Geology to understand the megalithic religion in the Shimane Peninsula: A case program of the Kunibiki Geopark Project, Shimane University

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In recent years, it becomes popular to visit a megalith in the Izumo Province. Over 30 people participated in the short tour organized by the Kunibiki Project, Shimane University, to go on an excursion to Tateiwa Shrine, Izumo in October, 2015. There were no more shrine building, but the megalith over 12 meters high exited in the shrine area. People believe the dwelling stone of god for the megalith, which is called Ishigami or Iwakura in the Japanese culture. The stone is no more stone itself, but the symbol of animism. We will introduce herein why such large monument stones were distributed in the Shimane Peninsula.
The Shimane Peninsula is characterized by four major landmasses that display eastward *en echelon* arrangement from the topographical point of view. Such a feature of the Shimane Peninsula is originally related to the early to middle Miocene tectonic event, the opening of the Japan Sea and clock-wise rotation of West Honshu Island that occurred in 20-15 Ma. The geology of the Shimane peninsula is characterized in having severe deformation of sedimentary and volcaniclastic rocks, and thus it has been called as “Sinji Folded Zone” (Otuka, 1939). The tectonic termination with a north-south stress is about 11 Ma. Tectonic duration of the Shinji Folded Zone would be over 4~6 million years, if we regard the opening event of the Japan Sea was stopped at 17 Ma or 15 Ma. We are able to find several large faults such as the Shinji and Taisha Folds that joined in this early to middle Miocene tectonic movement. Therefore, it is clear that the large stone monuments, mostly consisting of rhyolite, are closely related to the formation of the Shimane Peninsula. Shearing in the adjacent rocks and slickenside on the stone surface indicate clear evidence to explain the fault-related block of the stone.
Setting aside the question whether ancient Izumo people, ~1300 years ago, knew the geology or not, they fully understood the topography of the Shimane Peninsula and its neighbors. Moreover they created the “Kunibiki-Shinwa”, the story of land-pulling (Izumonokuni-Fudoki; 733). It is surprisingly enough that the story was appeared over 1000 years before the Wegener’s Continental Drift Theory (1912).

Keywords: Shimane Peninsula, Kunibiki myths, megalithic religion, Continental Drift theory

Granite of 18th to 19th century stone works in Itoigawa Geopark

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Determination of production area of stones using as historic stone works is useful for the studies on transportation condition and culture on those days. There are many stone works of 18th to 19th century in some shrines of Itoigawa Geopark. It is considered that they were made by stonemasons of Onomichi facing Seto Inland Sea, because of engraving of their name on the stone. They were brought by cargo vessel named Kitamaebune which is sailed the Japan Sea during the Edo period. These stone works are made of following two type granites.
Rock facies A: Medium grained biotite granites. They are characterized by white-colored K-feldspar and very low magnetic susceptibility showing $3x10^{-5}$-$1x10^{-3}$SI.
Rock facies B: Medium-grained porphyritic hornblende biotite granites. They are characterized by k-feldspar phenocrysts and euhedral hornblende of about 1 cm in long axis. They contain mafic enclaves Magnetic susceptibilities of this type of granites are $1x10^{-3}$SI to $5x10^{-3}$SI.
On the other hand, many evidences of quarrying work are remained in Onomichi City. Granites of such quarrying sites have similar rock facies and magnetic susceptibility to stones of Rock Facies B forming stone works in Itoigawa Geopark. Furthermore, stone works in some old temples of Onomichi City are composed of same rocks to Rock Facies B of Itoigawa area. These facts indicate that the granites of this rock facies in Itoigawa Geopark originated from Onomichi area.
However, granites corresponding to Rock Facies A in Itoigawa Geopark are not found in Onomichi area. This suggests a possibility that Onomichi flourished not only as producing center but as agglomeration area of stones.
The 18^{th} to19^{th} century stone works produced by stonemasons of Onomichi in Itoigawa Geopark are composed of granites from Onomichi area and them from other area.

