

# Pioneers of Scientific Thought: Empedocles and Anaxagoras

Recep KÜLCÜ<sup>1,2</sup>

<sup>1</sup>Isparta University of Applied Sciences, Faculty of Agriculture, Department of Agricultural Machinery and Technologies Engineering, ORCID: 0000-0002-7185-6514 Isparta, Turkey

<sup>2</sup>Akdeniz University, Institute of Social Sciences, Department of Philosophy (Second MSc and PhD), Antalya, Turkey

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## ABSTRACT

Scientific thought can be defined as a mode of thinking that enables the production of knowledge within the scope of episteme through experimentation, observation, and the validation of hypotheses. In ancient times, the idea of explaining nature beyond mythologies can be considered as the initial steps of scientific thought. Within this context, it can be said that the natural philosophers took a significant step and opened the door from mythos to logos. In ancient philosophy, Empedocles and Anaxagoras made important contributions to the development of scientific thought. Empedocles, a philosopher, physician, scientist, and politician, lived between 492 and 432 BC. He spent his life in a Greek colony on the southern shores of Sicily. Empedocles represented a pluralistic understanding in philosophy and followed a conciliatory path in the debates of his time regarding change. He achieved significant success in the field of medicine and was reputed to have revived the dead during his time. In the political arena, he advocated for democracy and played a significant role in the political life of his country as the leader of the Democratic Party. Empedocles aimed to reform the religious beliefs of his time. Anaxagoras (500-428 BC) was born near Klazomenai, which is located within the borders of present-day Turkey, near Urla. He is regarded as a philosopher and scientist who spent his entire life and fortune on scientific research. He went to Athens at the invitation of Pericles and conducted research on celestial bodies there. The explanations that contradicted the beliefs of their time were not always welcomed with respect by all segments of society. At times, due to their thoughts that went against the beliefs of their time, they also faced discrimination. This study attempts to present the lives, philosophies, thoughts, and discrimination faced by the two sages of ancient times.

**Keywords-** Anaxagoras, Empedocles, History of Science, *Philosophy*.

## INTRODUCTION

The sole legacy that humanity leaves and will leave for future generations is knowledge, but this knowledge belongs to episteme, not doxa. When humanity's history is assessed in general, it becomes evident that being the subject of knowledge has not been an easy task. The initial attempts for humans to become the subjects of knowledge started in the ancient Greek world, a beginning that is often considered as the inception of philosophy by many scholars. In this tradition initiated by the natural philosophers, the universe and nature were sought to be understood without resorting to supernatural principles, employing human reason and experience. It may not be entirely accurate to claim that philosophy began during this period, but it is a fact that the experiences conducted before this era were interpreted, developed, and passed down to us

by ancient Greek philosophers. The earliest examples of knowledge development within the scope of episteme were carried out during this period within the realm of theoria.

Following the natural philosophers, the sophists worked on the subjectivity of knowledge and the possibility of existence, and with Socrates, philosophy began to shift from nature to humanity. With Aristotle, philosophy encompassed human and natural sciences as a whole and underwent a transformation in the Middle Ages. As the subject of knowledge turned towards the divine, reason began to yield to obedience. In Europe, influenced by the Renaissance, the 17th century saw the emergence of Francis Bacon's statement that knowledge is power, followed by Descartes' mind-body dualism, opening up the domain for reason and science. Kant, by demonstrating the possibility of synthetic a priori knowledge and reconciling human reason and experience (Criticism), showed humanity that scientific laws could be developed. Following these developments, knowledge within the scope of episteme rapidly progressed, ushered in four different industrial revolutions, and shaped the structure we now call the "Knowledge Society." Of course, the process of humanity becoming the subject of knowledge and the development and elevation of collective knowledge has not been easy. There have been many breaking points in this struggle, and overcoming these breaking points has been achieved through the efforts and resistance of individuals.

