world history.<sup>6</sup> (While some scholars maintain that world history is primarily a matter of undergraduate teaching, others see it as a research area.<sup>7</sup>) However, their bird's-eye picture obscured the experiences of women and men whose lives were drawn into contact, such as African and Indigenous miners in the Americas, and it neglected the regions that were left out of these new flows of silver—capital that never coursed evenly around the globe, but instead

4. Exchange rates fluctuated, but in the late sixteenth century and early seventeenth century, gold was traded for silver in Canton at a rate of 1:5.5–1:7 and in Spain at 1:12.5–1:14, suggesting that silver was valued roughly twice as high in China as it was in Spain. Dennis O. Flynn and Arturo Giráldez, “Born with a ‘Silver Spoon’: The Origin of World Trade in 1571,” *Journal of World History* 6, no. 2 (Fall 1995): 201–21.

5. I refer to the economic systems that oversaw these ships, not to specific ships. As Nicholas A. Robins notes, “We will probably never know if the slaves who labored in Potosí were actually purchased on the coast of Africa with silver extracted by mitayos from the Cerro Rico, but such cases would be laden with a dreadful irony. Potosí came to them, and they came to Potosí” (*Mercury, Mining, and Empire: The Human and Ecological Cost of Colonial Silver Mining in the Andes* [Bloomington: Indiana University Press, 2011], 179–80).

6. Adam McKeown, “Periodizing Globalization,” *History Workshop Journal*, no. 63 (Spring 2007): 228.

7. Micol Seigel, “World History’s Narrative Problem,” *Hispanic American Historical Review* 84, no. 3 (August 2004): 431–46; Bruce Mazlish, “Comparing Global History to World History,” *Journal of Interdisciplinary History* 28, no. 3 (Winter 1998): 385–95. Raymond Grew takes a both/and approach in “Expanding Worlds of World History,” *Journal of Modern History* 78, no. 4 (December 2006): 878–98.

concentrated in enclaves of wealth within landscapes of poverty. Anthropologist James Ferguson, writing about contemporary extractive industries in Ghana, the Democratic Republic of the Congo, and Angola, notes, “Capital does not ‘flow’ from New York to Angola’s oil fields, or from London to Ghana’s gold mines; it hops, neatly skipping over most of what lies in between. . . . Capital is globe-hopping, not globe-covering.” In this view, as true for the present day as it was in the early modern era, globalization is not “an enveloping level of coverage superior to the national but, rather, a form of point-to-point connectivity that bypasses and short-circuits all scales based on contiguity.”<sup>8</sup>

Readers may have noted a conflation of world history and global history in this opening discussion. The two fields have different origins and etymologies, although they share scholarly aims. World history is a concept that “reaches back several centuries” and traces its linguistic roots to “the Middle English for ‘human existence,’” while global history originated in twentieth-century experiences of globalization, variously dated to the 1950s or 1970s, and maps particular aspects of globalization, such as travel, transportation, and communication, back in time, using a spatially named *etic* approach that “permits the notion of standing outside our planet.”<sup>9</sup> World history examines macroeconomic processes of change and diffusion among large-scale actors like civilizations or nation-states, which are taken as more or less stable entities, whereas global history emphasizes the practices and negotiations of individuals and communities amid “fluid” and “flexible” conditions that unfold across national, linguistic, and cultural borders.<sup>10</sup>

In many cases of world and global history, the difference is perhaps one of degree, not of kind. Whereas they focus on different subjects, both approaches share a concern for connection and convergence, rather than difference and divergence. Some scholars even use the “world” part of world history to explain global history, asserting that “while the world has always been a globe . . . globalization describes the process by which this globe became a world, to the extent that its parts came to know themselves to be a world.”<sup>11</sup>

8. James Ferguson, *Global Shadows: Africa in the Neoliberal World Order* (Durham, NC: Duke University Press, 2006), 38, 42.

9. Sebastian Conrad, *What Is Global History?* (Princeton University Press, 2016), 62; Mazlish, “Comparing Global History to World History,” 389, 391. Environmental humanist Phillip John Usher argues, “We can no longer make do with looking back at Earth *as if from nowhere* or *as if from outer space*,” but must instead think “relationally” about the Earth and “make perceptible the material and immaterial entanglements of the Earth from which we extract” (*Exterranean: Extraction in the Humanist Anthropocene* [New York: Fordham University Press, 2019], 1–2).

10. Conrad, *What Is Global History?*, 64–65.

11. Iyonna del Valle, Anna More, and Rachel Sarah O’Toole, editors’ introduction to *Iberian Empires and the Roots of Globalization* (Nashville: Vanderbilt University Press, 2020), 10.

Others simply write of “world/global historians,” treating them as synonymous terms.<sup>12</sup>

However, one mode of global history, microhistory, cannot easily be incorporated into world history paradigms. Microhistories do not focus on world-changing systems like the silver trade, but instead on points of connection among communities who shared similar experiences but did not know of each other’s existence. Examples of recent global microhistories include the coeval development of *casta* classifications in the Iberian colonies of Goa, Mexico, Yucatán, Peru, and Brazil; the diary entries of Nahua author Domingo Chimalpahin Cuauhtlehuanitzin (1579–1660) on the assassination of King Henry the Great, of France; and the martyrdom in Japan of twenty-six Christians of Spanish, Portuguese, Indian, Mexican, and Japanese descent.<sup>13</sup> Serge Gruzinski, who uses this last example as a point of departure for his study of global early modernity, worries that discourses of alterity lead scholars to privilege or even “reify” difference, instead of studying the connections that made the early modern world truly global.<sup>14</sup>

But such connections are only made possible by separation: coming into being and tearing asunder are two coeval, constitutive processes, such as the “great divergence” of Europe from Asia, or of Britain from Asia and certain areas of Europe, as historian Prasannan Parthasarathi argues.<sup>15</sup> In the kinds of human terms that such macroeconomic stories often occlude, the violent separation of African women, men, and children from ancestral homelands enabled the development of racial capitalism and produced the “trauma of realization that one had neither the right nor the power to resist what must have seen so often to be the arbitrary or cruel removal from those who really mattered.”<sup>16</sup> In the Americas, Indigenous families were conscripted into tribute labor service (*repartimiento*); as women, men, and children migrated from ancestral villages to mines and plantations, they severed connections

12. Conrad, *What Is Global History?*, 67.

13. María Elena Martínez, “Religion, Caste, and Race in the Spanish and Portuguese Empires: Local and Global Dimensions,” in del Valle, More, and O’Toole, *Iberian Empires and the Roots of Globalization*, 75–104; Serge Gruzinski, *Las cuatro partes del mundo: Historia de una mundialización* (2004; Mexico City: Fondo de Cultura Económica, 2010), 25–49. For a later example, see Gabriela Soto Laveaga, “Largo Dislocare: Connecting Microhistories to Remap and Re-center Histories of Science,” *History and Technology* 34, no. 1 (2018): 21–30.

