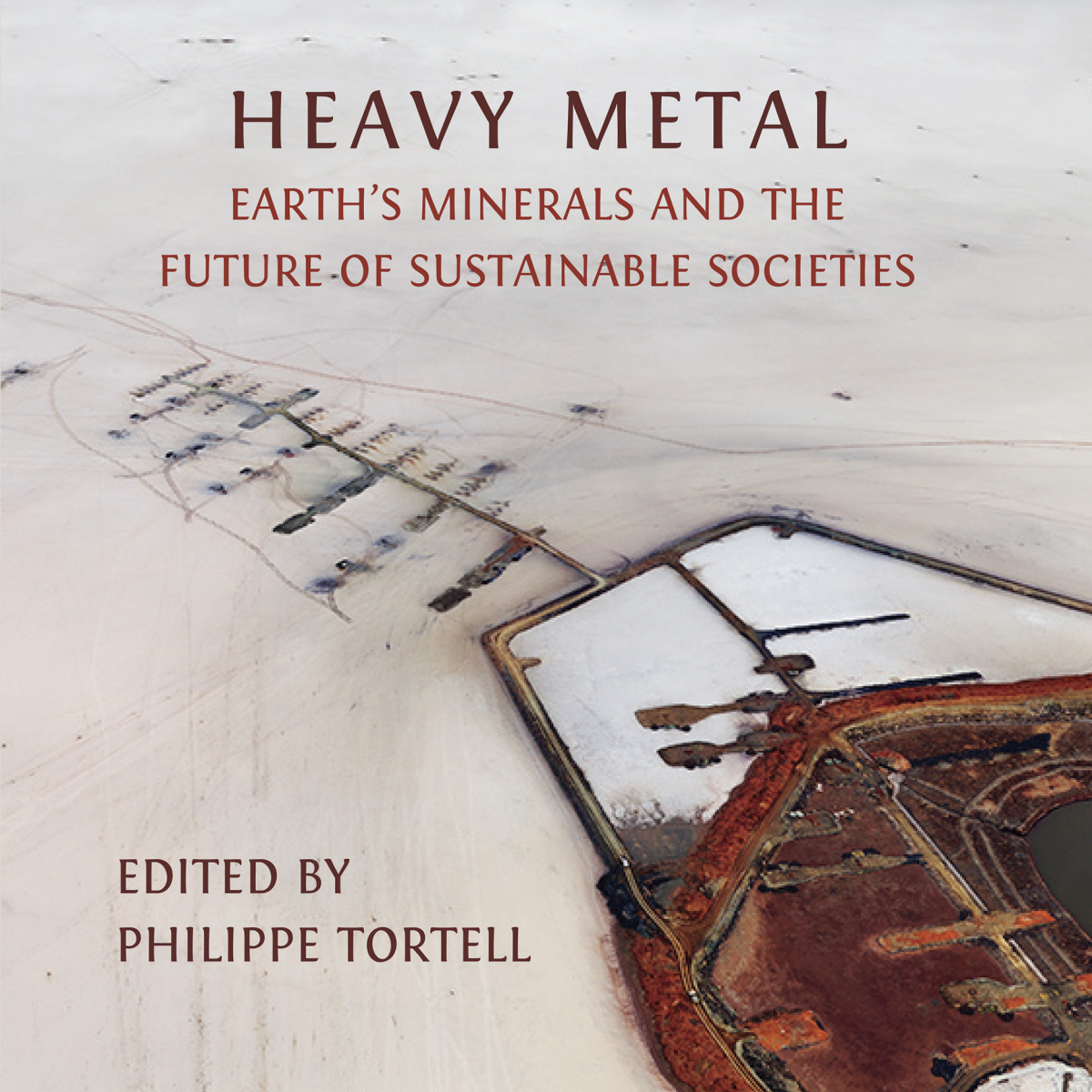
HEAVY METAL

EARTH'S MINERALS AND THE FUTURE OF SUSTAINABLE SOCIETIES



EDITED BY
PHILIPPE TORTELL

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Cover image: Edward Burtynsky, *Silver Lake Operations #15*, Lake Lefroy, Western Australia, 2007. Photo © Edward Burtynsky, all rights reserved.

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and connections that showcase the five world-class musicians of the Axiom Brass Quintet in a display of rhythmic and timbral dexterity, counterpoint, dynamic and articulative range, precision, and teamwork. Each of the five musicians is featured in several brief soloistic phrases.

Music's eternal quality is its capacity for change, transformation, and renewal. No one composer, musical style, school of thought, technical practice, or historical period can claim a monopoly on music's truths. I believe music feeds our souls. Unbreakable is the power of art to build community. Humanity has worked, and always will work, together to further music's flexible, diverse capacity and innate power. In reflecting the duality of gold through my music, I sought to express a prayer and plea for worldwide equity, seeking economic, environmental and social justice for everyone, and allowing radiance to illuminate the darkest corners of our planet.