Keywords: granite, stone works, magnetic susceptibility

Roles of the information by geopark in natural disaster -A Case Study of 2015 Hakone eruption

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We'll report about information dissemination by Hakone/Izu-Peninsula Geopark and its questionnaire result of 2015 small eruption in Hakone volcano.
Owakudani in Hakone volcano has been restricting due to volcanic activity since May 6, 2015. We had produced the movie to explain the state of Owakudani and had published at Aug. 6. Aerial video by multirotor was used in this movie, and explanation about volcanic activity was created from the report (July 21) by Hot Springs Research Institute of Kanagawa Prefecture were used in this movie. The movie can be viewed on Youtube and Hakone Visitor Center, is linked from the web site of Hakone and Izu Prninsula Geopark. Views on youtube is about 2700 times.
At the same time as the publication of this movie, we started questionnaire survey at Izu Peninsula Geopark web site and in the Hakone Visitor Center. Number of valid responses was 97 (65 from web site and 32 from visitor center). 99% of answerers agreed to the question "Should such information be published?" From this survey results, it was found that the demand for information about " What has happened at Owakudani?. Geopark is expected to transmit easy-to-understand information. For the information from Geopark is to be trusted, activities in time of a disaster does not occur are also important.

Keywords: Geopark, Disaster Information, Hakone volcano

Lecture of physical geography with topics of geopark for students of University of Nagasaki, southwest Japan

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Lecture of physical geography in the University of Nagasaki was prepared for first- to forth-years students of all faculties. The lecture focused on regional geography and includes topics of geopark. The tour of Unzen Volcanic Area Global Geopark was impressive activity for student participants. Geology, geomorphology, hazard, history, vegetation, industry were explained comprehensively at five geosites. A questionnaire survey in 2015 indicated that geopark has became familiar with university students for several years and a field tour would be an useful teaching method for facilitating interest and concern on geopark . Geopark is a scheme and an actual example of a concept of regional geography.

Keywords: Unzen Volcanic Area Global Geopark, Nagasaki Prefecture, Physical geography

Wind ripples with colored sand in a doughnut type circular wind duct

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A doughnut type transparent circular wind duct experimental apparatus (width: 30 cm, inner diameter: 200 cm, depth: 50 cm) was made newly and colored sand according to grain sizes was installed. We performed wind ripple making experiments with 6.0 m/s wind and three issues came up: i) vent shape and position have clue to wind velocity distributions, ii) grain size mixture ratio, and iii) the secondary flow leads to spatial sorting of colored sand.

Keywords: doughnut type circular wind duct, colored sand, wind ripple, secondaly flow, spatial sorting, circular wind tunnel

Important role of resident earth scientists in Geopark–In case of Making Geopark Model Route in San’in Kaigan Global Geopark

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Geoparks is a “bottom-up” or community-led program. Local people approach to recognize geological significance of each Geopark and they conserve and promote geological heritage and regional resources for science, education and tourism etc. One of the important roles of geopark activities is resident understanding of the geopark concept, territory and its features. For this purpose, it is important that local residents participate in geopark activities positively. However, in Japan, where local development has been undertaken by governmental organizations, it is difficult for local residents to take part in geopark activities. This time, we planned ”Geopark Model Route” across the San’in Kaigan Geopark in cooperation with local people, to promote better understanding and communication with local people, government and academia involved in geopark activities.
In a geopark, creating a tour route and map which allow visitors to explore the geosites easily is required. We have therefore prepared a ”Geopark Model Route” for walking tours, sea kayaking, driving in half-day or one day, and for enjoying the feature of each area. Each map includes outlines of about twelve must-see geological spots, allowing visitors to enjoy sightseeing and learn about the San’in Kaigan Geopark.
We were able to make ”Geopark Model Route” useful for local residents, by involving experienced local people in the area. By working together by local residents and researchers, scientific information could be shared among local people. However, some problems were found in its operation. The map is not used effectively in the area which has fewer visitors and no local guides. From now on, it is also necessary to accept visitor’s opinions and correct continuously so that the map may come to be more effective and useful for both visitors and local residents.