14. Gruzinski, *Las cuatro partes del mundo*, 42. The original quotation reads: “Más recientes y más capciosas todavía, las retóricas de la alteridad—los discursos o la mirada sobre el Otro, la visión del Otro . . . —levantan obstáculos tan terribles como las torpezas y los reduccionismos de las historiografías locales. Diferencias y distancias, frecuentemente exageradas, reificadas y a veces, incluso, totalmente imaginadas, terminan por enterrar las continuidades, escamotear las coincidencias o los pasajes que harían viable la diaria coexistencia entre los seres y las sociedades.”

15. Prasannan Parthasarathi, *Why Europe Grew Rich and Asia Did Not: Global Economic Divergence, 1600–1850* (Cambridge University Press, 2011), 2.

16. Cedric Robinson, *Black Marxism: The Making of the Black Radical Tradition* (Chapel Hill: University of North Carolina Press, 2000), 123.

with extended kinship networks, life-giving land, and the cosmological rhythms that both informed and drew their meaning from daily practices.<sup>17</sup> Telling the story of global early modernity through the lens of connection, without considering which kinds of convergence “were crucial to the social make-up of a society” and which “remained accidental and ephemeral,” or without analyzing how those connections were enabled by separations, leaves us with a distorted view of the past.<sup>18</sup>

## 2. World Literature and Global Literature

Unlike world history, world literature, or global literature, as it is sometimes called, started from the premise of disconnection.<sup>19</sup> The field was named by Johann Wolfgang von Goethe in the nineteenth century (*Weltliteratur*), but it traces its roots to the violence of early modern European colonialism when, as literary scholar Srinivas Aravamudan writes, “A nascent world literature began with the linguistic and cultural decoding of multiple languages thrown together by exploration. ‘Worlding’ at this moment of early modern/Renaissance discovery featured the polycentric and pluralized languages of a singular modernity, bolstered through investigations of cultural pasts that intercommunicated contingently.”<sup>20</sup> In essence, as European conquerors, missionaries, and merchants appropriated the knowledges, goods, and labor of people in Asia, Africa, and the Americas, they learned local languages and created relationships with translators, interpreters, and intermediaries who strategically shared and withheld information about their land, history, and ways of being in the world.

The translated texts produced by colonial violence, which include genres like histories, natural histories, relations, and chronicles, as well as lettered accounts of daily life like surveys, parish records, and instructions to local officials, created “inter-relationality but also the mutual tolerance of minute particulars that do not get homogenized.”<sup>21</sup> In other words, translation both

17. Kendall Brown, *A History of Mining in Latin America: From the Colonial Era to the Present* (Albuquerque: University of New Mexico Press, 2012), 54; Esteban Mira Caballos, *El indio antillano: Repartimiento, encomienda y esclavitud (1492–1542)* (Seville: Biblioteca Americana, 1997), 94–218.

18. Conrad, *What Is Global History?*, 68.

19. Anders Pettersson, “Transcultural Literary History: Beyond Constricting Notions of World Literature,” *New Literary History* 39, no. 3 (Summer 2008): 470–71. See also the critique in Pheng Cheah, “World against Globe: Toward a Normative Conception of World Literature,” *New Literary History* 45, no. 3 (Summer 2014): 303–29, esp. 310–13.

20. Srinivas Aravamudan, “East-West Fiction as World Literature: The ‘Hayy’ Problem Reconfigured,” *Eighteenth-Century Studies* 47, no. 2 (Winter 2014): 196.

21. *Ibid.* On the genres of colonial encounter, see Walter Mignolo, “Cartas, crónicas y relaciones del descubrimiento y la conquista,” in *Historia de la literatura hispanoamericana*, ed. Luis Iñigo Madrigal, vol. 1 (Madrid: Cátedra, 1992), 57–116.

enabled the exchange of cultural data around the world and documented the limits of eyewitness observers, interpreters, and editors to convey meanings that slipped between tongues.

New work in translation departs from these moments of nonconnection, arguing, as does literary scholar Emily Apter, that an appreciation of untranslatability “as a linguistic form of creative failure” can help “to wean World Literature from its comfort zone,” a space in which obtuse writing, elitist references, and an inability to “question what it means to ‘have’ a literature or to lay claim to aesthetic property” has rendered “literary communities . . . gated” and wanting in their “anti-capitalist critique.”<sup>22</sup> While Apter focuses on contemporary world literature in a globalized, neoliberal economy, her use of Barbara Cassin’s theory of the untranslatable resonates with scholars of translation in the colonial Americas. Literary scholar Larissa Brewer-García’s work on Black translators and interpreters as meaning-making agents in the Christian economy of Nueva Granada and Peru is one recent example of this approach.<sup>23</sup> In a similarly novel vein, but in a different region of the hemisphere and with a focus on Native interpreters, Anna Brickhouse reads mistranslation as evidence of Indigenous agency in resisting colonial settlement.<sup>24</sup>

Literary scholars have readily embraced divergence and difference in their study of the past, while historians have more often studied connections and entanglements.<sup>25</sup> Because the study of global early modernities has one foot in both fields, this essay attempts to bring them into dialogue. Here I approach nontranslation not through the theoretical lens of the untranslatable (Apter), or as mistranslations that enable access to subaltern agencies (Brickhouse), but rather as an ostensibly simple case in which someone decided not to translate something—in this case, a work so important it was known as “the miner’s Bible.”<sup>26</sup>

## II. TRANSLATION AND NONTRANSLATION IN EARLY MODERN ENGLAND

In 1556, German physician Georgius Agricola (1494–1555), known as Georg Bauer to the miners whose ailments he treated in the towns of Jáchymov

22. Emily Apter, *Against World Literature: On the Politics of Untranslatability* (London: Verso Books, 2013), 20, 334, 15.