The purpose of the publication series "Pioneers of Scientific Thought" is to analyze the lives, ideas, and beliefs of individuals who paid a price for their thoughts and beliefs in the struggle for humanity to become the subject of knowledge. Beyond knowing the individuals to whom we owe the knowledge society we live in today, the goal is to create a projection on how we can benefit from the legacy of the past in overcoming the obstacles to the development of knowledge within the scope of episteme today.

## **EMPEDOCLES**

Empedocles, who is known to come from an aristocratic family, lived in Akragas in Sicily [1]. Empedocles left behind many works, but two of his main works stand out. These works are "On Nature," in which he presented a pluralistic philosophy of nature, and "Purifications," in which he expressed his views on the immortality of the soul, metempsychosis (reincarnation), prayer, and healing.

### **Empedocles' Philosophy**

Empedocles actively engaged in the debates about change in his era. On one side of the debate, Heraclitus argued that everything in the universe was in constant flux and that nothing remained the same. On the other side, Parmenides and the philosophers of the Eleatic school, whom he founded, claimed that change was an illusion and that nothing actually changed. Empedocles attempted to find a middle ground between these two extremes. In this quest for reconciliation, Empedocles also adopted a different approach to the contemporary debate about "arkhe" (the fundamental principle of existence). Empedocles' solution to this reconciliation was the assertion that everything in the universe is composed of four fundamental elements: air, water, earth, and fire. With this approach, he offered a pluralistic explanation of the universe. According to Empedocles, the differences between objects are determined by variations in the mixtures of these four elements, and change is the result of alterations in the ratios of these elements.

In his philosophy, Empedocles was influenced by Parmenides and Pythagoras. The Pythagorean influence is evident in his views and his attribution of numerical proportions to the natural combinations of elements. Empedocles proposed that there are four root substances at the foundation of everything, asserting their immutability, which aligns with the ideas of Parmenides and the philosophers of the Eleatic school [1]. In fact, it is claimed that Empedocles was initially a Pythagorean but was later expelled from the school for allegedly divulging its secret teachings [2].

Empedocles believed that the four elements that constitute the basis of everything in the universe could not create objects on their own. He postulated the existence of forces that both combined and separated these elements, which he called love and strife. Love was the force that held the four elements together, serving as the power he used to explain the formation and harmony. In contrast, strife was the force responsible for disruption, disintegration, and disharmony. There was a perpetual struggle between these two forces.

In the battle between love and strife, Chaos initially prevailed. However, the Goddess of Love, Aphrodite, intervened in the chaos, bringing an end to disorder and establishing order in the universe. Nevertheless, strife began to disrupt this order by separating the elements from each other. Empedocles believed that this struggle would continue until the end of the universe. This ongoing battle of love and strife was responsible for all the diversity in the universe, including trees, plants, animals, and humans, in hierarchical order [3].

Empedocles' philosophy was unlike that of any philosopher before him. While the concept of *arkhe* existed before him, the idea of four immutable *arkhe* elements belonged uniquely to Empedocles. Additionally, the notion of the ongoing battle between the forces of love and strife, and how these forces drive change and transformation, was first introduced by him.

### **The Reaction to Empedocles' Philosophy**

Empedocles' ideas gathered a significant following, and his thoughts were supported for a certain period. Empedocles was also a prominent actor in the political life of his time. His father played a crucial role in the overthrow of tyranny in 470 BC. Diogenes Laertios VIII 63 states that the throne was offered to Empedocles after the tyrant was overthrown, but he declined it due to his belief in and commitment to democracy [4]. After the fall of tyranny, Empedocles led the Democratic Party, which was the most powerful among the factions in Akragas, and he spent his wealth in support of this cause [5]. Diogenes Laertios VIII 59 also mentions that Empedocles conducted studies in the field of medicine and even had rumors of reviving the dead. The sophist Gorgias stated that he was also interested in magic and sorcery [4].

There are various accounts and claims regarding the death of Empedocles. Some accounts suggest that he died a natural death, while others believe that his life ended on Mount Etna. The beliefs about Empedocles' life ending on Mount Etna involve two different claims. According to the first claim, Empedocles threw himself into the volcano, thus proving himself to be a god. The volcano then engulfed him and sent his sandals back to confirm his godhood. This claim was put forward by Empedocles' supporters. The second claim suggests that Empedocles, feeling misunderstood due to his thoughts and ostracized by society, chose to end his life on Mount Etna [5].

