Geotourism: Use of Environmentally Friendly Geological Wealth
(Field Study of Kayangan Api, Mystical Tourism for the Traces of Empu Supo in Bojonegoro)

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ABSTRACT

The writing of this article examines how solutions using geology can be cultivated in the management of historical sites as community ecotourism and community economic activities. The geotourism management paradigm is how tourism management can optimize the natural potential (geology) to add value to the economic well-being of local people living in the Kayangan Api area and minimize potential natural damage in Kayangan Api environment. The method used in this study is Kayangan Api tourist observation, expert interviews (guards) and literacy surveys. Therefore, this paper proposes a tourism management model. Geotourism management is grouped under five main focuses, including the formulation of natural opportunities used in tourism activities, the description of criteria for geotourism sites (Kayangan Api), the management of geotourism (Kayangan Api), and the explanation of geotourism activities and finally the indicators of success in Kayangan Api Bojonegoro Geotourism Print.

INTRODUCTION

Kayangan Api is the "Fountain of Eternal Fire" located in Sendangharjo Village, Ngasemi District, Bojonegoro Regency, East Java. Kayangan Api is a geological phenomenon in the form of natural gas that escapes from the ground through weak zones (cracks). There is a spring near the gas outlet that has a strong smell because it contains sulfur. Under such conditions, however, the fire raging in the blazing sky could not be extinguished.

Kayangan Api was originally called Kayangan Gen. The story goes that Empu Kriyo Kusumo was first visited by a blacksmith named Kriyo Kusumo. Kriyo Kusumo is the pseudonym of Empu Supo, the ruler of the Majapahit Empire. "At that time, the Majapahit kingdom sent Suna Ampeli to find Sup Empu. Finally, Pandhe Butoh Suna gathered at Ampel Ngasem village. Empu Kriyo Kusumo was not present at the meeting at the time. Later, Sunan Ampel said, "It means that Empu Supo is ngayang or always alone," Kayangan Api Juli (61), caretaker, said on Saturday (11/16).

After that, Empu Kriyo Kusumo finally ordered that neither Pande nor Master come to Sendangharjo village. Until now no residents of Empuna or Pandhe lived in Sendangharjo village in Ngasemi district. After leaving the message, Kriyo left Kusumo's village and moved into the middle of the forest. On Friday at 13:00, Empu Kriyo Kusumo, who switched to the right, brought the legacy light carried by him. The fire point was placed in the middle of the forest and is now in the fire sky. So far, the fire has never been extinguished. The fire is now
surrounded by bricks to protect visitors from entering the fire arena. There are also many burnt stones, like the first time I discovered Kayangan Api. Additionally, there are 4 temples next to the burning coals (Department of Culture and Tourism of Bojonegoro, 2020).

To the east of the fire is the place of Empu Kriyo Kusumo, whose authenticity has been preserved until today. When Empu Kriyo moved from the Kusumo village to the forest, he decided to continue making legacies. The seat he bequeathed was right under the tree by the fire pit, on top of a brick. Until now, the bricks where Empu Kriyo Kusumo sat are still intact as before. The difference now is that there is a lot of moss inside the brick. The seat is now fenced off to prevent visitors from entering or stepping on Empu Kriyo Kusumo's seat. On the west side of the fire there is water where the Empu Soup cools the burned heritage. Many people think that water is sulfur. However, the sulfurous water in the fiery sky was strangely cold.

"Empu Kriyo Kusumo made a legacy for gold in the boiling water of this place. Gilding is the term used to cool an heirloom that has been burned in charcoal. After the heirloom is burned with coal, it is gilded. This process of gilding is useful to strengthen the heritage. Yes, many people think that water is sulfur. But when the sulfur water is hot. But the water here is cold," said Juli. This is supported by heritage weapons expert M. Mansur Hidayat, who told Detik's team, "To make a heater, you need strong coals with a temperature of 1200 degrees Celsius, and Kayangan Api is proper place to do it, heritage keris". He also named Empu Supo as the producer of the keris. "It is blukutuk, a well of sulfur water to open the pores of the keris so that it is easy to paint. Thus, metallurgically very suitable. We believe this is where the champions have made a difference during their reign," he said.