23. Larissa Brewer-García, *Beyond Babel: Translations of Blackness in Colonial Peru and New Granada* (Cambridge University Press, 2020).

24. Anna Brickhouse, *The Unsettlement of America: Translation, Interpretation, and the Story of Don Luis de Velasco, 1560–1945* (Oxford University Press, 2015).

25. Marcy Norton, “Subaltern Technologies and Early Modernity in the Atlantic World,” *Colonial Latin American Review* 26, no. 1 (2017): 18–38.

26. Gray A. Brechin, *Imperial San Francisco: Urban Power, Earthly Ruin* (Berkeley: University of California Press, 1999), 25, quoted in Usher, *Exterranean*, 11.



(present-day Czech Republic) and Chemnitz (present-day Germany), completed what was then the most comprehensive, detailed, and informative book on mining and metallurgy. His 558-page Latin-language tome, *De re metallica*, published in Basel by Hieronymus Froben (1501–1563), is divided into twelve books. Like many works of natural history, and unlike practical treatises in the mechanical arts, the *De re metallica* takes readers through the lifecycle of mineral production, from theories of mineral genesis to the experiential knowledges required to remove metals from mines and separate ore from dross in refineries. Today these fields are divided into geology and chemistry, but in the early modern era they formed a single, comprehensive module of mineralogical science.<sup>27</sup>

In addition to his scientific prose, Agricola's book contained 292 illustrations, drawn by Blasius Weffring and rendered into woodcuts by a team of expert engravers that included Hans Rudolf Manuel Deutsch (1525–1571) and Zacharias Specklin (1530–1576). The engravings were not ancillary to the text. They communicated important ideas about size, scale, and technical instruments, and they provided insight into the gender- and age-inclusive nature of mineral work. Figures 1 and 2 depict women and men sorting metals together and an outdoor workshop where experienced artisans break for rest with young apprentices. Agricola, knowing that the work would be incomplete without them, waited nearly twenty years for their printing.<sup>28</sup> These images, like descriptions of miners' beliefs about demons, and rituals for expelling them through "prayer and fasting" ("quod genus dæmonum precibus & ieiunjs pellitur ac fugatur"), provided readers with deeper understandings of the experiences of mining communities.<sup>29</sup>

As a sign of the work's importance, the *De re metallica* was reprinted several times in the sixteenth and seventeenth centuries (Basel, 1558, 1561, 1621, 1657, 1672; Wittenberg, 1612), and it was translated into German, Italian, and Spanish within fifteen years of its first print run.<sup>30</sup> The German translation of 1557 was reprinted in 1580 and 1621, in an edition that

27. Rachel Laudan, *From Mineralogy to Geology: The Foundations of a Science, 1650–1830* (University of Chicago Press, 1987), 21.

28. Pamela O. Long, "Of Mining, Smelting, and Printing: Agricola's 'De re metallica,'" *Technology and Culture* 44 (2003): 97. The Dover edition—Agricola, *De re metallica*, trans. Herbert Clark Hoover and Lou Henry Hoover (New York: Dover, 1950)—mentions 289 images.

29. Agricola, *De re metallica*, trans. Hoover and Hoover, 217; Agricola, *De re metallica Libri XII* [. . .] (Basel, 1556), 173, Linda Hall Digital Collection, [https://catalog.lindahall.org/permalink/01LINDAHALL\\_INST/1nrd31s/alma991944083405961](https://catalog.lindahall.org/permalink/01LINDAHALL_INST/1nrd31s/alma991944083405961). On the relationship between underground spirits and scientific writing in Germany, see Smith, "Vermilion, Mercury, Blood, and Lizards," 35.

30. Phillip Bech, trans., *Vom Bergkwerck xij Bücher* [. . .] (Basel, 1557), Wellcome Library EPB/D: 70/D, <https://wellcomecollection.org/works/k9y7j85w>; Michelangelo Florio, trans.,



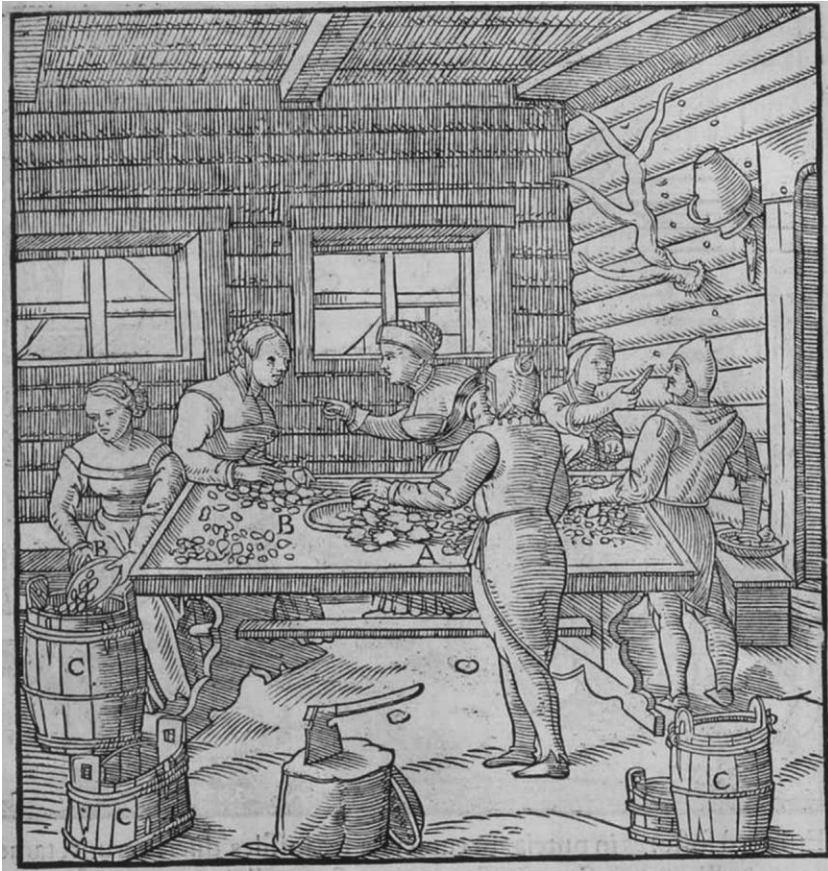


Figure 1. Metallic sorting (*Metallimassa*) performed by male and female miners. Georgius Agricola, *De re metallica*, 12 vols. (Basel, 1556), 8:209. Courtesy of the Linda Hall Library of Science, Engineering & Technology, Kansas City, MO.

