A. Identification of the Area 01
A-1. Name of the proposed Geopark 01
A-2. Surface area, physical and human geography characteristics of the proposed Geopark 01
A-3. Organization in Charge and Management Structure 07
A-4. Application Contact Person 10

B. Geological Heritage 11
B-1. Location of the proposed Geopark 11
B-2. General Geological Description of the proposed Geopark 11
B-3. Listing and description of the Geological Sites within the proposed Geopark 26
B-4. Details on the interest of these sites in terms of their international, national, regional or local value 32

C. Geoconservation 33
C-1. Current or potential pressure on the proposed Geopark 33
C-2. Current status in terms of protection of geological sites within the proposed Geopark 33
C-3. Data on the management and maintenance of these sites 33
C-4. Listing and description of non-geological sites and how they are integrated into the proposed Geopark 33

D. Economic Activity & Business Plan 34
D-1. Economic activity in the proposed Geopark 34
D-2. Existing and planned facilities for the proposed Geopark 34
D-3. Analysis of geotourism potential of the proposed Geopark 35
D-4. Overview and policies for the sustainable development of geo-tourism, geo-education and geo-heritage 36
D-5. Policies for, and examples of, community empowerment in the proposed Geopark 36
D-6. Policies for, and examples of, public and stakeholder awareness in the proposed Geopark 37

E. Interest and arguments for joining the GGN 39

Appendix 42
1. References 42
2. Geosite List 43
3. Geosite Map 46
A. Identification of the Area

A-1. Name of the proposed Geopark

The main theme of the Oki Islands Geopark is the majestic landscape created by a combination of impressive land formations, unique ecosystem, lifestyle and culture in the remote Oki Islands in the Sea of Japan.

The Oki Islands are located in the Sea of Japan, the world’s newest marginal sea (Figure A-1). The flora and fauna that make up the natural landscape of these islands is truly special. The influx of sub-boreal (subalpine) zone vegetation that occurred during the coldest stage of the last ice age can still be seen today, mingled with warm-temperate (basal) zone vegetation. This unique ecosystem is linked not only to environmental elements such as terrain and climate, but also to the origin of these islands and their geology.

The foundation for this diverse vegetation is the geology of the land. The basement of the Oki Islands is a fragment of the Eurasian Continent, left behind during the formation of the marginal sea, and later overprinted by violent volcanic activity. This process and combination of activity is unusual throughout the world. Oki basement gneisses contain evidence of their continental origin, and the extensive alkali volcanic rocks present, extremely rare elsewhere in the Japanese arc, record the evolutionary history of these islands. Coastal erosion of rock faces has created stunning scenery that features numerous sea caverns and steep cliff-lined coastlines.

The roots of Oki history and culture are deeply ingrained in the traditions and rituals held at shrines throughout the Oki Region. These traditional practices date back to the ancient times when obsidian, a product of the past volcanic activity, was an important cultural item.

Visitors to the Oki Islands Geopark can view landscapes created by a fusion of geology, geography, topography, geological history, flora, fauna, culture and history, and at the same time come to learn about “the Earth”.

The name of the region, Oki, has been incorporated into the name of this Geopark – “Oki Islands Geopark”. The word Oki is included in the name of this Geopark to embrace the historical names of the area, Oki-no-kuni (Oki District) and Oki-gun (Oki County), as well as the present geographic name, Oki-shoto (Oki Islands group). This Geopark became a member of the Japan Geoparks Network (JGN) in October 2009.

The Oki Islands Geopark Promotion Committee, a committee comprised of local government bodies, businesses and non-profit organizations based within the Oki Islands Region, are submitting this application for the Oki Islands Geopark to become a member of the Global Geoparks Network (GGN).

A-2. Surface area, physical and human geography characteristics of the proposed Geopark

A-2-1. Area of the proposed Geopark

The confines of the Oki Islands Geopark is indicated by the boundary (as indicated by the thick yellow line) on the map in Figure A-2. Aside from the land area inside this yellow line, the geopark also includes 1km of sea area from the coastline, in consideration of the importance of marine life and the fisheries industry to the way of life of the people of the Oki Islands. This geopark area is clearly marked by the yellow line in the map below and is a total of 673.5 km² (land area 346.0 km² and marine area 327.5 km²).
The geological basement of the Oki Islands is Paleogene gneiss, and subsequent volcanic activity at Miocene created two volcanic islands. The remaining volcanic topography of the Oki Islands has very different geographical and geological properties from those of the Japanese mainland and its surrounding islands.

A-2-2. Geographical Setting of the proposed Geopark

The Oki Islands Geopark is nestled alongside the Japanese archipelago, and is comprised entirely of remote islands. Oki is situated between the island arc of Japan and the Eurasian Continent, within the marginal sea represented by the Sea of Japan. The closest land mass is the western part of Honshu of mainland Japan. The nearest point on the mainland is Shimane Peninsula in the Chugoku Region, approximately 40km from Oki (Figure A-3).

Four inhabited islands and 180 smaller uninhabited islands and rocky reefs (satellite rock clusters) make up Oki. The islands all lie within a 40km north-south, east-west perimeter, and are divided into two main areas. The three inhabited islands closest to mainland Japan which form a circular shape (Nishinoshima Island, Nakanoshima Island, and Chiburijima Island) are collectively known as Dozen. The largest inhabited island is named Dogo Island (approximately 242 km²). Dogo is circular, and lies 10km north-east of the Dozen Islands.

Dozen

The three Dozen Islands have a total area of 50 km² inner sea enclosed by the islands has a maximum water depth of 55m, and is connected to the open ocean by three waterways and one canal. Nishinoshima lies on the outer perimeter of the inner sea in a west-north direction. A large peninsula (Mt. Takuhi) juts out to the south of Nishinoshima, into the center of the inner sea. With an altitude of 451.7m, Mt. Takuhi towers over the rest of the Dozen Islands. This area thus has three key elements – Mt. Takuhi, the inner sea, and the islands themselves. All of the major settlements in Dozen are located on the shoreline of the inner sea.

