The sound of mineral stone: Chemical properties of civilisation

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This paper examines the result of a laboratory analysis of mineral stones with metal properties that have had an impact on raising today's civilisation. Through the artistic prism of intuitive perceptions and factual scientific analyses, in this case I present the process of creation of my research based art project *New Europe* and its poetic outcome from a scientific analysis of mineral stones. The project reflects the Change phenomenon, visibly - large geomorphic reliefs covered with mineral stones and Dark matter (unmaterial dimension of stones) shown audibly - two types of transmission of X-ray analysis into sound - music. How do mineral stones sound? The combination of reliefs, mineral stones and sounds creates a unique blend of material and energetically beneficial. The presentation focuses on the process of transmission involved from one medium to another, primarily on possibilities of the poetic outcome of scientific analyses - sonified X-ray data.

*Keywords: X-ray, crystallography, laboratory analysis, mineral stones, data sonification, data processing, software, sound art, visual art, reliefs*¹. Introduction

1. INTRODUCTION

Sound is a medium used in this project to reveal the unmaterial dimensions of stones - dark matter from a material object. Mineral stones used in the project possess metal properties which have a great impact in making today's civilisation in terms of its chemical aspect. The paper examines a very important phenomenon which exists without any change in its condition. The process of creation is implemented through every level of this topic, including the creation of Earth, civilisation, artistic projects, and techniques of transmission from one media to another. The process of creation is closely related to the Change phenomenon as an absolute ubiquitous constant in the Universe. The main key of human evolution is creativity and imagination as tools for surviving. Naturally, human evolution is the outcome of the genes from our ancestors. Similar to this fact Oxford professor and British Academy fellow, Timothy Williamson, gave an explanation in the New York Times philosophy blog, *The Stone* titled *Reclaiming the Imagination* in 2010. Today, humans can use these tools for different purposes such as a contribution to Art and Science for example. The artistic project titled *New Europe* presented in this paper reflects the time we live in when technology, science, medicine, astronomy, art and knowledge has evolved. After the process of creation and humans evolved imagination, the paper examines a similar example of sonified X-ray data. The use of X-ray data sonification has been published in 2011 which deals with a different type

– a sonification of astronomical X-ray from the author Wanda Diaz Merced. Her doctoral project was published on Harvard's web page under the title *Star Songs – from X-rays to music*.

For the purpose of the realisation of the *New Europe* project, in collaboration with Ruđer Bošković Institute Zagreb in 2017, quantum mechanics were used for various analyses:

- 1) X-ray powder diffraction (XRPD) which deals with particle analysis, determination of chemical and crystallographic properties.
- 2) a high-resolution scanning electron microscope FESEM.

Natural mineral stones are: gold Pyrite (FeS₂), silver Galena (PbS) and black Sphalerite (ZnS). These minerals were used for further processing into sound. Digitally obtained data has been converted into two different types of transmission. One is a software that produces sound from the image called *Photo Sounder* made by a software maker Michel Rouzic, and the other is *Musical Algorithm* made by Professor Jonathan M. Middleton. The outcome from the *Photo Sounder* is a deep frequency sound and from the *Musical Algorithm* the sound is rendered in a piano version. The sounds, ie music from the *Musical Algorithm*, result in an aleatoric music in which some element of the composition is left to chance. Although everything is left to chance, the music sounds partly harmonious and meaningful. When put

together, deep frequency sound and piano version, the result is almost a meditative experience of a relatively harmonious but abstract music. My aim is to make you aware of these stones and their essential role in our existence and whole civilisation. We are all connected materially and unmaterially to mineral stones as a result of the mutation of stardust. The realization of my research based art project titled *New Europe* is multi-layered. I realised this project by arriving to a poetic outcome from a scientific analysis of mineral stones – sonified X-ray data.

2. A PROCESS OF CREATION

The cause of two objects colliding and changing each others chemical properties such as meteorites crashing on planets and causing a shift in the climate over extended periods of time **has truly marked our planet**. Through millions of years of many external crashes and depressions, vast changes in temperature, environment, geomorphic creation, the soil of the Planet became rich. Magical properties of meteorites have crossed cultures through history.