Keywords: Geoparks, Community Development, resident earth scientists

Recognition of Geoparks Shown in Data Retrievals

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A geopark has a character of “business.” In particular, sustainable development and promotion through geotourisms is important. Thus, objective analysis of the business is needed. Full-fledged marketing researches by research companies has been rarely seen in the record and there are only a few studies by researchers with small-scale questionnaire surveys and interviews.
Therefore, we are aiming to clarify how geoparks are recognized by using the objective data. In this paper, we try to visualize the degree and the time variation of the spread of geoparks by using the Twitter advanced search and a newspaper article database. In addition, the initial results of the analysis using the traffic big data for the movement of people associated with geoparks will be also reported. We also want to consider what context geoparks are mentioned in, by corpus analysis and morphological analysis of newspaper articles.

Keywords: geopark, geotourism, big data

Seeking Components of Geotours Attractive to Visitors

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Geological conservation, education, and revitalization of geotourism are important issues for geopark activities. Of these, it is expected that geotourism's revitalization will bring sustainable development to the regions. Itoh et al. (2015) grasped trends and needs of tourists who were potential customers of geotourism via online surveys, and found that tourists would look for "relaxation" and "extraordinariness" in travels. In this study, we quantitatively ascertained directions of attractive geotours for general tourists who are potential customers of geotourism, using an online survey.

We used NTTCom Research Light provided by NTTCom Online Marketing Solutions for the survey, which was conducted on September 27th and 28th, 2015. We set the target respondents as 400 and collected 433 responses.

Among the respondents, 29.8% are in their 50s, and 64.0% are male. Their places of residence are mainly metropolitan areas of Tokyo, Saitama, Chiba, and Kanagawa, and prefectures with big cities such as Aichi, Osaka, and Fukuoka.

In the survey, we asked which tours respondents would like to participate in, from specific geotours at member geoparks of the Japanese Geoparks Network as well as those in general package tours from travel agents' websites, such as "Rurubu" and "Jalan". Respondents could give multiple answers. As a result, the more ordinary the tours are, such as "hot springs" and "to enjoy local cuisines," the more positive the responses. On the other hand, general geotours, such as "to take in the scenery and topography" and "to observe strata and gather fossils," are not so popular. Also, the tours "to visit historic spots" and "to visit shrines, temples, and castles" do not seem to be so popular, either. We did not observe any significant trends by age.

Therefore, we set these tours as variables to conduct principal component analysis using a variance-covariance matrix, and then performed cluster analysis using principal component points as variables (SPSS Statistics ver. 23 produced by IBM). As a result, items representing "to visit shrines, temples, and castles" and "to visit historic spots" were extracted as the first principal components and items representing nature observation such as "bird/animal watching," "botanical observation," and "mountain climbing and trekking" were extracted as the second principal components.

The respondents were sorted into four clusters, of which Cluster 3 especially had a tendency to show strong interests in both items relating to nature and those relating to history and culture. From these results, it could be suggested that expressing seamlessly themes of not only natural phenomenon but also history and culture could attract more visitors to geotours.

Keywords: Geopark, Geotourism, internet questionnaire

Methodology for seamless geostory

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Geoparks require attractive story based on geoscience. Geostory enhances educational effects for geoconservation and geotourism, whereas the story depends primarily on scientific evidences. Geostory involves many geoscientific disciplines characterized by multi-scale historical, vertical and horizontal phenomena. Field observation in geotour might confuse visitors, because understanding of multi-scale phenomena relies on academic experiences. Geotour for public tourists should produce well-selected and arranged story targeting historical, vertical and/or horizontal phenomena. Educational geotour should produce programs on comprehensive geoscientific system to understand interrelationship among many geoscientific disciplines. Seamless geostory dramatically promotes educational effects in geotour, and improves multidisciplinary and interdisciplinary geoscience. Geoparks should prepare and propose various geostory collaborated with geoscientists.