Villagers found Kayangan Api when Empu Kriyo Kusumo was dead. It means getting away from nature. The caretaker said that Empu Supo or Kriyo Kusumo still lives with his family in the Fiery Heaven. The two daughters of Empu Kriyo Kusumo named Sri Wulan and Siti Sundari are now in the fire heaven entrance tree. The two of them guarded the entrance, which was a round tree. The fire that is in the fiery heaven never goes out, even when it rains. Visiting the village at night, you can see the blue color of the fire in the middle of the dark night. The tree where Empu Kriyo Kusumo sits to make legacies is also never dry and always fruitful. "Some people think there is a source of natural gas under the fire. However, I think it is a miracle. Look, fire can change shape. Some became birds that fly. Some may become a different legacy and many others. It cannot be seen with the naked eye. The fire only changes when it's quiet and it's just me," Juli said of the image where the fire can change shape. The trip to Kayangan is about 15 km from the city center. This tourist area is located in a protected forest. Although it is located in the forest, the government provides easy access roads, so visitors need not worry. In Kayangan, the api is also often used as a venue for certain events such as Bojonegoro births and mass rituals. Kayangan Api became more famous when the PON (National Sports Week) firefighting event was organized in 2000.

In relation to the above explanation, the purpose of this article is to study geology as a science to create an understanding of modern science from the perspective of the philosophy of science, the history of the development of geoscience from geology, geotourism as a Use of Environmentally Friendly Geological Wealth.

The word geology comes from two Greek words: geos (meaning earth) and logos (meaning science). Geology is therefore the study of the Earth and the phenomena that occur on it. Geology generally deals with the materials that make up the earth and all the processes that occur both inside the earth (under the surface) and on the surface. Internal (endogenous) forces cause earthquakes and volcanic activity, while external (exogenous) forces cause weathering, erosion, and creation of natural landscapes. All these processes give stones special properties. Geology studies the characteristics and properties of rocks. Interpret what geological processes affect the formation of these rocks (Muksin, 2019).

Aristotle proposed 2,300 years ago that rocks are formed by the influence of stars. Earthquakes are caused by the explosion of dense air above the earth due to the heating of the center of fire. Frank D. Adams in Geological Science (Devor, 1938) states that in the Middle
Ages Aristotle was honored as the head and leader of all philosophers whose opinion on any subject was legitimate and final. The ink sketches of the great artist Leonardo da Vinci (1452–1519) bear witness to the early traces of geology. In his sketches, he carefully described the shape of the stone blocks to understand the natural shape of the earth (1.1). Then in the 17th century came the first descriptions of stone deformation. Nicholas Steno (1631-1686) studied outcrops where the rock layers were not horizontal and suggested that the layers were not horizontal and that they had changed for some reason. By the early 18th century, the complexity of rocks in mountains such as the Alps was widely known and in need of explanation (Figure 2).

![Figure 1](image1.png)

**Figure 1.** Sketch by Leonardo da Vinci detailing the folded layers of the Italian mountain range (c. 1500 AD).

![Figure 2](image2.png)

**Figure 2.** Aerial view of the European Alps (France).

French citizen Baron Georges Cuvier (1810) noticed that in ancient times there were species of plants and animals that died out, and then new species of plants and animals appeared. All these events were caused by a sudden (catastrophic) disaster that was very powerful and happened all over the world. This concept is known as catastrophe theory or catastrophe (catastrophe).

At the end of the 18th century, the Scottish physicist James Hutton (1795) published the book "Theory of the Earth". Hutton coined the phrase "The present is the key to the past." The phrase means that current geological conditions are the result of past geological processes, so by studying the current features of the earth we can learn about past geological processes. James Hutton is called the father of modern geology and the theory that Hutton presented is known as the theory of uniformitarianism. Charles Lyell (1797-1875) expressed his ideas through his books, one of which was Principles of Geology. Lyell illustrates the concepts of similarity from one nature to another. Lyell was able to show that the geological processes observed today were also valid in the past. Although Lyell did not originate the theory of uniformitarianism, he was much better able to interpret it and spread it to a wider audience.

The science of geology continues to evolve with the discovery of various technologies such as geophysical technology. For example, Alfred Wegener's theory of continental drift from 1912, which asserted that 250 million years ago, all the current continents and islands were originally
one giant land mass, which then broke up and continued to move (float), which, among other things, caused the American and African continents and other separation of the continents. Subsequent researchers continued to refine this theory until the birth of the theory of plate tectonics in 1968.

The earth's crust, the ongoing process (before, during and after) its formation and all kinds of living things that were or lived around it (Sya, 2012). At the same time, according to Purbohadiwijoyo (1967), geology can be interpreted as a geographical science that studies its history with existing life, the composition of its crust, the structures inside, the various forces acting on it and its evolution, experienced.