Iztacteocuitlatl (Silver)

Roberto Morales-Manzanares

For many centuries, silver held great cultural and economic importance to the Indigenous civilizations of Mexico, including the Aztecs, Mayans and other Mesoamerican cultures. In the Aztec Nahuatl language, which is still spoken today by more than a million Indigenous people in Mexico, the metal is known as *iztacteocuitlatl*, derived from a combination of the words white (*iztac*), power (*teo*) and solar excrement (*cuitlatl*)—quite literally 'golden poo'. Silver was highly prized for its shiny, reflective qualities, making it popular for crafting ornamental and religious items, as well as decorative jewelry. Indigenous artisans in Mexico developed sophisticated techniques for working with silver, including casting, embossing, engraving and filigree, in which intricate designs are created by weaving fine silver wires together. Silver objects were used in rituals and ceremonies to honor deities or celebrate important events in

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Indigenous societies, and the metal held symbolic meaning representing the moon, femininity and purity.

With the arrival of Spanish colonial rulers in the early sixteenth century, the production of silver from Mexico began to increase significantly, creating enormous wealth that fueled the Spanish crown for more than two centuries. But the colonial extraction of silver in Mexico also had significant and enduring negative consequences for Indigenous populations and the environment. These included forced labor and enslavement of Indigenous peoples working in silver mines under harsh and often brutal conditions; depopulation resulting from the introduction of diseases; breakdown of traditional cultures and the loss of Indigenous languages, knowledge and social structures; wealth extraction and economic disparity favoring the Spanish crown and colonial elites; and environmental degradation resulting from deforestation and water pollution with chemicals used for silver extraction. The colonial harms associated with silver extraction have had a lasting impact on Mexico's social, economic, and environmental landscape. They have contributed to the systemic inequalities and challenges faced by Indigenous communities that persist to this day.

In writing a silver-themed movement for the *Heavy Metal Suite*, I wanted to reflect the long and complex history of this metal in Mexico. As a starting point, I took inspiration from the five large Indigenous silver mining regions that still exist in the country today; Zacatecas, Guanajuato, Taxco, Pachuca–Real del Monte and Capulálpam de Méndez. Silver mining in these regions goes back at least two hundred years and, in the case of Taxco, can be traced to the pre-Columbian era. Four of these regions all played crucial roles in Mexico's history of silver production, and their mining activities have influenced the cultural and economic development of the country. Today, Taxco is still renowned for its silver jewelry and craftsmanship. Capulálpam (Nahuatl for 'land of capulins') is currently facing a legal battle to cancel all mining concessions granted in its territory, and to close a gold and silver mine located two kilometers from its urban center, in the neighboring municipality of Natividad Ixtlán.

I also took inspiration from the chemical properties of silver, and from the Nahuatl language itself, with its intricate pattern of syllables, consonants and vowels. In this respect, I am grateful to Gabriel Pareyón for his knowledge of the Nahuatl language, which made it possible for me to articulate the musical motifs, and his inspiring work[1] mapping the periodic table of elements to musical frequencies, corresponding to 440 hertz (Hz) for silver.

Using a rhythmic structure inspired by the sounds of Nahuatl, I explored overarching themes in my musical composition, including abuse and labor exploitation, insecurity, conductivity, recycling and water. For example, some of the rhythm patterns used in the score are derived from Nahuatl words, such as:

Atl = water; 1 syllable

Tla-le = land; 2 syllables

Mejtsintle = moon; 3 syllables

Tonaltsintle = sun; 4 syllables

Iztacteocuitlatl = silver; 5 syllables

And some phrases like:

No ikniuan kitoga tlaol-le = My brothers grow corn (*Mis hermanos siembran maíz*); 8 syllables

Siguin gualaske an siguin yaske = some will come and others will go (*Algunos vendrán y otros se irán*); 9 syllables

Some of these words and phrases were extracted from the book *Ejercicios para el aprendizaje de la lengua Náhuatl de Hueyapan y diccionario Español-Náhuatl*.[2] I played with notes in the score to represent these words musically. For example, in the figure below, you can see the accent on the E♭ (the 4th note in the bar) to match the natural accent of the word silver in Náhuatl.