became the source text for the Mandarin-language work that Chinese intellectuals and Jesuit priests, including Wang Zheng (王徵) (1571–1644) and Johann Terrenz (1576–1630), presented to Emperor Chongzhen (1611–1644; ruled 1627–44).<sup>31</sup>

Each edition recast Agricola's work in its own way. When printer Peter Schmidt reissued the German translation from Frankfurt, a city more hospitable to bankers than to the Protestant reformers who shaped Basel's

*Opera di Giorgio Agricola* (Basel, 1563); Bernardo Pérez de Vargas, trans., *De re metallica* (Madrid, 1569).

31. Pan Jixing, "The Spread of Georgius Agricola's 'De re metallica' in Late Ming China," *T'oung Pao* 77, no. 1/3 (1991): 108–18.



Figure 2. Artisans work in the background and rest in the foreground between rounds of smelting. Georgius Agricola, *De re metallica*, 12 vols. (Basel, 1556), 9:341. Courtesy of the Linda Hall Library of Science, Engineering & Technology, Kansas City, MO.

politics and print culture, he replaced the title page's monotone black ink with alternating lines of black and red, recalling the aesthetics of Gutenberg's Bible to subtly connect the edition to a larger Protestant community.<sup>32</sup> In the Italian translation, Protestant convert Michelangelo Florio (1515–1572), father of humanist John Florio (1553–1625), future language instructor of King James I of England, dedicated his work to Queen Elizabeth I (“Lisabetta, per la Dio Gratia Regina di Inghiterra, di Francia, e d’Hibernia”),<sup>33</sup> signaling his spiritual convictions and political networks. In the Mandarin-language edition, painted illustrations featured miners wearing local clothing, rather than the European dress depicted in figures 1 and 2.<sup>34</sup> Spanish translator Bernardo Pérez de Vargas added references to Iberian empires. Whereas Agricola’s book 1 mentions “miseri uiatores” (miserable travelers) who seek wealth abroad, Pérez de Vargas places them in the Indies: “Otros desterramos con gran regozijo a las Indias, o a lo menos con grandes esperanças” (Others disembark with great joy to the Indies, or at least with great hope).<sup>35</sup> Around the world, printers and translators accommodated Agricola to their readers’ interests, biases, and needs.

As the *De re metallica* circulated in multiple languages, it was cited by metallurgists throughout the Atlantic and Pacific worlds, each putting the material in dialogue with local customs and practices. This is especially true in the Andes. Historians have often repeated the claim that priests in Potosí bound a copy of the *De re metallica* to their altars to encourage miners to attend mass.<sup>36</sup> One priest used Agricola extensively outside of religious services. In his report to the Crown, Potosí-based priest and metallurgist Álvaro Alonso Barba (1569–1662), a man born in Andalucía who spent most of his life ministering to Andean mining communities, called Agricola “el mayor maestro de estas materias” (the greatest master of these matters).<sup>37</sup> In his *Arte de los metales* (1640), which was printed with support from the Crown, Barba cited a variety of authorities, from the natural philosophies of Empedocles and Aristotle to early modern artisans and scientists. These voices included unnamed Andean miners, who located unique minerals and shared

32. Agricola, *Berckwerck-Buch: Darinn nicht Allain alle Empter Instrument Gezeug, vnd alles, so zu diesem Handel gehörig* [ . . . ], trans. Phillip Bech (Frankfurt, 1580), Staats- und Universitätsbibliothek Dresden, <http://digital.slub-dresden.de/id264312570>.

33. Florio, *Opera di Giorgio Agricola*, 2.

34. Jixing, “Spread of Georgius Agricola,” 113.

35. Agricola, *De re metallica Libri XII*, 6; Pérez de Vargas, *De re metallica*, 52. Unless otherwise noted, all translations are my own.

36. Ernst Hamm, “Mining History: People, Knowledge, Power,” *Earth Sciences History* 31, no. 2 (2012): 323.

37. Archivo General de Indias, Indiferente General, 771, “Memorial de Alvaro Alonso Barba al rey” (La Plata, 1649), quoted in Josep María Barnadas, *Álvaro Alonso Barba (1569–1662): Investigaciones sobre su vida y obra* (La Paz: Biblioteca Mínera Boliviana, 1986), 152.

samples with Barba, as well as Galileo Galilei (1564–1642), who published observations of planets, stars, and other astronomical elements. Within this broad body of technical expertise, Barba invoked Agricola as an authority on all matters of mining, including mineral formation, washing, crushing, and reduction.<sup>38</sup>

Unlike Agricola's book, Barba's five-part *Arte de los metales* was quickly translated into English. In 1670, Edward Montagu, First Earl of Sandwich and Fellow of the Royal Society, published his *Art of Mettals*, a translation of books 1 and 2 of the *Arte de los metales*.<sup>39</sup> Book 1, sold separately from book 2, provided an overview of mineralogical theory transmitted from the ancients (Empedocles, Aristotle, Albertus Magnus), with some references to metals and minerals found in the Andes. Book 2 explained the New World method of amalgamation in great detail, indicating through its blend of Quechua, Aimara, and Spanish how Andean miners shaped the science of metallic classification, extraction, and processing.<sup>40</sup> In 1674, Samuel Mearne (1624–1683), bookbinder to the restored Stuart monarchy, reissued Montagu's translation as a single volume. Two years later, German translator Johann Lange completed his edition of Montagu's translation, *Albaro Alonso Barba Berg-Büchlein*.<sup>41</sup> In 1763, Lange's work was reprinted in Ephrata, Pennsylvania, marking the first time that the *Arte de los metales* was published in the Americas in any language.<sup>42</sup> The German-language volume made its way into the library of US president George Washington (1732–1799; governed 1789–97).<sup>43</sup>