Beautifully described in one sentence from the internet article *Splitting the heavens: 4 real swords made of meteorites* (2015) from the author Kruse C. ⁽¹⁾

“Legends are saturated with fables of powerful weapons forged from the stars.”

Meteoric swords aren't just a myth. The examples of extraordinary swords from the list selection of Kruse C. such as Attila the Hun's fabled Sword of Mars and the Japanese katana Tentetsuou or The Sword of Heaven - as The Chiba Institute of Technology where it is on display writes: "...the Sword of Heaven truly symbolizes the relationship between human technology and space." ⁽²⁾

All these legends, history of the human civilisation was built on wars, lives and deaths, conquering territories and seizing power. The earliest historical example of a meteoric blade is the dagger found in the tomb of Tutankhamun - which was found in 1925 and dates back to over 3000 years.

Change is unescapable and we are all evolving through actions of change. It is a matter of time when we will be more aware of the environment and our consequences.

3. THE EVOLUTION OF IMAGINATION

Every creation and imagination starts with inspiration as an individual experience of thoughts and surroundings. **We are on the path of one**

major phenomenon – the Change phenomenon.

The Change in its structure belongs to the absolute constant and it shows no change in conditions.

Fisher M. (internet article *Why We Did Evolve Imagination?* 2010) addresses the Oxford professor and British Academy fellow Timothy Williamson who gives us an explanation in the New York Times philosophy blog, *The Stone* titled *Reclaiming the Imagination* (2010). For what purpose did we evolve our imaginations, which have come to guide so much of human culture? He agrees with Williamsons argument that imagination is an essential tool for survival, but a poorly developed imagination could lead people into potentially deadly situations. Therefore, those of our ancestors with the sharpest and most precise imaginative abilities would be the most likely to have survived and passed on their genes. ⁽³⁾

Timothy Williamson claims that in science, the obvious role of imagination is in the context of discovery:

“Unimaginative scientists don't produce radically new ideas. But even in science imagination plays a role in justification too. Experiment and calculation cannot do all its work.” ⁽⁴⁾

The use of imagination is a constant phenomenon with passing centuries. **Imagination and creativity drive human evolution.**

Characteristics of the creative approach used in the project *New Europe* are a fusion of urge, intuition and facts, combined with laboratory analyses and scientific methods, resulting in a poetic-scientific outcome. The project reflects the state of our human evolution (and my personal evolution) in relations to discoveries and knowledge including:

science, technology and environmental conditions.

Through the artistic prism of intuitive perceptions and factual scientific analyses, the project represents the phenomenon of dark matter shown audibly - two types of transmission of X-ray analysis into sound ie music, and the Change phenomenon shown visibly - large geomorphic reliefs covered with mineral stones.

3.1. New Europe - visual and material aspects

Beautifully made reliefs reflect the visualisations of the impact of Change phenomenon presented as organic-geomorphic surfaces of the Planet. The project consists of three (3) reliefs, two diptychs and one triptych.

The diptych, *New Europe* shows impacts on Earth from the outside, from space such as craters formed by meteorites crashing on our planet. This

represents external depression. The surface of the relief is covered with dust and small pieces of Gold Pyrite mineral stone.

Gold Pyrite FeS₂ (fake gold, gold for fools) mineral stone is technically known as iron sulfide and is one of the most common sulfide minerals. In recent times, a group of MIT researchers and the University of California have been taking another approach to developing iron pyrite for solar energy; the surface “energy bandgap,” of pyrite, a property essential for making solar cells or semiconductor devices.

Figure 1: *The diptych, relief New Europe (2016)*

The diptych, *Whip of God* represents the tectonic changes of Earth, an internal change. Its surface is covered with a dust and small pieces of Silver Galena mineral stone.

Silver Galena PbS mineral stone is a cubic stone that is made of lead minerals. This mineral has been mined for thousands of years due to its lead and silver content. Galena is usually located in Germany, United Kingdom, Peru, and the USA.