Dogo

Dogo is almost circular in shape, with a NE-SW dimension of 18km and a NW-SE diameter of 20km. Most of its coastline features areas of coastal erosion backed by undulating mountain districts, but few coastal plains. An expanse of flat land lies in the center of the island. The mountainous areas are separated by flat land which divides the mountains into northern, southern, eastern, and western districts. A lava plateau headland on the south-west corner of the island provides the site of the Oki Islands' only airport. Terraced geography occurs along the seashore where there is no coastal erosion, and in the central lowland.

Many settlements are located on open flat ground made from wave-cut benches cut into the steep cliffs along the coastline. Bold cliffs are located in the vicinity of these settlements. The main road which connects these settlements features more than 20 tunnels along its coastal route, which cuts through these cliffs.

A-2-3. Access

The Oki Islands can be accessed from the mainland of Japan by either sea (ferry and high-speed ferry) or air (Oki Airport).

Visitors travelling by ferry arrive at Saigo Port (Dogo Island) or at one of the ferry ports in the group of
three smaller islands (Dozen). These are Beppu Port (Nishinoshima Island), Hishiura Port (Nakanoshima Island) and Kurii Port (Chiburijima Island). The ferry service connects the four ports in Oki with Shichirigahama Port and Sakaiminato Port on the mainland.

Flights from Shimane Prefecture’s regional airport (Izumo Enmusubi Airport) and one of Japan’s major domestic airports (Itami Airport, Osaka) operate to and from Oki Airport, which is located on Dogo, the largest island.

Scheduled ferry and plane services to and from the mainland operate daily. However, bad weather during winter leads to the cancellation of a small percentage of ferries and flights.

There is no direct connection to Oki from overseas ports or airports, but access is easy. The most direct way to access Oki is by domestic transfer from international airports in Japan such as Tokyo Narita (NRT), Osaka Kansai (KIX) and Fukuoka (FUK), to either Izumo Enmusubi (IZO) Airport for air connection to Oki or to Yonago Kitaro (YJG) Airport for a ferry connection. From Yonago, passengers can transfer to either Shichirigahama Port or Sakaiminato Port and use the Oki Kisen Ferry Line to reach each of the Oki Islands. Visitors arriving at Narita or Kansai need to transfer by bus or train to domestic airports (Haneda (HND) and Itami (ITM), respectively), to fly on to Izumo or Yonago. Recent expansion of international flights at Tokyo International Airport (Haneda, HND) from Europe and Asia also provide an efficient method of transfer to Izumo and Yonago. Direct flights also operate from Incheon Airport in South Korea to Yonago (Figure A-4).

A-2-4. Transportation

Access between Oki Dozen and Oki Dogo is by ferry or high-speed ferry. A regular small vehicle ferry service and a smaller passenger ferry run between the three Dozen Islands. A water taxi service can be used to reach uninhabited islands and rocky areas, but this is by request only.

Most roads in Oki are paved, and all settlements can be reached by car. Most roads are two-lane, but there are several one-way sections, along with many narrow lanes and small unsealed side streets. Most people in Oki use their own cars, but public transport is also available in the form of a local bus network and a taxi service. Infrequent bus services and the limited number of taxis can be inconvenient, so for visitors rental cars are the best way to travel around the islands. Excluding those sites best seen from the sea or along walking tracks, all other geosites in this Geopark can be accessed by car and then on foot, within a 10 minute walk at most.

A-2-5. Social Economy

(1) Population

The current population of the Oki Islands Region is 21,657, with women outnumbering men by approximately 1000. The population has decreased in recent years, with an average decline of 1.5% per year (2010 National Census). The population of each island is illustrated in Figure A-5. Approximately half of the population (nearly 10,000 people) lives in the area around the main transport link of Saigo Port, and along the Yabi River which flows through the town center.

(2) Economic Activity

The tertiary industry sector accounts for 78.5% of the gross domestic product of the Oki Islands. The secondary industry sector makes up 13.3%, and the primary industry sector accounts for the remaining 8.2% (Oki Branch Office, Shimane Prefecture, 2011) Although the primary industry sector forms the smallest proportion,
it is actually greater than the national average (Figure A-6). The fishing industry is especially important, and numerous fishing boats can be seen at all ports in the Oki Islands.

Prior to modern times, rice was at the center of the Japanese economy (rice-based economy), and rice cultivation was extensive throughout the country. On Oki Dogo and Nakanoshima rice is cultivated on the abundant flat land. Flat land is limited on Nishinoshima and Chiburijima, and consequently rice farming is seldom carried out nowadays. Livestock farming is common on the three Dozen Islands, with farmland covering most of the islands. Legally-controlled mining of obsidian for use in traditional crafts is a small-scale industry that is indigenous to the Oki Region.

(3) Employment
The total potential labor force population of the Oki Islands Region across all industries is 11,846. At present 11,327 people are in paid employment, and 519 are listed as unemployed. This represents an unemployment level of 4.4% (National Census, 2005).

The average annual income for a working adult living in Oki is 2,253,000yen (Gross Municipal Product Population Ratio). This is slightly below the Shimane Prefecture average of 2,469,000yen (Shimane Municipal Residents’ Economic Calculation, 2008).

A-2-6. Natural Environment

(1) Landscape
The natural landscape differs greatly between Dogo and Dozen. Dogo has many natural forests, and afforestation is extensive, with many trees covering the low and rugged mountain districts. As a result, if you take a step back inland from the coast you cannot see the ocean. In contrast, few trees remain on the mountains on Dozen as a result of land clearance for farming and the ravages of pine tree death in recent years. Dozen consists of undulating mountains, so the ocean can be seen from most places across the islands.