Why was Agricola ignored by translators who eagerly embraced a less-famous book? The answer does not seem to be that English audiences were served by the Latin-language original. Although Latin is known as the early modern era's lingua franca, new research suggests that literacy rates in Latin declined precipitously in Britain between the fifteenth and sixteenth centuries.<sup>44</sup> According to historian Carole Shammas, in the first quarter of the

38. Barba, *Arte de los metales*, 23, 25v, 84v, 42, 96v.

39. Edward Montagu, trans., *The First Book of the Art of Mettals in which is Declared the Manner of their Generation and the Concomitants of them* [ . . . ] (London, 1670), and *The Second Book of the Art of Mettals Wherein is Taught the Common Way of Refining Silver by Quicksilver* [ . . . ] (London, 1670); both titles are available at Early English Books Online (EEBO), <https://proquest.libguides.com/eebopqp>.

40. See Bigelow, *Mining Language*, 229–93.

41. Johann Lange, trans., *Albaro Alonso Barba Berg-Büchlein: Darinnen Von der Metallen und Mineralien Generalia und Ursprung* [ . . . ] (Hamburg, 1676).

42. Johann Lange, trans., *Gründlicher Unterricht von den Metallen, darinnen beschrieben wird, wie sie werden in der Erden generirt* [ . . . ] (Ephrata, PA, 1763), Early American Imprints, Series I: Evans (1639–1800), <https://www.readex.com/products/early-american-imprints-series-i-evans-1639-1800>.

43. Lawrence Washington, Bushrod Corbin Washington, and Thomas Blackburn Washington, *The Final Sale of the Relics of General Washington* ([Philadelphia], 1891), 133.

44. See Aravamudan, "East-West Fiction as World Literature," 198.



sixteenth century (1500–1524), Latin-language titles represented 58 percent of the books published in the British Isles, a notable increase from the 41.9 percent registered during the previous twenty-five years (1475–99). But by the second quarter of the decade, 1525–49, the rate dropped to 19.9 percent. The rate continued to decline through the end of the century. Between 1550 and 1599, when Agricola’s book was published and translated in other European regions, Latin-language books represented 12 percent of the works published in Britain.<sup>45</sup>

The Iberian Peninsula observed a similar pattern of decline in the early modern era, although the drop-off was never as steep as it was in Britain. Between 1475 and 1499, Latin titles represented 23.8 percent of the books published in Portugal and Spain. The rate increased to 34.9 percent between 1500–1524 before hovering around 30 percent for the rest of the century (27.2 percent for 1525–49 and 30.6 percent for 1550–99).<sup>46</sup> Although there was a larger appetite for Latin-language works in Spain and Portugal, relative to preferences in England, translators like Pérez de Vargas still found an audience for their work. Anglophone readers, in contrast, would have muddled through Agricola’s German-inflected Latin and tried to decipher the hundreds of new terms that he coined to explain technologies and methods that did not exist in antiquity.<sup>47</sup>

Perhaps unsurprisingly, in light of the difficulties of reading the work in Latin, database records indicate that Agricola’s book had limited circulation in England. According to an EEBO search of all publication dates (1473–1700), seven copies of the book were listed at auction or in personal collections,<sup>48</sup> and it was cited twelve times.<sup>49</sup> Although the English Company of Mines Royal recruited German copper miners in exchange for partial

45. Carole Shammas, “Vernacularization of Print,” unpublished paper (January 2020 draft), chap. 2, table II–1, citing EEBO and the Universal Short Title Catalogue, <https://www.ustc.ac.uk>.

46. Ibid., chap. 2, table II–1. See also Alexander S. Wilkinson, *Iberian Books: Books Published in Spanish or Portuguese or on the Iberian Peninsula before 1601*, vol. 1 (Leiden: Brill, 2010).

47. Agricola, *De re metallica*, trans. Hoover and Hoover, i–ii.

48. *A catalogue of valuable books* [ . . . ] ([London], 1688); *Bibliotheca curiosa* [ . . . ] ([London], 1697); John Bullord, *A catalogue of books* [ . . . ] ([London], 1691), and *An excellent collection of books* [ . . . ] ([London], 1694); George Digby, Earl of Bristol, *Bibliotheca digbeiana* [ . . . ] (London, 1680); Edward Millington, *Bibliotheca whateliana* [ . . . ] ([London], 1683), and *Bibliotheca ashmoliana* [ . . . ] ([London], 1694); Samuel Brooke, *Catalogus librorum bibliothecae reverend. & eruditi* [ . . . ] (London, 1681). The Universal Short Title Catalogue shows 150 known holdings of the *De re metallica*, printed in 1556 (USTC 600324), 1561 (USTC 600325), and 1621 (USTC 2031846). There are sixty-two holdings of the German translations (1557, 1580, 1621) and forty-nine of the Italian translation of 1563 (USTC 600327, USTC 808094).

49. The *De re metallica* was cited by Sir John Pettus (1580, trans. Lazarus Ercker), John Greaves (1647), Robert Boyle (1666, 1671, 1692, 1699), John Webster (1671), Robert Plot (1677, 1686), Henry Stub (1680), Edward Brown (1685), and Robert St. Clair (1697, trans. Bernardino Ramazzini).

ownership of the company, there was no printed equivalent of these artisan interchanges.<sup>50</sup> Instead, translators adopted Barba's Andean treatise—a work whose geographies, mineral deposits, and Indigenous knowledge systems were unlike anything to be found or reproduced in the British Isles. While it is certainly true that early moderns owned scientific books for a variety of reasons, access to information and social status would seem to be two key factors. Agricola's tome would have provided scientific data and social currency among a transnational community of readers, but it was largely overlooked by early modern English audiences.<sup>51</sup>