Tourism is derived from the secret language which consists of two words, namely "pari" which means around or together and the word "wisata" which means to travel (Pitana, 2009). Destinations are places that are visited for a significant amount of time during a tourist trip compared to other places passed during the trip, such as transit areas (Pitana, 2009). In the study of the sociology of tourism, the interest of tourists in visiting a natural destination is determined by external factors, namely external factors related to natural tourist sites (Pitana & Putu, 2009). One of these external factors is the attraction force, often called the tourist attraction. According to Pendit (2002), a tourist destination is defined as anything that is interesting and worth visiting and seeing.

Geo tourism (geotourism) is a particularly interesting tourism that uses all the possibilities of natural resources, therefore it is necessary to enrich the understanding and understanding of the processes of natural physical phenomena (Nainggolan, 2016). Geotourism is particularly interesting tourism that uses all the possibilities of natural resources, therefore it is necessary to enrich the understanding and understanding of the processes of natural physical phenomena (Nainggolan, 2016).

Geotourism is a tourist activity of special interest, which focuses mainly on the geological aspect of the earth and the environment it contains, to promote the understanding of the environment, nature, and culture, however, as a form of appreciation and nature protection activities, concerns about preserving local wisdom (Ginting & Sasmita, 2018; Wood, 2002; Chen et. al., 2015).

RESEARCH METHOD
This study used a qualitative research design.

RESULTS AND DISCUSSION
The result of this study was geological phenomena are essentially very different, each of which forms a beautiful landscape with its own value, exoticism, and uniqueness, suitable for management as a tourist destination (Dowling, 2011).

a. Development of Geotourism
These geological phenomena include e.g. (1) Geological structures are inanimate natural structures both below and above the ground that are built by forces acting within and above the ground. Energy operating underground is called endogenous energy, while above-ground energy is called exogenous energy. (2) Stratigraphy is rock layers with all kinds of rock types, structures, properties, and symptoms resulting from the description of these layers (Sya, 2012). (3) Topography is the shape of the landscape. In geology, topography is shaped by endogenous and exogenous forces, so topography is constantly changing. (4) The mineral content of the underground layer can also be an educational and valuable tourism destination, which is very interesting to study based on its name, history, and formation process, properties and chemical elements, and their purpose of use in their daily life.

Tourism is essentially due to the human tendency to seek new things and environments or in sociology it is often called a ritual of inversion (Pitana & Putu, 2009). Differences in natural elements, community culture and built elements in each hemisphere are the things that can motivate a person or a group of people to travel (Darsorajitno, 2002). According to
Geotourism: Use of Environmentally Friendly Geological Wealth

Geotourism is the ritual orientations of Indonesian tourists, which are the opposite, are supported by its natural potential and various geological phenomena. The compatibility of these two factors is the driving force behind the development of geology-based tourism or geotourism. In addition to the factors mentioned above, the development of geotourism is also supported by the growing demand for special tourism.

Special tourists are usually tourists who like unusual tourist places and like difficult or unusual tourist activities (Hermawan, 2017), in scientific language they are often called drift tourists (Pitana & Putu, 2009). This type of tourist is not limited to visiting natural tourist destinations to see natural panoramas or take selfies like most tourists today. The tourist destinations they choose are destinations that can satisfy their thirst for adventure, but also destinations that can enrich them with new experiences and insights.

This article attempts to suggest guidelines for determining geotourism attraction criteria by adapting already existing nature tourism criteria. The criteria for natural attractiveness are at least the following:

a) Existence of informative aspects Geotourism is sustainable tourism, whose main focus is to experience the geology of the Earth. Therefore, in the form of information carriers, we need features that promote the understanding and appreciation of the environment and culture and the preservation of the earth's geology as experienced on-site. Also, information that can promote understanding, appreciation, and protection of the environment and culture and be useful on earth. The quality of information is the most important factor necessary for tourists because basically, the main motive is to look for something new to get rich. Therefore, geotourism must have informational means of communication (Pásková, 2012). For the adventurous traveler, knowledge is an absolute prerequisite for organizing nature tourism, because information about natural phenomena is always necessary to prevent danger. The information aspect is also related to security factors, for example in the installation of transmitters installed in the Dieng area of Central Java. With this transmitter, the gas temperature of Dieng Crater can be transmitted to the data center by radio, and then the data will be displayed at the entrance of the tourist attraction so that visitors or tour operators can be alert when traveling by looking at the data. displayed by the tool.