A characteristic of the Sea of Japan that encircles the Oki Islands is its very small tidal fluctuation when compared to the Pacific Ocean. Movement of sea water between the almost closed waters of the Sea of Japan and the open waters of the Pacific Ocean is restricted, resulting in very small diurnal and annual tidal fluctuation (Figure A-7).

Most parts of the western coasts of both Dozen and Dogo feature sheer cliffs. The majority of these sea cliffs were created approximately 6Ma (Ma = Mega-annum; million years ago) from lava and pyroclastic rocks. Erosion of these cliffs has created places where the internal structure of volcanoes and pyroclastic cones can be observed. Many of these cliffs are well-known as places of natural beauty and sightseeing spots, and are used as a location for filming movies and television programs. Five locations in Oki are currently designated as sites of “National Scenic Beauty”, and all feature seaside landscapes. Four of these five sites are also listed as geological and mineralogically important “National Natural Treasures” (Table A-1). Many prefecturally-protected species are also present in this landscape.
Along the western coast of Dogo, cliffs can also be seen around settlements. These form geological boundary lines and are also ancient sea cliffs. Waterfalls can often be seen along these cliffs.

Due to its extensive and striking natural scenery, in 1963 the Oki Islands Region was included as part of the Daisen-Oki National Park. This designated park covers the coast, marine areas one kilometer from the coastline, and the mountainous area from Mt. Daimanji to Mt. Kosukubara in Dogo, but does not include the port areas (Figure A-2).

(2) Climate
Under the Köeppen Climate Classification, most of Japan is considered to have a humid temperate climate. The Oki Islands Region is no exception. In this warm humid climate there are four distinct seasons, with heavy rainfall in early summer and snow in the winter. However, snowfall in the Oki Islands Region is relatively light compared with other nearby regions. The average annual rainfall is 1750 mm; average annual temperature is 14℃, and average humidity level is 76%. The coldest month is February, with an average temperature of 3.9℃, while the warmest month is August, with a comfortable average of 25.6℃ (1971 – 2010 Average, Japan Meteorological Agency). Based on the yearly rainfall, the monthly average is more than 100 mm. The humidity level is not less than 70% in any month (Figure A-8).

(3) Wildlife and Ecosystem
The remote Oki Islands are a place where one can observe the classical patterns of the “Ecosystem of a Continental Island” alongside a unique ecosystem that has been influenced by the geology, geography, and history of the region (refer to Section B-2-1: Scientific Description of the Ecosystem). Special characteristics of a continental island ecosystem include the evolution of endemic species, absence of large animals, animal species with smaller body size than on the mainland, and the existence of “living fossils”.

Nineteen endemic flora and fauna species have been identified in the Oki Region. There are also many examples of flora and fauna which have not as yet been identified as separate species, but which have characteristics that clearly distinguish them as differing from the same species in other regions. The precise number of such species has not yet been determined.

The largest endemic Oki mammal, excluding animals kept as pets, for farming or introduced species, is the 30cm Oki-no-usagi (Oki Hare) (Figure A-9). The large animals which make up the basis of the ecosystems on mainland Honshu – the bear, wolf, wild boar, deer, monkey, fox and raccoon dog (tanuki) – are not present in the wild. However, many tanuki are present on Chiburijima Island. This population grew from two tanuki that escaped from captive breeding in 1940.

Many migratory birds pass through the isolated Oki Islands, with over 100 species confirmed in the area. The uninhabited islands and rocky reefs within Oki are the habitats and breeding grounds for many seabirds.
Overall, more than 150 species of birdlife have been observed in the Oki Islands when the resident non-migratory bird population is included.

There is an abundance of unique vegetation in the Oki Region where southern, northern, highland and lowland species are intermixed and flora from the Eurasian Continent also occurs. This combination of plant life cannot be seen in other regions. This peculiar vegetation can be seen in the natural forests and along roadsides throughout the Oki Region. The natural forest area of Oki represents 37.3% of the total forested area (Figure A-10).

Numerous species of seaweed and marine plants are abundant in the seaweed beds and sea forests along the coastline of the Oki Islands. The warm current which flows adjacent to Oki (Tsushima Current), the coastal current of the Oki Islands, and inflowing river waters combine to create warm sea water which is rich in nutrients. This rich marine fauna is the basis for the abundance of fish and seafood which inhabit the waters around Oki.

Importantly, this rich natural environment, both on land and in the sea, has not been destroyed by development. Many rare species thrive within this unspoilt environment.

(4) Natural Disasters
Natural disasters in the form of floods and subsequent landslides and mudflows represent potential problems in the Oki Islands Region, but landslide types differ between Dogo and Dozen.

Landslides on Dogo occur most often in inland areas or within river basins. This can be attributed to the river gradient and to the structure of geological layers, which may combine to cause landslides and mudflows. The most notable recent disaster was an exceptionally heavy rain event which struck Oki Dogo in 2007 (131 mm/hour), resulting in landslides, flooding and building collapse.

Few places are listed as potential landslide sites in Dozen, but one large-scale landslide occurred on Chiburijima in 1977. Slope-failure and cliff face collapse are parts of the natural coastal erosion process, with the causes of the collapse being strongly related to the local geology, physical setting and environment of the land, slopes, and cliffs.

No potentially earthquake-generating active fault lines have been identified in the Oki Islands Region, and there has been no observation made or evidence recorded in ancient documents of a large earthquake causing death. However, there is evidence of damage from a tsunami which was caused by the 1983 Middle Japan Sea Earthquake centered in the Sea of Japan, some 700km north of Oki (Tsuji, 1988).