In the eighteenth century, one man sought to translate Agricola's book into English. Not much is known about the proposed translator, Samuel Evatt, a reverend based in Ashford, Derbyshire, England, but the extant documentary record suggests true polymath interests. In 1759, he exchanged theories on medieval warfare and burial practices with clockmaker John Whitehurst (1713–1788), a member of the Royal Society and correspondent of Benjamin Franklin.<sup>52</sup> In 1761, he paid £1 to support the local teacher in Ashford.<sup>53</sup> Nothing more of Evatt is known until he surfaced in a proposal, published on July 2, 1764, to translate the *De re metallica* into English, in collaboration with London-based printer S[amuel?] Crowder and Sheffield-based printer W[illiam?] Ward.<sup>54</sup>

Evatt argued for the scientific and economic importance of Agricola's work. In an elegant combination of font sizes and styles, his translation promised to provide “A<sup>N</sup> exact and compleat System of MINING, in all its Branches, from the first discovery of the Mineral, and the nature of seeking for it, to all the process in use, for reducing it into Metal for the purposes of human Life.” Such principles would be “laid down in a clear distinct and methodical manner, and accommodated to every Capacity” and “Illustrated by upwards of two Hundred and Fifty Copper Plates neatly Engraved.” Evatt

50. Eric H. Ash, *Power, Knowledge, and Expertise in Elizabethan England* (Baltimore: Johns Hopkins University Press, 2004), 19.

51. See David Pearson, “Patterns of Book Ownership in Late Seventeenth-Century England,” *Library: The Transactions of the Bibliographical Society* 11 (2010): 139–67.

52. “To Benjamin Franklin from John Whitehurst, [28 March 1762],” Founders Online, National Archives, <https://founders.archives.gov/documents/Franklin/01-10-02-0035>; in *The Papers of Benjamin Franklin*, vol. 10, *January 1, 1762, through December 31, 1763*, ed. Leonard W. Labaree (New Haven, CT: Yale University Press, 1959), 70–71.

53. Daniel Lysons and Samuel Lysons, *Magna Britannia; Being a Concise Topographical Account of the Several Counties of Great Britain* (London, 1817), 308.

54. Little is known of either printer. Crowder published political and scientific works like W[?]. S[?]., *Liberty regain'd* (London, 1755); Sarah Jackson, *The Director: or, Young Woman's Best Companion* [. . .] (London, 1755); and Henry-François Le Dran, *Observations in Surgery* [. . .] *Translated by J.S. surgeon* [. . .] (London, 1771). Ward specialized in religious materials, such as William Vickers, *A companion to the altar* (Sheffield, 1765); and *Holy Bible: with a commentary and practical improvements: from the writings of the most learned men* (Sheffield, 1768).

concluded in his one-sentence opening pitch that such content “may be of the greatest service to the New Plantations of Florida and the West-Indies.”<sup>55</sup>

Evatt’s concise summary of the *De re metallica*, and his promise to provide the “compleatest System of Mining, that ever appear’d in the English Language,”<sup>56</sup> were not enough to attract subscribers, even though this was precisely when local knowledge of mining became critical to industrialization. By the end of the eighteenth century, approximately 83 percent of the global supply of coal was mined in the British Isles.<sup>57</sup> Agricola’s work contained important explanations of tunnel mining and safety precautions that coal miners and owners could have used.<sup>58</sup> The National Coal Mining Museum in Wakefield, West Yorkshire, calls Agricola’s work the “most important mining text for nearly two centuries after its publication,” although it went largely ignored in England during that time.<sup>59</sup>

In fact, it went untranslated into English until a later wave of industrialization, this time in the former Spanish colony of California, which became part of the United States in 1850. Following the end of the US-Mexico War (1846–48) and the signing of the Tratado de Guadalupe Hidalgo (1848), prospectors flocked to California in the hope of finding gold. These largely white, Anglo settlers displaced and decimated Indigenous communities, in what scholars now call the California Genocide.<sup>60</sup> Against this backdrop of resource extraction, settler colonialism, and the shifting borders of the US and Latin America, the first Anglophone edition of the *De re metallica* appeared in print.

### III. TRANSLATING AGRICOLA IN THE TWENTIETH CENTURY

In 1891, twenty-six years after the nominal end of the California Gold Rush (1848–55), Herbert Hoover enrolled as an undergraduate at Stanford University. There, he met the university’s only female geology major, Lou Henry,

55. Samuel Evatt, *Proposals for Publishing by Subscription a Neat and Elegant Translation of the Celebrated Work of George Agricola, de Re Metallica: Or the Art of Mining. In Twelvebooks* [. . .] ([London?], 1764), 1.

56. *Ibid.*, lv.

57. Donald R. Prothero, “Coal: The Rock That Burns Fires the Industrial Revolution,” in *The Story of the Earth in 25 Rocks: Tales of Important Geological Puzzles and the People Who Solved Them* (New York: Columbia University Press, 2018), 57–58.

58. Tunnel mines are depicted in Agricola, *De re metallica Libri XII*, 72–74: “Tres putei recti: quorum” (Three vertical shafts), “Tres putei obliqui: quorum” (Three angled shafts), and an unlabeled image depicting wells.

59. *De re metallica—Online Exhibition*, National Coal Mining Museum for England, <https://www.ncm.org.uk/library/de-re-metallica-online-exhibition>.

60. Brendan C. Lindsay, *Murder State: California’s Native American Genocide, 1846–1873* (Lincoln: University of Nebraska Press, 2015).



who was president of the Geology Club.<sup>61</sup> By all accounts, Herbert was an unimpressive student, although he distinguished himself in the field as the research assistant of Waldemar Lindgren, a German-trained Swedish mining engineer on assignment with the US Geological Survey. In 1895, Herbert took his degree and began working as a mining engineer in a remote region of what is now New Mexico. Part of the job involved policing. Because the community was too small for a jail, when night fell the future US president “lowered his prisoners by rope into abandoned mine shafts,” suggesting how carceral politics, mining economics, and racial-ethnic identities in the US-Mexico borderlands converged early in Hoover’s mining career.<sup>62</sup>

By 1897, Herbert Hoover was promoted to supervisor in the gold mines of western Australia, where he sought to improve operations by introducing new technologies and importing Italian laborers. Although he boasted that Italian miners were 50 percent more productive than Australians, and perhaps less likely to inspire state intervention in private enterprise, Herbert criticized the workers for not speaking English.<sup>63</sup> Two years later, Lou finished her degree and the couple married in California before moving to northeast China, where Herbert took a job in the outskirts of Tianjin. There, as in Australia, he was disappointed by “inefficiencies,” “primitive” technologies, and “sickening” corruption. He now lodged his complaints as racial grievances, blaming Chinese miners’ “racial slowness” and “low average of intelligence,” and “the simply appalling and universal dishonesty of the working classes.”<sup>64</sup>