Keywords: Geoscience, Outreach, Geopark

ESD for Geoparks in Japan

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Relationships between ESD (Education for Sustainable Development) and Geoparks are examined in this paper. Geoparks have a marked affinity for ESD because education and sustainable development are highlighted in the concepts of geoparks, and both have strong associations with UNESCO. However, small number of papers have been written about the relationships between ESD and geoparks, and few schools in geoparks are the members of the ASPnet (UNESCO Associated Schools Project Network). Therefore, the author tries two methods to examine possibilities of our society led by multiplying ESD and geoparks. Firstly, the description contents of the Global Action Programme (GAP) on ESD were considered about cases of geoparks. GAP is intended to make a substantial contribution to the post-2015 agenda, and the follow up to the United Nations Decade of Education for Sustainable Development (2005-2014). From the “Priority Action Areas” of the GAP, many points related with organizational operations were found as areas which should be improved. Increasing member schools of the ASPnet in geoparks as hubs for practicing ESD, and setting out policies and agendas to integrate ESD into the various processes and structures of stakeholders in geoparks are the examples.
Regarding learning contents, placing great emphasis on efforts to build a sustainable society mentioned in course of study in Japan is important in geoparks, as well as having viewpoints of international cooperation, giving participatory skills to youth, and so on.
Secondly, learning contents for geoparks are examined from the viewpoints of Earth Sciences and community development. From the former, nature of familiar territory as the first stage, and understanding of the mechanism of Earth activity as the second stage have been found. From the latter, relationships between our life and nature as the first stage, and development of social skills for reaching an understanding with other stakeholders as the second stage have been found. Additionally, international understanding and cooperation through geopark would be the third stage. From the above, geoparks could be places for inspiring learners to act for realizing sustainable society if we transform organizational operations and maximize learning contents given by Earth Sciences and community development.

Keywords: Education for Sustainable Development, Geopark, UNESCO Associated Schools

Restoring records of the 1930 North Izu earthquake through illustration

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A significant quantity of records document the Great East Japan earthquake due to the widespread ownership of cell phones and digital cameras among ordinary citizens when that disaster occurred. Other past disasters have fewer records available, in some instances due to wartime information control measures. Hayashi et al. (2006) interviewed survivors of the 1945 Mikawa earthquake that hit the Mikawa region in Aichi Prefecture, and then recreated both written form and Japanese-style painting images of the disaster experience, based on the accounts gathered in the interviews. Based on these interviews with the few remaining survivors, this study produced illustrations and restored a record of the scenes of the disaster. Further, details of post-disaster life and restoration efforts from the 1930 North Izu earthquake were also collected. As the disaster occurred 85 years ago, shortly before the start of World War II, the population of remaining survivors who could be interviewed is decreasing.
Ahead of the interviews, information was collected from literature, newspaper articles, and housing maps available at the Library in Shizuoka Prefecture. The events and social conditions at the time of the earthquake were organized into supplementary resources in preparation for the interviews. Two survivors of the earthquake from Shizuoka Prefecture were interviewed on October, 2015, one who resided in Kannami Town and the other in Nirayama Town. The interview was structured with three major questions as the focal point –First, life at the time of the earthquake and actions taken during evacuation. Second, human casualties and physical damage caused by the earthquake. Finally, support they received during the process of restoring their lives. Interviewees were asked to speak freely about their memories. In order to draw the details of the damage experienced and processes of restoration of the livelihood undertaken more accurately, first-person accounts from the interview emphasized identification of "when it happened" and "where it happened" as much as possible. The interview process was anchored by asking certain questions in a sequence, changing questions in response to the memory of the interviewee, and listening to their stories.
The survivor from Kannami was able to give accounts of events before and after the earthquake in chronological order, as well as the details of his area of residence. The survivor from Nirayama, contrastingly, could only recall memories from fragmented events. A total of ten illustrations were created based on the interview results, including: 1. life before the earthquake, 2. preparations made in anticipation of the earthquake, 3. human casualties caused by the earthquake, 4. evacuation after the earthquake, 5. housing repairs and local wreckage removal efforts.Lessons also emerged from the interview results while considering the themes and details to be drawn for the illustrations. As a result, it was revealed from the pre-earthquake efforts that there was an awareness of building damage and fire prevention from lessons learned after the Great Kanto earthquake, which occurred 7 years before the North Izu earthquake in the local area where the interviewees lived. It was also revealed that precautions and specific preparations for the earthquake were being practiced in the local area, given that earthquakes were erupting frequently prior to the North Izu earthquake.
The Kannami participant was particularly able to express pre-earthquake efforts and describe chronological events during and after the disaster, which was helpful in producing illustrations through this study. The illustrations were also able to touch upon the lessons learned at the time,

and therefore it may be worthwhile considering utilization of the illustrations as an educational resource for children, possibly in the form of a paperback story or a coloring book.