b) Nature tourism places should be diverse. Good geological tourism destinations have at least many alternative flora and fauna attractions for tourists. This is the ultimate value for the destination because the development of tourism activities in the destination can be developed more freely and versatile. In this way, it is hoped that tourists will not get bored and will be able to extend their stay.

c) Beauty and uniqueness is a value, natural attractions consist of natural phenomena and only occur at certain times, so there is no similarity between the area and other tourist sites, so natural attractions have their own characteristics compared to cultural and man-made attractions, especially because you can fully enjoy the natural attractions of this ecosystem.

d) The potential for overrunning is there, in addition to nature tourism, the motives of tourism can be research, education and nature protection. The special interest is adventurous, so you need really untouched areas, without any artificial or artificial attractions that really hinder their activities.

e) Availability of natural ecosystems. A natural attraction should still provide an area with an intact ecosystem. Natural ecosystem means a natural ecosystem that functions naturally and not as a result of man-made or artificial technology.

The tourist destination criteria proposed above often belong to geological areas that have the status of national geoparks. Because the geopark has definitively gone through the stages of evaluation or strict standardization by several authorized organizations, including UNESCO. Geoparks are nationally protected areas that contain some important geological heritages of
certain beauty and rarity, which can be developed as part of a comprehensive concept of nature protection, education and local economic development (UNESCO, 2006).

In order to join the Global Geopark Network (GGN), UNESCO established several criteria that had to be met beforehand, including: (1) the size of the site parameters. The size of the parameters of the area used as a geopark must have clear boundaries, an area large enough to cover cultural and economic development activities. In addition, the area planned as a geopark must have an important international scale, rare, scientific and beautiful geological heritage. Including integration with the cultural wisdom of the local community; (2) There is a control check. The condition of the Geopark is a board and a comprehensive development plan; (3) Economic development. One of the strategic objectives of establishing a geopark is the promotion of economic activity and the promotion of sustainability. Just as tourist destinations are always promoted as the pillars of a country’s economic development; (4) Educational considerations. The Geopark must provide and support equipment and activities for the development of science, especially geoscientific knowledge and the general concept of protection. Several basic infrastructures are important to support public education, such as information centers, museums, development of geopark roads; (5) Environmental protection aspect. In addition to protected areas, parks are a tool for local socio-economic development. The Director of the Geopark area is responsible for ensuring that the geological heritage is protected according to local traditional values and current regulations. The conservation of geological phenomena of historical value is important in the management of geoparks.

Two criteria can be taken as attractive criteria for geotourism, the criteria of a natural area and the criteria of a geopark. Thus, the criteria for the attractiveness of geotourism are given in the following Table 1.

Table 1. Geotourism criteria formula

<table>
<thead>
<tr>
<th>Criteria for the Attractiveness of Nature Tourism</th>
<th>Geopark Criteria</th>
<th>Geotourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informative side</td>
<td>Educational aspect (geoscience)</td>
<td>Knowledge and enriching aspects of geological science (geoscience) exist</td>
</tr>
<tr>
<td>A variety of attractions</td>
<td>The size of the interval parameter</td>
<td>There are many attractions in one area</td>
</tr>
<tr>
<td>The beauty, authenticity and uniqueness of nature</td>
<td>The size of the area parameter: It has scarcity, scientific value and beauty</td>
<td>The beauty of nature, authenticity, scientific value and uniqueness</td>
</tr>
<tr>
<td>Adventure potential</td>
<td>-</td>
<td>A geological nature-based adventure</td>
</tr>
<tr>
<td>Natural ecosystem</td>
<td>Environmental protection aspect</td>
<td>There is a natural ecosystem preserved through conservation tourism activities/management</td>
</tr>
<tr>
<td>-</td>
<td>There is administrative management</td>
<td>There is administrative management</td>
</tr>
<tr>
<td>-</td>
<td>Economic development continuous</td>
<td>Economic development continuous</td>
</tr>
</tbody>
</table>

Geopark is a management concept for managing a highly visible, unique and rare geodiversity site (Geoheritage), of high scientific value, nationally and globally recognized and supported by diversity. (cultural diversity) in the area, geological areas that become heritage and then designated for protection, and protected areas that include people living around the protected area. Where the area around the protected area is developed as an educational and geotourism destination that can increase the economic activity of the community surrounding the protected area (Rosana, 2016).
b. Studies on Philosophy of Science

1. Ontology

Kayangan Api is the "Fountain of Eternal Fire" located in Sendangharjo Village, Ngasemi District, Bojonegoro Regency, East Java. Kayangan Api is a geological phenomenon in the form of natural gas that escapes from the ground through weak zones (cracks). There is a spring near the gas outlet that produces a pungent smell because it contains sulphur. Under such conditions, the fire burning in the fiery sky still cannot be extinguished. In this case, the study of the history of the development of geology. The connection with geology is that the opposite ritual inclination of Indonesian tourists was supported by its natural potential as well as all kinds of geological phenomena.