Empedocles' ideas and life have been the subject of many artistic works throughout history. Hölderlin wrote a tragedy about the death of Empedocles. In his tragedy, Hölderlin emphasized Empedocles' isolation, exclusion, and experience of discrimination over time due to his thoughts [6].

## **ANAXAGORAS**

Anaxagoras was born in 500 BC in the city of Klazomenai, located in the Ionia region of western Anatolia, which is present-day Urla [3]. According to his own beliefs, he transitioned from existence to non-existence in 428 BC. This is because Anaxagoras criticized the Athenians' ideas about birth and death. For him, death could not signify annihilation because in the universe, nothing comes from nothing and nothing goes to nothing; only generation and destruction could be discussed.

In 462 BC, Anaxagoras moved to Athens at the invitation of Pericles. Pericles was one of the influential statesmen of his time who aimed to advance Athens in arts and politics, especially after the Greeks'

victorious return from the Persian expeditions. The innovations introduced by Pericles faced criticism from conservatives, but instead of directly targeting a powerful statesman like Pericles, the conservatives preferred to target the artists and thinkers he brought to Athens [7]. Anaxagoras also faced the wrath of the conservatives and was put on trial.

### **Anaxagoras' Philosophy**

Anaxagoras, like Empedocles, displayed a pluralistic attitude in the quest for “arkhe” (the fundamental principle of existence) among the natural philosophers. While Empedocles posited the existence of four arkhe elements in the universe, Anaxagoras proposed the presence of an infinite number of arkhe elements. According to Anaxagoras, as many entities as there are, there are just as many arkhe elements. Anaxagoras stated that everything in the universe is composed of “spermata” (seeds or particles). However, nothing we see around us is in its pure state. Anaxagoras expressed this by saying, “Everything is in everything” [2].

In his view, everything in the universe is made up of mixtures. The predominant element within objects determines which element becomes apparent and forms a cohesive whole, making it perceivable. He called these elements “spermata,” which are invisible, limitless, eternal, and uncreated.

Initially, these spermata were in a state of chaos in the universe. The spermata, which were in a mixed state in the universe, transformed into order, creating the cosmos. Just as a lump of clay needs a sculptor to turn it into a statue, the transition from chaos to cosmos did not happen spontaneously. Anaxagoras referred to the element responsible for this transformation as “Nous,” which can be described as universal intelligence or intellect [8]. Nous is timeless, eternal, and uncreated, like the spermata. Nous organized the spermata in accordance with a plan, shaping the cosmos. After Nous gave order to the cosmos, the spermata, having acquired their purpose, could create without the need for further intervention from Nous. For the spermata, there is no birth or death; birth is the separation from the whole to emerge as a new entity, and death is the dissolution of the unity of different spermata. Describing birth and death as generation and destruction is more accurate. Anaxagoras' concept of a universe filled with mindless spermata and the purposeful force of Nous resulted in a dualistic and teleological cosmology [9].

Anaxagoras was not only a philosopher but also a scientist who applied observation and empirical methods. According to him, nothing comes from nothing, and nothing that exists can turn into nothing. Anaxagoras examined a meteorite that fell to Athens and concluded that it was a molten rock. He made inferences from this and claimed that the stars in the sky were also burning rocks. He even asserted that the Moon's light was reflected sunlight, demonstrating advanced views for his time.