Keywords: The North Izu earthquake, interview, illustration

Application of GIS for geopark activity in Muroto UNESCO Global Geopark

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Geoparks and its significances are widely known to geological and geographical societies, but still unfamiliar to non-specialist people in Japan. Some visitors to Muroto UNESCO Global Geopark Center seem to expect a geopark to be the facility like amusement park or zoological park. The Muroto Geopark covers whole administrative area of Muroto city, and the “geopark center” is no more than a hub facility for geopark activities, including exhibition, education, scientific research, and administration. Geopark has a geographical space with a certain area and its whole image can be best illustrated by maps. Such geographical information of the geopark must be shared with geopark staffs, exhibited to the public, and always updated. It is presumably well managed with the GIS technique. In Muroto Global Geopark, the author conducts researches on coastal geomorphology, environment of wild animal habitat, tourism development, and geopark management. Field survey results will be plotted on the map together with topography, vegetation, and other National Land Numerical Information, using the GIS techniques. The GIS allows analyzing, sharing, and publishing geographical information quickly and efficiently at the every aspect of geopark activity.

Keywords: GIS, geopark activity, Muroto UNESCO Global Geopark

Teacher's licence renewing class using geoparks - A case study of Hakusan Tedorigawa Japanese Geopark -

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Recently geoparks are established in various places of Japan, and various educational activities are carried out in each geoparks. Teachers are in the forefront of the educational activities using geoparks in each area. Training programs on geoparks for teachers are carried out in various styles. Teacher's licence renewing class is one of those programs.
In Hakusan Tedorigawa Japanese Geopark, we are carrying out a teacher's licence renewing class jointly organized with the Seismological Society of Japan and the Hakusan Tedorigawa Geopark Promotion Council since 2014. Under the theme of natural disaster learning in geoparks, we visit the geo-sites in an excursion style. We explain the constitution of the earth, factors of the natural disaster seen there, and the past cases of disaster and disaster prevention. Moreover, in the class, we are considering about the science education, geography education and disaster prevention education using geoparks.
In this presentation, we will report about the class and discuss the effectiveness of using geoparks based on the results of the questionnaire. From the results, we found the following points. The local teachers were able to get a new point of view about disaster prevention from the everyday landscape. The teachers from outside the area were able to experience the relations between the disaster and the living of people, from the typical and understandable landscape.

Keywords: Geopark, Teacher's licence renewing class, Education, Disaster prevention, Field work

Workshop of Making Personal Evacuation Map

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The west part of Izu peninsula has often hit by huge tsunamis caused by Suruga trough. And this area is expected to be hit by 5m to 7m-high tsunami in near future again. The inhabitants living here must find the way to escape from the disaster. The members of Nishiizu volunteer coordinator group have tried to find how to evacuate from the disasters such as tsunami and avalanche and keeping the inhabitants mind highly motivated for disaster. We have performed the workshops walking around the town 6 times and analyzed the result of the questionnaires.
1. An avalanche occurred in this area in July 2013 and the group members managed the volunteer center. This experience made the members eager to help the inhabitants from the disasters.
2. We divided Nishiizu area into seven small areas because each area is expected to be isolated when the disaster occur.
3. The participants including junior high students walked around the town together in a small group watching and checking the safeties of the evacuation road, and checked evacuation time. They tried to find the shortest way to evacuate and tried to find the alternatives.
4. The map was made by Airbone LiDAR elevation data. A map of Ansei Tsunami flooded area was show behind the room.
5. They put the data into a large map after walking.
6. The data will be put into the government GIS map.
7. At the end of the workshops we asked them questions and analyzed 281 questionnaires.

Keywords: Geopark, Disaster, Questionnaire survey

Prospective customer study of Sanriku Geopark using the Sanriku railway.