2. Epistemology

Kuhn's assumption that the objectivity of science is not authoritative is limited to a reasoned final observation. This is the basis of paradigmatic epistemology, which criticizes people's belief in science as a representation of reality. The epistemology of science is rational, empirical and positive. The paradigm accepts the revolutionary theory in the name of creationism, which encourages the truth of science to be a reality that fights against each other, while science in its search for truth has an autonomous space between prediction and observation, which isolate each other (Kholish, 2012). Therefore, in order to develop a science that has rational frameworks and at the same time reflects the true reality of this thinking, an experimental method has been developed, which is a bridge between theoretical and rational explanations, empirical evidence (Jujun & Suraismantri, 2010). In this article, the experimental method, namely structural geology, makes a comprehensive study of geological science, that is, the study of the shape and geometry and processes of rocks as a component of the earth's crust (crust). to cause these shapes and geometries.

3. Axiology

Geotourism was born in the international community in the mid-1990s. Tom Hose, a geologist at the University of Buckinghamshire Chilterns in England, was probably the first to use the term. In 1996, he wrote an article in the Geological Society (Dirgantara, n.d), "Geotourism or Can Tourists Become Random Rock Dogs: Geology at Your Doorstep". In 2005, the term geotourism became known in Indonesia. Geotourism (geotourism) is a nature tourism activity that focuses on the geological features of the earth's surface to promote environmental and cultural understanding, appreciation and conservation, and local wisdom. Geotourism (geotourism) has several concepts of nature tourism, including tourism that emphasizes the beauty, uniqueness, rarity and wonder of natural phenomena closely related to geological phenomena (Kusumahibrata, 1999 in Hidayat, 2002).

Figure 3. Bojonegoro source of eternal fire in the heaven of fire

The geotourism activities developed at the sites are: (1) geological education; (2) Activities capable of enriching knowledge (community tourists), which are mainly related to the geological aspect of the tourist destination. (3) Valuable and protective or nature conservation
activities (4) Land migrations. This must be accompanied by professional management regarding (1) geotourism attraction development and environmental protection; (2) sustainable tourism development and community engagement; 3) security management; (4) Excellent service with supporting infrastructure.

CONCLUSION
This paper attempts to suggest a management model for geotourism. Geotourism management has five main focuses, which are formulation of natural potentials used in geotourism (areas with geopark status can be used), formulation of criteria for geotourism destinations, management of geotourism, formulation of geotourism activities and finally. indicators of success or geotourism production. Geological features or phenomena used as tourist attractions include: (1) geological structure; (2) stratigraphy; (3) topography, (4) including rocks, fossils and materials contained therein. The four phenomena mentioned above must meet the criteria to be developed as a geotourism destination. The criteria for geotourism destinations are: (1) Aspects related to information and enrichment of geological science (geoscience); (2) There are many different attractions in one area; (3) beauty, originality, scientific value and natural uniqueness (geology); (4) opportunities for nature adventures; (5) Existence of a natural ecosystem that is preserved through conservation tourism activities/management. The geotourism activities developed at the sites are: (1) geological education; (2) Activities capable of enriching knowledge (community tourists), which are mainly related to the geological aspect of the tourist destination. (3) Valuable and protective or nature conservation activities (4) Land migrations. This must be accompanied by professional management regarding (1) geotourism attraction development and environmental protection; (2) sustainable tourism development and community engagement; 3) security management; (4) Excellent service with supporting infrastructure. Geotourism activities are expected to benefit from revenues that include: (1) benefits to nature conservation and geological phenomena that are tourist sites; (2) Achieving tourist satisfaction by enriching travel experiences and knowledge gained during the trip; (3) increasing the economic well-being of the community; (4) Implementation of sustainable tourism management.

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Geotourism: Use of Environmentally Friendly Geological Wealth

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