A-2-7. Cultural and Historical Records

(1) Historical Property
It is believed that people began to settle in the Oki Region 30,000 years ago. Oki appears as an important location in the *Kojiki* and *Nihon-shoki*, Japan’s oldest literary documents. Based on these creation myths, Oki appears as to have been the third or fifth area created in Japan. Since ancient times, the region was considered by central government to have been of vital importance. Oki has helped to spin history within the region, acting as a gateway to the nearby populated regions of Izumo and Yonago, former capital cities (Nara, Kyoto), and to overseas.

(2) Culture and Customs
One of the special characteristics that distinguish the remote Oki Islands is the deep sense of community that prevails. Activities such as neighborhood clean-ups and beautification and management of communal spaces are conducted jointly by the local residents. At ceremonial occasions such as the coming of age, marriages,
funerals and ancestral worship, close neighbors often assist with proceedings. This community spirit stems from ancient rituals.

Within each area, many people have the same family name. It is very common for people to be referred to by the name of the family unit in which they live (yago). Most people have many relatives (yauchi), and as such, who someone’s relatives are, whose friend is who, and who that person is related to come to be common knowledge. This forms part of daily conversation, just like making small talk about the weather.

Most traditional festivals in Oki follow in the style of Shinto religion. However, people who follow other religions are not excluded from these rituals. These festivals are considered to be a “Community Event”. Compared with other areas of Japan, Oki has many more shrines and fewer temples.

Japanese sake (Nihon-shu) is always produced at festival rituals or on auspicious occasions. For local residents, sake is not just a drink, it is a sacred beverage used to purify oneself and also a way to encourage conversation among local residents. Sake is offered and consumed at regional festivals, community gatherings and on many other occasions.

The abundance of fish and seafood is a special feature of local cuisine. The active fishing industry in the region supports the livelihoods of many people, producing a plentiful supply of fresh seafood that forms part of the daily diet for the islanders. Enjoying a feast of fish and seafood in Oki is one of the things travelers look forward to the most.

(3) Cultural Heritage

Many cultural artifacts remain in the Oki Islands. The eki-rei is one example of a remaining cultural artifact. The eki-rei was a special bell that was distributed to designated officials by the central government across Japan in ancient times. It was used to identify government officials who could then exercise imperial power. The only remaining eki-rei, a historically “Important National Cultural Property”, is on display in the Oki-ke Homotsu-den (Oki Family Heirloom Museum).

A wide variety of Oki cultural traditions known as “Intangible Cultural Heritage” (rituals, traditional performing arts, arts and crafts) stretch across many time periods, and have been handed down through the generations.

(4) Cultural Ruins

Cultural ruins dating from the Paleolithic Period to the 20th century can be found within the Oki Islands Region (Table A-2). Some of the oldest ruins include an obsidian mining and processing site, which are believed to be from the Paleolithic Period (first migration of people into the Japan archipelago ~16,500 years ago). There are also many large kofun (tumulus for people in positions of authority) in Oki dating back to the Yayoi Period (mid-3rd century to late 7th century).

Table A-2. Ruin Sites in the Oki Islands

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<th>Shintō</th>
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A-3. Organization in Charge and Management Structure

A-3-1. Oki Islands Geopark Promotion Committee

Geopark related activities are being carried out under the leadership of the Oki Islands Geopark Promotion Committee. The main tasks of this committee can be divided into four:

1) Plan: Planning and policy-making related to the operation of the Geopark;
2) Do: Undertake tasks related to the operation and development of the Geopark;
3) Check: Summarize Geopark activities, understand the current situation, and identify any problem areas;
4) Action: If there is a problem, meet to discuss measures to formulate a solution.
The Oki Islands Geopark Promotion Committee is drawn from 43 representative groups including municipal governments, municipal assemblies, business groups, tourism groups, and educational facilities. Within this committee, there are four subgroups: General Committee, Administrative Board, Head Office and a Working Committee (Figure A-11).

As a rule, the general committee meeting will be held once a year, when representatives from all of the relevant member groups meet to negotiate and approve budgetary and planning matters. Only executives attend the administrative board meeting to make decisions regarding the general business plan. The head office is responsible for the Oki Islands Geopark Promotion Committee, and is the contact point and program planning area of the Oki Islands Geopark Project. The working committee deals with issues in separate areas, forms groups relevant to the various issues, holds discussions with the head office, and puts these plans into effect.

There are three working committee groups: Investigation and Research Group, Planning and Public Relations Group, and the Human Resource Development Group. Each group has a specified role:
1) Investigation and Research: Investigation and research of regional resources, promotion of protection and conservation activities;
2) Planning and Public Relations: Public relations, event planning, and product development;
3) Human Resource Development: Guide training, guide system development, hosting lectures and workshops, connecting to local school education programs.

A-3-2. Head Office Structure

The main Geopark office is housed in the Shimane Prefecture Government Oki Branch Office Building, with staff allocated to the office for the promotion of the Oki Islands Geopark Project. As of October 2011, five staff members are employed in this office, one from Okinoshima Town, one from Nishinoshima Town, two from Shimane Prefecture, and one specialist contracted employee who is a graduate in paleontology. A foreign (English) language specialist will be employed from January 2012.

A-3-3. Oki Islands Geopark Promotion Committee Support System

The committee receives support from external groups and academic specialists.

(1) Academic Support
The committee is supported by academic organizations and specialists. In the field of geology, 15 lecturers from the Department of Geoscience of Shimane University, members of the Chugoku Geotechnical Consultants Association (Shimane Branch) and the Geological Society of Shimane provide their expert knowledge to Geopark activities. In the field of ecology, biologists from Kyoto Prefectural University, Kwansei Gakuin University, University of Nagasaki, Misaki Marine Biological Station – The University of Tokyo, and Forestry and Forest Products Research Institute are supporting the Geopark. Humanities experts from Hiroshima
University and Kwansei Gakuin University also support this Geopark in the fields of history and culture. Tourism experts from the University of Nagasaki are advising us on the beneficial outcomes of eco-tourism and geo-tourism (Table A-3).