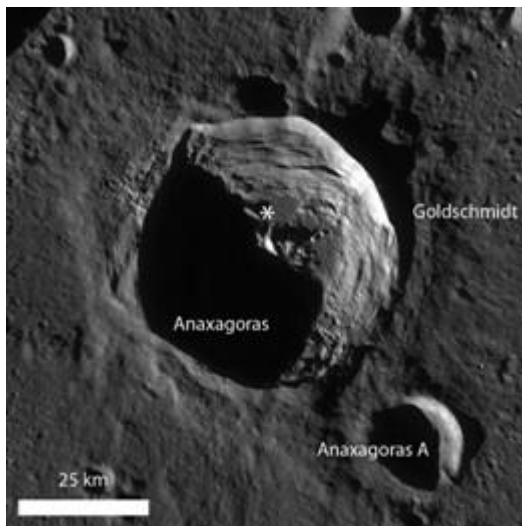
### **The Reaction to Anaxagoras' Philosophy**

Anaxagoras was the philosopher who brought the Ionian school's natural philosophy and scientific thinking tradition to Athens. With Anaxagoras's arrival, Athens learned to look at the universe from a scientific perspective, based on observation and empirical principles, and to engage in philosophy through these principles. However, as in any era, innovations were not always welcomed by all segments of society; they could be met with inertia, resistance, and even anger. In the time when Anaxagoras lived, as in other periods, not everyone found these ideas reasonable. Many innovators, scientists, and philosophers who embarked on a journey to guide society with forward-thinking ideas faced such reactions. Especially considering that Athens was historically experiencing a transitional period, it is clear that the intensity of this reaction would be high. In transitional societies, social divisions often reach their peak. Unfortunately, in human history, many thinkers and scientists have paid the price for the chasms that emerged between these camps, even with their lives.

Anaxagoras was indeed put on trial because of his ideas. His views on celestial bodies being burning stone

masses, the Moon receiving its light from the Sun, the uncreated nature of spermata, and the lack of control by Nous, which organized the spermata, over the functioning of the universe were all ideas that contradicted the beliefs of his time. Therefore, Anaxagoras is remembered as a philosopher and scientist who was tried for his thoughts in ancient Greece. During this trial, Anaxagoras had to go to Lapseki, a town near the Dardanelles Strait, where he established a school and continued to teach young people about his thoughts on science and philosophy. Anaxagoras' ideas served as an inspiration to subsequent atomists, and the concept of Nous became the foundation for Aristotle's theory of the efficient cause. While Anaxagoras is remembered with respect for his influential ideas that influenced many philosophers and scientists who came after him, the type of thinking that led to his trial has unfortunately reemerged throughout human history and continues to exact its toll.

Anaxagoras incurred the wrath of the conservative factions in Athens due to his ideas. He claimed that the moon, the goddess Selene of the time, was a piece of the sun's light reflecting from it and had separated from the Earth. In modern times, in reference to his ideas, a crater on the surface of the moon was named after Anaxagoras (Fig. 1).



**Fig 1. Anaxagoras crater on the surface of the Moon [10]**

## CONCLUSION

Empedocles and Anaxagoras are significant thinkers and scientists of the ancient era. Empedocles' pluralistic approach in his search for the "arkhe" laid the groundwork for the modern atomic model. The concepts of love, which holds objects together, and hatred, which drives them apart, emerged as important ideas in explaining time and change. Anaxagoras' concept of "spermata" took Empedocles' pluralism a step further, bearing similarities to the concept of atoms, and his idea that nothing comes into existence from nothing and nothing goes out of existence into nothing laid the foundation for modern physics' laws of conservation of matter and energy. Additionally, his observations and deductions about celestial bodies based on the examination of a meteorite demonstrated the potential of human beings to generate knowledge through experimentation and observation. This example highlights Anaxagoras' significant role as a pioneer in scientific thought and methodology. Like many other pioneers in the history of civilization, Empedocles and Anaxagoras were ostracized and subjected to discrimination by closed-minded communities of their time. However, despite the discrimination they faced, these two philosophers have rightfully earned their place in the history of science and thought as pioneers of scientific thinking.

In the history of science, there have been scientists who made significant contributions to scientific thought

after Empedocles and Anaxagoras. Sometimes, the ideas of these individuals were met with resistance from society. However, following the Middle Ages, as a result of scientific advancements, trust in science and scientific data increased in societies. Nevertheless, even today, we can observe that some new scientific developments and ideas are not immediately accepted by societies. Perhaps what distinguishes these individuals as pioneers is their ability to possess a more universal perspective outside the general norms of society.

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