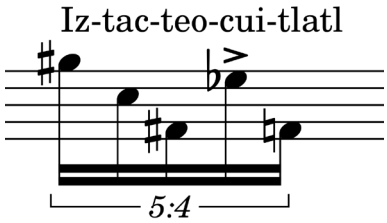
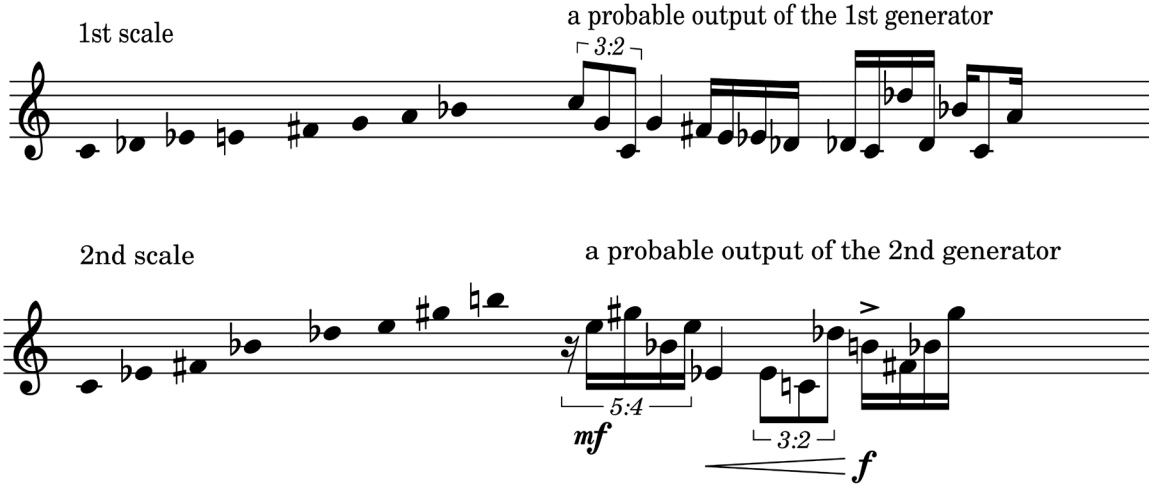


Fig. 1 Extract from *Iztacteocuitatl* score, showing the correspondence between musical accenting and the rhythmic structure of Náhuatl words. Image created by Roberto Morales-Manzanares (2024), CC BY-NC.

The rhythmic elements were placed on top of five different scales (one for each of the mining regions), including octatonic or symmetrical (8 notes per octave), major, chromatic, whole-tone and a split scale with four notes in the first octave and five notes in the second octave. I then used a series of statistical probability functions to choose rhythmic elements and notes from the different scales. From each scale, I generated a set of one hundred notes to reflect the one hundred protons contained in an atom of silver.

To further reflect the five mining regions, I designed the general structure of the score based on five groups of musical motifs, corresponding to each group as shown below:



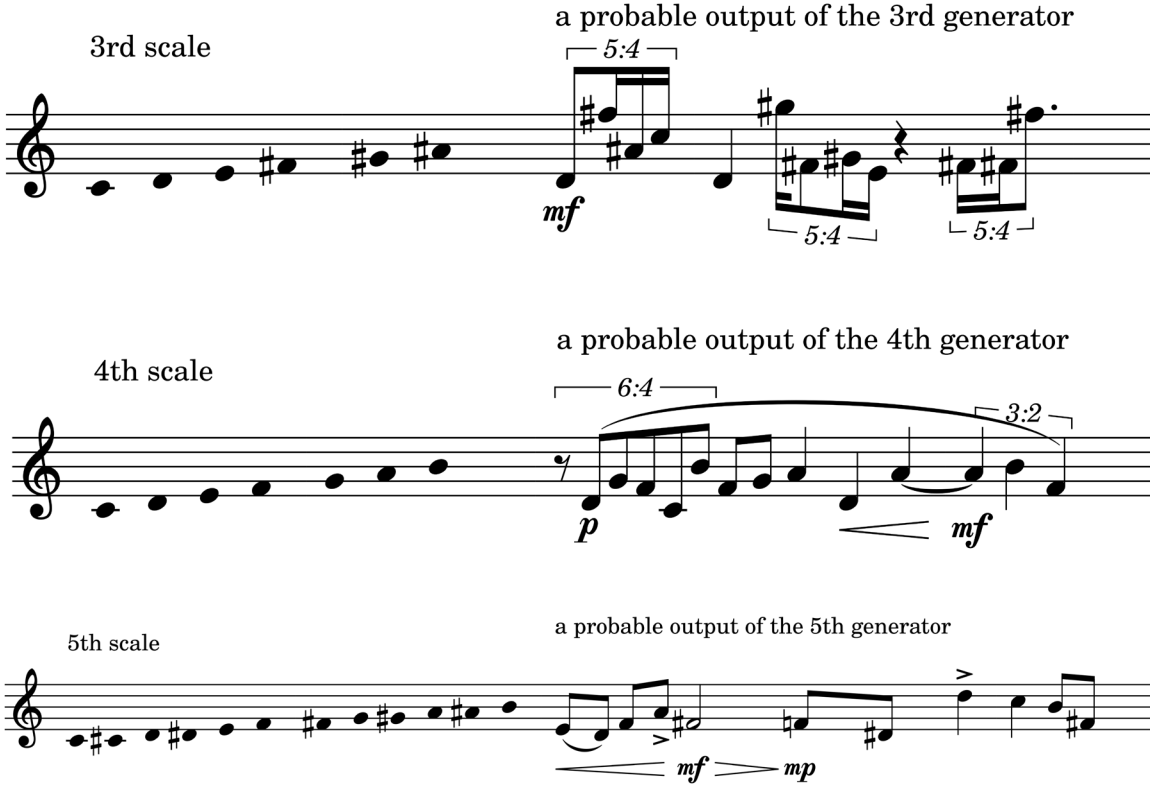


Fig. 2a–e Extracts from *Iztacteocuitatl* score, showing five groups of musical motifs that correspond to five mining regions in Mexico. Image created by Roberto Morales-Manzanares (2024), CC BY-NC.

Recycling and conductivity are represented in the score as bars that make a smooth transition between sections, and by the repeated use of certain musical phrases in slightly altered form throughout the piece. As an example, the musical fragment below uses a hammer and anvil performed by the two trumpets to recombine different scales and motive generators in distinct ways.

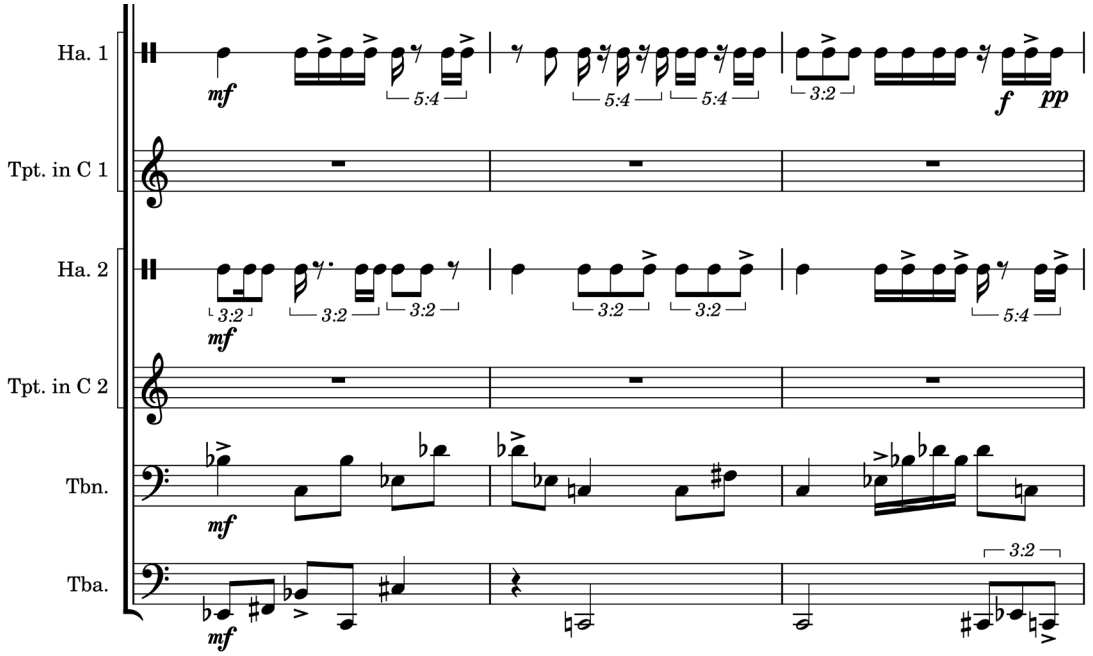


Fig. 3 Extracts from *Iztacteocuitatl* score, showing groups of repeated musical motifs that represent the concepts of conductivity and recycling. Image created by Roberto Morales-Manzanares (2024), CC BY-NC.

It is my hope that the *Iztacteocuitlatl* movement of the *Heavy Metal Suite* will allow listeners to enjoy beautiful sounds that emerge from the innate chemical properties of silver and its long history with the Indigenous people of Mexico. I hope, also, that we will be able to reimagine a future for silver mining in Mexico that embraces human and environmental well-being.

Endnotes

1 Gabriel Pareyón, 'Music as a Carbon Language: Clarifying Methods, Results, Fresh Data, and Perspectives', *Journal MusMat* 7 (2023): 1–25, https://musmat.org/wp-content/uploads/2023/09/01-Pareyon.pdf

2 Marcelino Montero Baeza, *Ejercicios para el aprendizaje de la lengua Nahuatl de Hueyapan y Diccionario Español-Nahuatl* (Mexico City: CDI, 2016).