In these early years in global mining operations, Herbert Hoover gathered data on what he would later call the “labor efficiencies” of white, Black, and Brown miners in the United States, Australia, India, and South Africa, where 40 percent of workers were African and the rest were Asian. In his later publications, as in these early reports, he assessed miners’ labor, intelligence, and technology within a broader matrix of political regulation, commercial practices, and legal codes. (By 1909, when he published lectures that he delivered at Stanford and Columbia, he seemed to have forgotten his aversion to Australian miners.) He concluded, “The ratio of efficiency as measured in amount of output works out from four to five colored men as the equivalent of one white man,” because the costs required to supervise Black and Brown miners shifted the scales in favor of white, Anglophone miners, what he

61. David Burner, *Herbert Hoover: A Public Life* (New York: Knopf, 1979), 16, 21, HathiTrust, <https://www.hathitrust.org/>.

62. Kenneth Whyte, *Hoover: An Extraordinary Life in Extraordinary Times* (New York: Knopf, 2017), 40, 48.

63. Burner, *Herbert Hoover*, 29–31.

64. Whyte, *Hoover*, 53, 72–73. Lou also surveyed underground tunnels and aboveground refineries, but we do not know what she thought of them.

called “the higher intelligence.” Even if “American or Australian miners” were paid five or ten times as much as those of “a low mental order, such as Asiatics and negroes,” he went on, “it may be stated with confidence that the white miners above mentioned can, under the same physical conditions . . . produce the same economic result—that is, an equal or lower cost per unit of production.”<sup>65</sup> These attitudes about the economic and technological supremacy of white, English-speaking miners seem to have informed Hoover’s later policies in Latin America and his translation of Agricola.<sup>66</sup>

In 1907, having been expelled from China during the anti-imperialist Boxer Rebellion, Herbert and Lou were living in London. With one toddler and a baby on the way, they began to translate the *De re metallica*, “a labour of love” waged “in night hours, weekends, and holidays.” It was a love whose value was exclusively historical, given that mining techniques from 1556 had, as they write in the preface, no “‘practical’ value” by then.<sup>67</sup> Five years later, on July 1, 1912, their work was published in the *Mining Magazine* of London.<sup>68</sup> In 1950, it was reprinted by Dover. Today, it is still the only English-language edition of Agricola, and it has become one of the most important and most popular books in the field. At the time this essay was written (May 2020), it was the twelfth most popular book of mining on Amazon.<sup>69</sup> No small part of the work’s contributions are the 342 footnotes written by Herbert and edited by Lou. Some were only a few words long (e.g., “Albertus Magnus”), whereas others, such as an extensive note on amalgamation, analyzed below, spanned pages.<sup>70</sup>

In book 8, Agricola explains how to separate mixed-metallic “impurities” (*impura & mista*) from refractory gold ores, leading to more accurate classification and, thus, better outcomes in later stages of refining. After

65. Herbert Hoover, *Principles of Mining: Valuation, Organization, and Administration; Copper, Gold, Lead, Silver, Tin and Zinc* (New York: McGraw Hill, 1909), 163–64.

66. Alexander DeConde, *Herbert Hoover’s Latin-American Policy* (Stanford University Press, 1951), 28–31. DeConde praises Hoover’s role in resolving a territorial dispute between Perú, Bolivia, and Chile sparked by the War of the Pacific (1878–83). The deal gave Chile control of copper-rich lands south of the city of Arica, assigned the unmineralized area north of Arica to Perú, and left Bolivia as a landlocked country. Because Bolivia and Perú have larger Indigenous populations than Chile, Hoover’s diplomacy seems to align with his assessments of the economic value of white and Brown miners’ labor, intelligence, and technology.

67. Agricola, *De re metallica*, trans. Hoover and Hoover, iii. They returned to Tianjin on and off between 1901 and 1907 as part of a reorganized Chinese-British mining company—one in which Herbert negotiated an extremely favorable contract for himself. See Burner, *Herbert Hoover*, 38–41; and Whyte, *Hoover*, 79–81.

68. I thank Elena Danielson for information on the publication history.

69. “Amazon Best Sellers: Best Mining,” [https://www.amazon.com/gp/bestsellers/books/227542/ref=pd\\_zg\\_hrsr\\_books](https://www.amazon.com/gp/bestsellers/books/227542/ref=pd_zg_hrsr_books).

70. Agricola, *De re metallica*, trans. Hoover and Hoover, 76 n. 11. They write, “There are no footnotes in the original text, and Mr. Hoover is responsible for them all,” but the note uses “we” pronouns to describe editorial decisions (ii).

obtaining ore through preliminary crushing and roasting, miners used water- and animal-powered mills to pulverize gold, sort it with sieves (this was women's work: "mulier ipsum uicissim ad dextram & sinistram uerfans succutit"), and wash it. Some miners built devices that combined these stages by channeling pulverized gold ore, water, and mercury into a tub with paddles to agitate and amalgamate the mixture. Next, miners washed and placed the amalgams into a bag that they squeezed to expel mercury, drip by drip, into a jar below, leaving pure gold in the bag ("in alutam, uel linteum lini xylini contextu factum infunditur: quae cum, ut alias scripsi, comprimuntur argentum uiuum per eam defluit in ollam subiectan: aurum in ea re manet purum"). Then, they proceeded to the next stage, roasting.<sup>71</sup>