(2) Corporate Support
A tie-up with AEON Group, a national major distribution company, was approved and confirmed in 2009. An electronic money card (WAON Card) was created from this, containing a contribution system for consumers (Figure A-12). In this system, electronic money which is either purchased or installed onto the card can be used by shoppers at AEON Group stores around Japan. A small percentage of this forms a deposit which is then gifted from the AEON Group to the Oki Islands Geopark Promotion Committee at the end of the year. The AEON Group travel agency (JUSVEL) is also marketing “Geo-Tour” packages as part of its travel product range.

(3) Other Support
In September 2011 the Oki Islands Geopark Strategic Committee was launched to look directly at support systems for this Geopark. The main focus point for this committee is the enhancement of the paid guide system, and the foundation of a guide society which will form the base of the guide system. The main objective of this “New Public Management System” is to link the Oki Islands Geopark and business interests. The strategic committee is currently working alongside the Human Resource Development Group to establish a guide training system.

(4) Collaboration with Other Independent Groups
Many groups are involved in activities related to the conservation and utilization of regional resources, but are not formally attached to the promotion committee.

A rental car company in Okinoshima Town has already remodeled and converted a gasoline-driven vehicle into an electric-powered vehicle.

In recent years, the slump in the price of wood and a shortage of forestry workers has left many forested areas in Dogo abandoned. An industrial project currently under development aims to effectively utilize timber in Okinoshima Town. Wood thinned from trees is broken down into lignin and cellulose, with the lignin being used as a plastic substitute, and the cellulose utilized as an electricity-producing fuel. Tree thinning is necessary for the forested areas to be conserved. By using the thinned timber in a beneficial way, tree thinning activities can be further promoted.

Many volunteer initiatives are arising from this Geopark movement. Examples include clean-up activities by
community volunteers in the natural parklands, and research by high school students into the endemic and introduced herbaceous species in Oki.

These activities share a common goal of conserving, protecting, and utilizing regional resources in the area of industrialization. The Oki Islands Geopark Promotion Committee intends to work positively towards furthering these initiatives.

A-3-4. Budget and Finance

The Oki Islands Geopark Promotion Committee has an independent budget and financial management system. Most of the committee’s income is direct funding from the local governments of Shimane Prefecture, Okinoshima Town, Nishinoshima Town, Ama Town and Chibu Village. The promotion committee budget is set aside for matters relating to committee operation, developing knowledgeable citizens (campaigns, dispatch of guest lecturers to seminars, guide training workshops), and information available via the internet, homepage, and other methods.

At a local level, each town and village is responsible for the construction of information signboards based on guidelines given by the promotion committee.

The Ministry of the Environment and Shimane Prefecture are responsible for the national park areas, and Shimane Prefecture is responsible for national and prefectural roads. Each will invest time and money into the construction of signage (road signs) based on discussions with the Geopark promotion committee.

From 2011 and onwards, the four municipal governments of Oki and the Shimane Prefectural government will continue to give their support to ensure the continual development of the Oki Islands Geopark Project.

A-4. Application Contact Person

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B. Geological Heritage

B-1. Location of the proposed Geopark

The south-west corner of the Oki region is located at latitude 36°N and longitude 133°E. The ocean topography around the Oki Islands can be divided into three parts:

1) A shallow channel (Oki Channel) extends south to Shimane Peninsula. The channel has a maximum depth of 70 m.
2) To the east and west of the islands the seabed slopes gently away some 30 – 50 km offshore, reaching a depth of 300 m, which then suddenly increases to a depth of 1000 m.
3) A 300 – 500 m shallow extends some 140 km to the north of the Oki Islands, dividing the Sea of Japan into eastern and western parts (Figure B-1).

The Oki Islands Geopark features a unique ecosystem that incorporates relics from the last ice age, and a geological record from the time when the area was part of the Eurasian Continent through to when it became isolated islands. It is also a place where visitors can experience the diverse history and culture of each settlement within Oki.

The characteristics of the Oki Islands Geopark can be summarized thus:

1) The land within the region and the environment based thereon is highly diversified;
2) The isolated island environment limits external influences;
3) Physical isolation makes it easier for ancient customs and features to be protected in other areas;
4) Observation be made in this small region and links between elements can be understood.

These characteristics are notable in the relationships between the ecosystem, history, and terrain, as well as the relationship between culture, geography and terrain.

B-2. General Geological Description of the proposed Geopark

The Japanese archipelago is a mobile belt that forms part of the circum-Pacific orogenic zone. Volcanism is a characteristic form of geological activity in the belts, and can be observed in Japan in both the Unzen Volcanic Area Global Geopark and Toya-Usu Global Geopark. Muroto Geopark focuses on the characteristic geological activity of subduction belts, where the record of the accretionary prism formed by Pacific Plate subduction can be observed. The Itoigawa Global Geopark and the San’in Kaigan Geopark are Geoparks which exhibit the core history of the formation of the Japanese islands as a mobile belt. These Geoparks feature landscapes that record the earlier geological history of Japan, including tectonic lines, contrasting geology, and geography.

In contrast to the above Geoparks, the Oki Islands Geopark combines the characteristics of Japan as a mobile belt, with the geology of the stable landmass of the Eurasian Continent. A characteristic of the Oki Islands Geopark is thus the overall view of the land, ecosystem, and the lifestyle of humankind, woven together against the background of
unusual geological elements in an ancient volcanic island positioned in the marginal sea between the continent and island arc.