Figure 2: *The diptych, relief Whip of God (2016)*

The triptych *Rebirth of the Earth* reflects three different types of surfaces caused by inner or external physical influences. Its surface is covered with dust and small pieces of Black Sphalerite mineral stone.

Black Sphalerite is a mineral that consists largely of zinc sulfide in crystalline form, but it almost always contains variable amounts of iron. From the energetic aspect, this very interesting crystal will help you harmonize your female and male aspects while also unleashing your creativity.

Figure 3: *The diptych, relief Rebirth of the Earth (2016)*

All these three (3) minerals are energetically good for lower chakras and will help you to be more grounded, stable and find your own power. It helps you evolve more daily but it is necessary to use them in the right way.

3.1.2. Sonified X-ray data

What is Sonification? Sonification means to display data as sound or non-speech audio.

Sonification as a scientific tool: the scientific use of sonification has the goal of discovering meaning in sounds. Sonification intends to help recognize patterns or regularities underneath seemingly random X-ray data presented as sounds. In this case, X-ray analysis has been converted through two (2) different digital tools for audio readings which contributes to advancing scientific knowledge.

In relation to the sonification of X-ray was found one and a very specific example which deals with sonification of astronomical X-ray data. A doctoral project was published on Harvard's internet web page called *Star Songs – from X-rays to music*;

In spring 2011, Wanda Diaz Merced spent time at the Harvard-Smithsonian Center of Astrophysics, doing research for her doctoral dissertation at Glasgow University, Scotland. Wanda, who is blind, has been interested in sonification as a data analysis tool: how sonification might help scientists, even those who can see, detect patterns in large amounts of seemingly random astrophysical data. She used sonified X-ray data from EX Hydrae that have been collected by the Chandra X-Ray Observatory as it is written on the webpage. A well-known example is the Geiger Counter indicating levels of radiation. Wanda used the software *xSonify*, which was developed at NASA by Anton M. Schertenleib and Robert M. Candey, for sonifying the X-ray data. The software is an open-source and free and can be accessed on the NASA webpage. ⁽⁵⁾

For the project *New Europe*, the X-ray analysis of mineral stones was made in collaboration with Ruđer Bošković Institute in Zagreb Croatia. Two types of quantum mechanics were used: X-ray

powder diffraction (XRPD) which deals with particle analysis, determination of chemical and crystallographic properties, and a high-resolution scanning electron microscope FESEM.

FESEM has recorded these extreme close-up images of stones that clearly show how minerals are very contrasted.

Figure 4: FESEM - extreme close-up images of three different mineral stones

X-ray analyses are expressed in numbers. The higher the peak the more precious the stone is with metal elements. The highest peak is visible from Gold Pyrite. Numbers (analysis) are expressed with a blue line which was used for converting the values into sound and represent the value of the mineral stone. The green line represents the difference between the calculated and measured diffraction images.

- (i) **Silver Galena** mineral stone
<https://soundcloud.com/moon-sound-art/the-sound-of-mineral-stone-galenamix2019>
- (ii) **Black Sphalerite** mineral stone
<https://soundcloud.com/moon-sound-art/the-sound-of-mineral-stone-black-sphalerite-mix>
- (iii) **Gold Pyrite** mineral stone
<https://soundcloud.com/moon-sound-art/the-sound-of-mineral-stone-gold-pyritemix>

4. CONCLUSION

This is a sustainable piece of art which can simultaneously be enjoyed as an audio file and as a visual with different reflections and lighting on the reliefs. The main characteristics of the project *New Europe* are:

- a poetic outcome from laboratory X-ray analysis.
- sound as an unseen dimension of the stones - an untouchable medium.
- metal-based mineral stones have many beneficial material properties including energetic and healing properties which can have an impact on human development.

Humans are made to be connected with nature and are in balance between nature and technology. In the future, who knows what nature can bring, what we can discover which will makes us evolve, think differently. Our mindset will vastly depend on production and vice versa. The future of our civilisation remains unknown.

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