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The Sanriku Geopark was authorized in the Japan Geopark Network (JGN) in September, 2013. The expectation of the local to the sustainable regional activation by the Sanriku Geopark is increased.However,the increase of the visitors by the Sanriku Geopark is not recognized after the authorized.
Itoh,et.al(2015) suggested the Sunriku railway as a one of important factor to symbolize Sanriku Coast, and they also suggested that the several visiters using the Sanriku railway. In order to regional activate by the Geopark activities, it is necessary to know the transportation in the Sanriku area,such as the starting point and terminal of the vistors, and the image of the Sanriku railway. Internet questionnaire is useful such issues. The authors studied the regional activation strategy using Sanriku railway based on the Internet questionnaire.
At the results, the majority porpuse of the visiting to Sanriku area is “to get a train” “gourmets” and “to see the magnificent nature”. And the majority respondents choosing Kuji as the gate city,and the Miyako as the terminal for the sightseeing tour. The respondents have the image of the Sanriku railway as “beautiful coastline”,”tsunami disaster”and TV drama of “Ama-chan”. Based on a principal component analysis(PCA) employing variance-covariance matrices reveals that tourists are basically seeking “nostalgia” and “healing” experience. Based on these quietionnaire data, it is necessary to make a strategy for conrete tourist increaseing.

Keywords: Sanriku Geopark, Sanriku railway, tourism

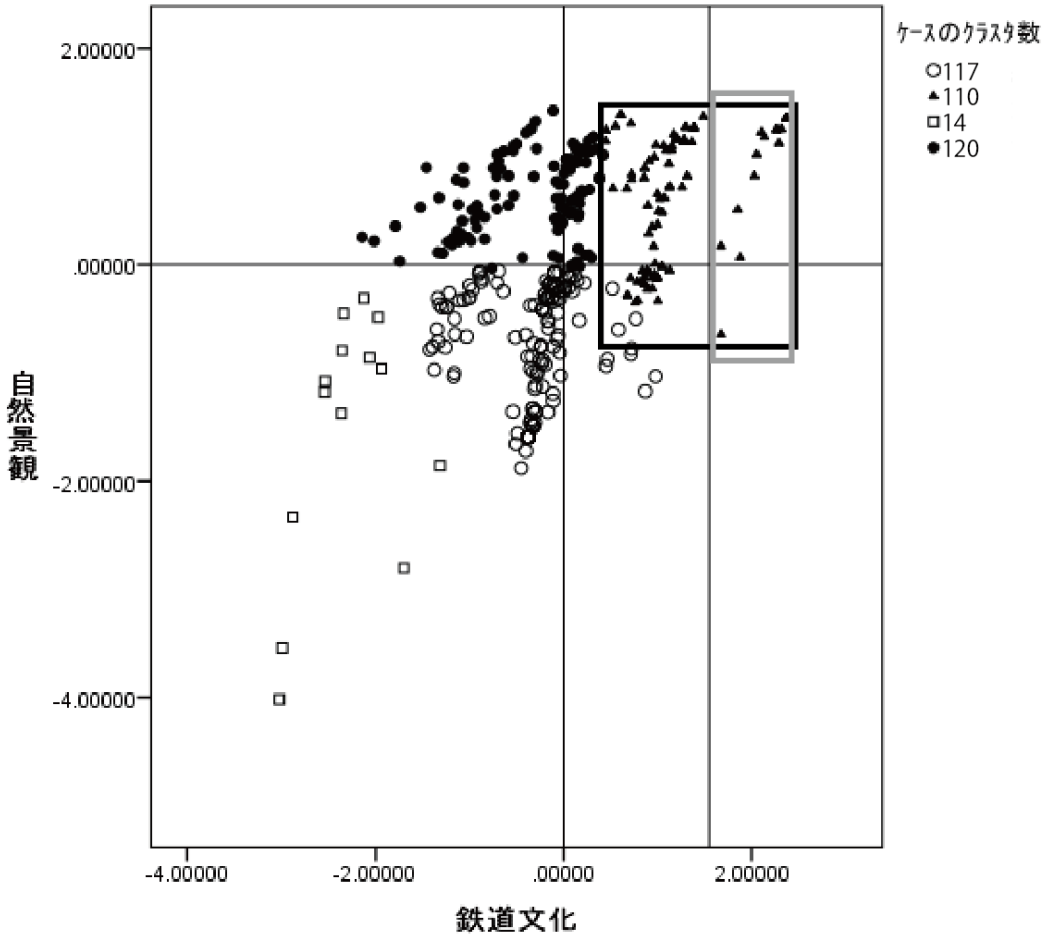

図 1 「三陸鉄道のイメージ」を変数とした場合のクラスター分析結果