Japan is surrounded by continental plate of the Eurasian and North American Plates, and oceanic plate of the Pacific and Philippine Sea Plates. Subduction of the Pacific Plate occurs from the Japan Trench toward the North American Plate, whereas subduction of the Philippine Sea Plate occurs from the Nankai Trough toward the Eurasian Plate (Figure B-3). Due to this subduction, vigorous seismic and volcanic activity occurs along much of the Japan island arc (Figure B-4). Despite these conditions, earthquakes rarely occur near the Oki Islands, and no active volcanoes are present. The Oki Region is thus geologically stable compared to the rest of Japan.

Japan is located on the eastern margin of the Eurasian Continent, separated by the Sea of Japan. The backbone of Japan is part of the Eurasian Continent that was separated from the continental mass roughly 20 Ma (Ma = Mega-annum; million years ago), moving to the south east, and taking its current position around 15 Ma (Otofuji and Matsuda, 1984, 1987; Tamaki, 1988).

The Japanese islands are currently composed of sedimentary and high pressure metamorphic rocks that formed in accretionary prisms and subduction zones, and also by granites that intrude these subduction complexes. However, high temperature metamorphic rocks formed by deep burial 250 Ma are distributed in the Hida-Oki Belt, which is positioned closest to the Sea of Japan in mainland Japan (Figure B-5). The protoliths of these gneissic metamorphic rocks include limestone and per-aluminous mudstone, and there is confirmed activity of bimodal (rhyolitic and basaltic) alkali volcanic rocks. These features are characteristic of sediments on the continental shelf or rift zone. Hida-Oki Belt rocks occurring as the basement in the Oki Islands thus formed part of the eastern margin of the Eurasian Continent prior to opening of the Sea of Japan.

The topography of the sea floor of the Sea of Japan also provides a record of the formation of the marginal sea in the back-arc basin. Elevated topography can be seen in the Yamato and Oki Banks, in contrast to the flat basin extending over most of the Sea of Japan. This elevated topography is thought to be cratonic crust that was part of the Eurasian Continent prior to the formation of the Sea of Japan, whereas the flat basin floor is new oceanic crust formed during the expansion of the Sea of Japan.

The Oki Islands are therefore a geologically precious region, in which the last remaining segment of the Eurasian Continent left during the formation of the Sea of Japan now stands as isolated islands (Figure B-6).

Although no deep drill holes have been put down in the Oki Islands, the composition of the crust beneath them can be determined from xenoliths included within alkali basalts from Oku, Nakamura and Kuroshima Island in Dogo (Takahashi, 1975; Aoki, 1977; Takahashi, 1978). In addition to ultrabasic and basic xenoliths such as spinel lherzolite, peridotite, pyroxenite and olivine gabbro, felsic xenoliths such as granitic and...
gneissic rocks are also present. Spinel lherzolite is stable at pressures of 7kb or more, equivalent to a depth of 25 km or more beneath the Earth's surface. The spinel lherzolite present beneath Dogo thus represents the very top of the underlying mantle. Peridotite and pyroxene are thought to have been derived from a layered ultramafic body near the Mohorovičić discontinuity. Olivine gabbro is a constituent of the lower crust, whereas gneisses and granitoids are components of the upper crust. The Dogo alkali basalts thus contain xenoliths drawn from the very top of the mantle through to the upper crust.

Expansion of the Sea of Japan was complete roughly 15 Ma, leaving the Oki Islands as an isolated continental fragment “floating” in the Sea of Japan. About 7 Ma, vigorous magmatic activity began in the Dogo and Dozen. Volcanic activity in Dozen was primarily basaltic, whereas that in Dogo was rhyolitic to trachytic. In both Dogo and Dozen, the magma causing the volcanic activity was alkalic. The Dozen Volcano formed about 6 Ma, leaving a geographical footprint in the form of a volcanic caldera. Primarily alkali basaltic volcanic activity began in Dogo 5 Ma, and small scale-volcanic activity was repeated through

Figure B-6. Distribution of Continental Blocks in the Sea of Japan Area (Tamaki, 1988)

Figure B-7. Geological Map of the Oki Islands
five periods up until about 0.4 Ma. No volcanic activity occurred in the Oki Islands after this phase ended.

The last ice age began about 70,000 years ago, and ended 10,000 years ago. It reached its coldest roughly 20,000 years ago (MIS2: Marine Isotope Stage 2). The surface of the Sea of Japan was then approximately 130 m lower than it is today. As a result, the Oki Islands became connected by land to the mainland Japan, and were positioned at the tip of a peninsula that stretched northward from the present-day Shimane Peninsula. Incursion of flora and fauna became easier due to this land connection. However, the end of the ice age caused the sea to rise. Oki once again became a distant island group, isolating the invading flora and fauna there. A unique ecosystem can be observed in the Oki Islands today, and this is thought to have been formed by the climatic change and geographical transformations between ice ages.

The geological history of Oki can be divided into four stages (Figure B-7):
1) Continental Period (Stage One): up to 26 Ma;
2) Sea of Japan Formation Period (Stage Two): from 26 to 10 Ma;
3) Volcanic land Period (Stage Three): from 10 Ma to 70,000 years ago;
4) Peninsula to Isolated Islands (Stage Four): 70,000 years ago to today.

B-2-1. Scientific Description of the Ecosystem

The geo-heritage of Oki includes the flora, fauna and ecosystem of these islands. This region is not only a good example of a remote island ecosystem, it is also a place where one can discover this concept and come to understand about the world which we live in.

The Oki Region is counted as a biodiversity hotspot in Japan (Myers et al., 2000). The biodiversity of Japan, with approximately 130 endemic land vertebrate species (excluding birds), is based on the diversity of landforms and the environment as a mobile belt, or in other words on its geology. The Japanese islands span subarctic to subtropical zones in their 3000km north-south stretch, and 70% of the area of the roughly 7,000 islands forming the country are mountainous.