Herbert Hoover did not proceed. Instead, he wrote a three-page footnote, entitled "Historical Note on Amalgamation," arguing that silver amalgamation—a topic not mentioned in Agricola's book—originated in Europe, not Latin America. He began by assessing medieval accounts of amalgamation, finding them "well aware that silver would amalgamate with mercury" but full of "gibberish" that "obscures most of their reactions."<sup>72</sup> He praised the comparatively clearer language of authors like Vannoccio Biringuccio (ca. 1480–1539), whose *Pirotechnica* (1540) was partly based on his time in central Germany. Biringuccio described a small-scale, costly process in which miners poured mercury and partially processed gold into a bag or bowl ("vna borsa, o per boccia"), waited for the mercury to evaporate, and added borax, saltpeter, or black soap ("borrase, o di salmitro, ouer di sapon negro") to reduce the gold and shape it into ingots.<sup>73</sup> In contrast, the large-scale amalgamation method that Indigenous, African, and European refiners developed in Mexico in the mid-1550s processed anywhere from two thousand to five thousand pounds of metals at once, and it could be applied on various forms of silver, including those mixed with elements like lead, tin, iron, and sulfur. The ten-step *patio* method, so named for the sun-drenched spaces where miners worked, transformed the economics of silver refining. If a hundred-pound batch of material yielded only 1.5 ounces of silver, the operation would still be profitable; exploitative colonial labor practices kept wages low, using sunlight as a catalyst reduced operational costs, and improved navigational technologies, developed hand in hand with imperial expansions, enabled shipping to lucrative markets. These scientific and nonscientific factors distinguished Latin American amalgamations from European techniques. Moreover, miners in Latin America developed a new scientific framework to explain the logic of amalgamation. Whereas European accounts

71. Agricola, *De re metallica Libri XII*, 208, 228, 233.

72. Agricola, *De re metallica*, trans. Hoover and Hoover, 297 n. 12.

73. Vannoccio Biringuccio, *De la pirotechnia: Libri x* (Venice, 1540), 2v, MMW.

emphasized metallic difference, the Latin American method was built on a theory of similarity.<sup>74</sup>

Herbert Hoover knew from his reading that Agricola's and Biringuccio's dripping-bag technique looked nothing like the large-scale refineries of Mexico or Peru. He cited colonial sources like José de Acosta's *Historia natural y moral de las Indias* (1589; via a nineteenth-century English translation), Jorge Juan and Antonio de Ulloa's *Relación histórica del viaje a la América Meridional* (1748; listed as a single-author work), and Barba, whose "best account" of the technology was lost in the "wretched" work made by English, German, and French "translators' total lack of understanding." He also knew that chronology was not on his side, for "the general introduction of the amalgamation of silver ores into Central Europe seems to have been very slow, and over 200 years elapsed after its adoption in Peru and Mexico before it received serious attention by the German Metallurgists," such as Ignaz von Born (1742–1791). Hoover credits von Born as "the first to establish the process effectually in Europe," even though "the only new thing in his process seems to have been mechanical agitation." It is worth recalling, as Hoover surely knew from the sources he cited, that von Born's book reprinted twenty-five pages of Barba's *Arte de metales*. And yet, Hoover argued, "the question arises whether the Patio Process was an importation from Europe or whether it was re-invented in Mexico. While there is no direct evidence on the point, the presumption is in favour of the former."<sup>75</sup> To recap Hoover's argument: silver amalgamation was used in Latin America two hundred years before it appeared in Germany, but it was presumably a European invention even though the first man to apply it did not add anything new.

This curious conclusion about scientific discovery and invention reveals the influence of the racism that Herbert Hoover so clearly expressed in his reports from the US-Mexico borderlands, Australia, and China. For Hoover, whatever miners in colonial Latin America did under- or aboveground, it was not science. True science happened in Europe, even if the chronology didn't quite fit or if European authors cited Latin American sources (and Latin American authors cited European sources, and Asian writers adapted European books to their own technical landscapes, as differently located parts of a global scientific community). In 1912, when Herbert Hoover intervened into the history of amalgamation, a metallurgical term that had, by then, become a well-known metaphor for racial mixture, he reinscribed a narrative of technological superiority and scientific modernity that was rooted

74. Agricola, *De re metallica Libri XII*, 233; Biringuccio, *De la pirotechnia*, 2v; Bigelow, *Mining Language*, 239, 243, 294–305.

75. Agricola, *De re metallica*, trans. Hoover and Hoover, 298–300 n. 12. Ignaz von Born, *Ueber das anquiesen der gold und silberhaltigen erze, rohsteine, schwarzkupfer und hüttenspeise Bon von Ignaz Edlen von Born* [. . .] (Vienna, 1786), 25–50.

in Europe.<sup>76</sup> Hoover's extensive digression had little to do with the content of Agricola's book. It had everything to do, I think, with the historical context in which he wrote. The future US president's teleological argument about the European origins of amalgamation emerged against a backdrop of anti-imperialist uprisings in China and Native American genocide in the US West. It recalls the ways in which racial prejudices, extractive economics, and vernacular sciences shaped the making of the early modern world—and how the global history of that world was later used to marginalize non-European ways of knowing.

#### IV. CONCLUSIONS

Each translation of a book like Barba's *Arte de los metales* or Agricola's *De re metallica* reveals more about the translators and their readers than it does the source text or its ideas. As part of this special issue's discussion of new theories and approaches to the global early modern era, this article has traced how translators, printers, and editors adapted Agricola's book in ways large and small. These adaptations included bibliographic-religious modifications (Schmidt); the introduction of culturally specific images (Zheng [王徵] and Terrenz), examples (Pérez de Vargas), or footnotes (Hoover and Hoover); and not translating the book (Evatt). Studying the circulation and reception of these translations requires crossing through disciplines that modern academic institutions separate into siloed fields such as history, history of the book, visual analysis, and literary studies in multiple languages.

By insisting on such transdisciplinary methods, and by resisting traditional frames of analysis and periodization, translation can open up new avenues of inquiry for early modernists. It is especially helpful in a field like the history of science, where we have been slow to find frameworks that fully account for the fuzzy edges of historical eras and literary periods, and for the profound ways in which white supremacy, settler colonialism, and extractive empires have shaped colonial archives and our access to them. As a practice that brought readers together and divided them, translation is an appropriately paradoxical, always contextual, forever unstable way through which to rethink scholarly approaches to global early modernity.

76. The *OED* dates the figurative use of amalgamation to 1828 (s.v. "amalgamation, *n.*," 4, <https://oed.com>), but it appears in the work of earlier proponents of scientific and systemic racism, such as Thomas Jefferson. See Elise Lemire, "*Miscegenation*": *Making Race in America* (Philadelphia: University of Pennsylvania Press, 2002), 51–52.