The ecosystem of Japan is linked to its environmental history. One element that is distinctive of Japan is koyo (mountains covered with seasonally colored foliage). These deciduous broad-leaved trees which were abundant before the ice age create the koyo seen in Japan in the autumn. In other mid-latitude regions of the world, these deciduous broad-leaved trees were reduced in range during the coldest time of the ice age, but due to the warm currents around Japan, the coastal areas were kept warm, allowing many deciduous broad-leaved tree species to remain.

Furthermore, the history of the formation of Japan contributes to the background behind the plethora of endemic species. As stated above, from roughly 20 Ma the flora and fauna of Japan became geographically isolated from the Eurasian Continent by formation of the Sea of Japan, beginning their path toward becoming endemic species.

The characteristics of such an ecosystem can be explained by the island ecosystem formation mechanism described in the Theory of Island Biogeography (1967) by MacArthur and Wilson.

![Southern Plants Nagoran](image1)
![Alpine Plants Giant Iwakagami](image2)
![Northern Plants Dogtooth Violet](image3)
![Continental Plants Darumagiku](image4)

Figure B-8. Particular Plants of the Oki Islands

The ecosystem of this region has unique characteristics that allow for interpretation as an island ecosystem, but there are also factors for which that explanation is inadequate. These factors have combined to create an ecosystem that is a condensed version of that which evolved in Japan as a whole.
Vegetation coexists on the Oki Islands from subtropical environments (Nagoran) and sub-boreal environments (Giant iwakagami) (Sugimura, 1994) (Figure B-8). Some organisms evolved from migrant to endemic species in a very short time (within 3 million years). Among the distributions within the islands, there are those which are clearly related to the terrain (see Section B-3-4) (IV B-11, 15; From here onwards, geosites will be listed similarly).

The ecosystem of the ocean is also important for the Oki Islands. Numerous varieties of seaweed and sea grass flourish in the seas around the Oki Islands, and many molluscs and fish that feed on them. The algae, molluscs and fish have long been used as fishery resources.

(1) Unique Flora composed of Relic Species

Vegetation is the easiest biological characteristic to observe in the region. The first point of notice is the high diversity of “mountain green color” on the mountains untouched by forestry (this can be seen from a distance). In Oki, the evergreen broad-leaved trees, deciduous broad-leaved trees, and conifers that are normally clearly delineated into separate bands based on climatic conditions are mixed together. The vegetation in Oki is an exception to the lateral and vertical distribution of normal forests in Japan (Figure B-9). Another characteristic is that there are many plants in common with the Eurasian Continent (IV B-1, 5).

Varieties from sub-boreal (subalpine) zones can be found at sea level at the same locations as warm-temperate (basal) zone varieties (low altitude zones) (IV B-4, 11, 12, 13). This area also serves as the southern limit for some northern varieties, as well as the northern limit for southern varieties (Figure B-10).

No research has yet been done to clarify this unique distribution, but several causes can be proposed.

The first relates to the history of the Oki Islands. Varieties introduced during the last ice age, when the region was a peninsula, remained on Oki as the islands became isolated sea level rise associated with warmer climate. Varieties that are primarily distributed in cool-temperate (montane) zones thus became established on Oki. Today, no area in Oki has an altitude that qualifies as a montane zone (700-1700m). A similar case can be seen in Tsushima further to the south (Figure B-11), but the trend is stronger on Oki.

Secondly, the current climate of Oki is also a contributing factor. Although precipitation is roughly the same as in Honshu, fog often occurs, making it a very humid environment. There are certain places in Oki where fog occurs, and cool-temperate vegetation (IVB-15) can be seen.
Recent studies of sugi (*Cryptomeria japonica*, sometimes called Japanese cedar in English, although it is not related to cedar), it is likely that this region was a “refugium” during the last ice age (Takahara et al., 2010). Sugi is an evergreen needle-leaved tree endemic to Japan, which has long been used as a construction material. Much of Japan is now covered in sugi forests.

Three varieties of sugi occur: *omote-sugi*, which is distributed on the Pacific Ocean side; *ura-sugi* on the Sea of Japan side; and *yaku-sugi* which is found in the Kyushu Region. The variety found on Oki is the *ura-sugi*, but it has primitive characteristics when compared to other locations.

It is thought that sugi, unable to survive in sub-boreal conditions, survived in this warm region during the Oki Peninsula stage as it lost its habitat during the last ice age. When the climate later warmed, it spread throughout Honshu. Data from DNA and pollen is beginning to back up this theory (Takahashi, et al., 2010).

Massive trees of this variety are found on Dogo. The leading three examples are called “The Three Giant Japanese Cedar Trees of Dogo” and each can be seen along the roadside (Figure B-12; IV B-9, 15, IV F-8).

(2) Regional Fauna
The leading characteristics of the fauna of Oki are the endemic species and the unique regional population. The Oki Salamander (*Hynobius okiensis*) is a particularly interesting endemic species, and is found only on Dogo Island (IVB-7). The *Hynobius* genus of the Asiatic Salamander family, a primitive amphibian, is widely distributed in central Asia, with 31 varieties found in East Asia, of which 17 are found in Japan (Li, et al., 2011). Japan’s Asiatic Salamanders are roughly divided into lotic and lentic types, based on biology and morphology. However, the characteristics of the Oki variety exhibit mixed biology and morphology. Furthermore, DNA analysis of the Oki Salamander has established that it is positioned in the lentic line which descended from the lotic ancestor group (Matsui et al., 2007) suggesting that changes in terrain and environment caused the evolution of this species. The range of this species is limited to Dogo. As it is biologically unique, the region is one of 587 chosen by the Alliance for Zero Extinction as important for environmental protection, and home to a rare species (AZE, 2010DL).

Many endemic species and subspecies are known in addition to the Oki Salamander (Table B-1). This shows that migration and genetic isolation occurred after the Oki Strait became a shallow sea from the Pliocene.
onward, ending in complete isolation with the formation of the Oki Strait roughly 10,000 years ago. Among the species is the dormouse *Glirulus japonicus*, which is endemic to Japan (Figure A-9). This species is the only one of Gliridae family intermittently distributed throughout Japan, and is the only species in the *Glirulus* genus. Dogo is the only isolated island where it is found. This species hibernates during winter, and is well known for lowering its body temperature to several degrees Centigrade during that time. Based on DNA analysis from a survey in 2011, it was reported in newspapers and on television that the genotype of this species and that of Honshu split from each other more than 1.3 Ma. Further research is needed.

### (3) Abundant Marine Organisms

An ecosystem reflecting the terrain and geological characteristics of the Sea of Japan can be observed around the Oki Islands.

The Sea of Japan became a marginal sea by intrusion of seawater roughly 20 Ma (refer to Section B-2-2(2): Sea of Japan Formation Period). The formation process created several distinct characteristics. The Sea of Japan is the youngest marginal sea in the world, the straits connecting it to the Pacific Ocean are shallow, and the average depth is far shallower than that of the Pacific. Consequently, sea surface changes due to tides are limited, and a stable body of cold water is present below a depth of 300m (Figure A-7).

The marine ecosystem that reflects these characteristics bears little similarity to that of the Pacific Ocean from the mesopelagic level and deeper (a depth of 200m or more), and few species inhabit the intertidal zone. Another characteristic is that species that prefer warm water have a range further to the north in the Sea of Japan than they do on the Pacific coast.

Although the biodiversity of the Sea of Japan is less than on the Pacific Ocean side, an arm of the Kuroshio Current flowing from the Pacific reaches the Oki area, creating a favorable environment for abundant seaweeds and sea grasses. Furthermore, the average monthly water temperature does not fall below 10℃ in winter, and thus many warm water species are present.

The sea area facing the open ocean surrounding Oki is very clear (20 m visibility). Fish from warmer climates can be observed (Shimane Prefecture, 1973) and several luminescent organisms can also be found here (Figure B-14).

### B-2-2. Scientific Description of Geology

#### (1) Continental Period (Stage One)

The basement of the Oki Islands is composed mainly of gneisses known as the Oki metamorphic rocks (I-1, 2, and 3). These metamorphic rocks were once located along the eastern margin of the Eurasian Continent before the formation of the Sea of Japan. The Oki metamorphic rocks are distributed in a more or less circular area roughly 8 km in radius, centered around Mt. Tsuzurao, and flanked by Miocene strata in the northeast of Dogo. The metamorphic rocks show a domal structure declining from the center toward the outer edge. These metamorphic rocks exist over a wide area as the basement of the Oki Islands and the surrounding sea, as shown by geophysical studies (Honza, 1978).

The metamorphic history of the Oki metamorphic rocks is very similar to that of the Hida metamorphic complex distributed in mainland Japan, and it is thought that they originally formed a single Hida-Oki Metamorphic Belt. On the Eurasian Continent, granite and gneiss aged at 3.8 billion (3800 Ma) years have been reported from the Sino-Korean Craton (North China Craton) with granites from 2000 to 1700 Ma most common (Liu...)

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<th>Taxa</th>
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<th>Endemic Subspecies</th>
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<td>2</td>
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<tr>
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<td>1</td>
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<td>Ferns</td>
<td>0</td>
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Table B-1. Endemic Species & Endemic Subspecies in the Oki Islands
et al., 1992); the similarity with detritus zircon from the Hida-Oki Belt is strong. The Yangtze Craton (South China Craton) in the south of the Sino-Korean Craton is mainly formed of rocks less than 1 billion (1000 Ma) years in age. Consequently, before the formation of the Sea of Japan the Hida-Oki Belt comprised a geological body on the eastern edge of the Sino-Korean Craton, and formed the eastern part of the Eurasian Continent (Figure B-15).

The Oki metamorphic rocks comprise pelitic and migmatitic gneisses, gneissose granites, amphibolites, and a small volume of calcic and siliceous gneisses (I-3). Migmatitic gneiss consisting of mixtures of pelitic gneiss and gneissose granite is extensively distributed, at scales from hand-specimen size to the geological survey level. This suggests partial melting in the Oki metamorphic rocks during the pro-grade heating, forming granitic melt. This partial melt and gneissic rocks were then mixed to form the most common rock facies of migmatite gneiss.

Low-grade Oki metamorphic rocks feature Miyashiro's (1961) andalusite-sillimanite facies series. The presence of both orthopyroxene and clinopyroxene has been confirmed in some amphibolites, and it is believed that at least part of the Oki metamorphic rocks reached granulite facies peak metamorphism (Hoshino, 1979). Hamada et al. (1996) suggest the peak metamorphic conditions of 750-820 °C and the pressure exceeded 4 kb, equivalent to the depth more than 15 km (Figure B-16).

Detritus zircons of primary igneous origin which formed part of the original sedimentary protolith occur in the pelitic gneiss. Some of these zircons are spherical (Figure B-17). U-Pb SIMS ages and SHRIMP single-crystal ages of the detritus zircons in the pelitic gneiss range from 2.4 billion (2400 Ma) and 1.7 billion (1700 Ma) years (Tsunogae, 1995; Tsutsumi et al., 2006). Furthermore, CHIME ages of the detritus zircon stretch from 3 billion years (3000 Ma) to 350 Ma (Suzuki and Adachi, 1994). From this, sedimentary deposition of the pelitic gneiss dates from 350 Ma or older, and the igneous rock in the source area of the sediments formed between 3000 Ma and 350 Ma.

The peak metamorphic age of the Oki metamorphic rocks is thought to be 240 and 250 Ma, based on monazite CHIME and zircon SHRIMP ages (Suzuki and Adachi, 1994; Tsutsumi et al., 2006). The cooling period was estimated using 40Ar/39Ar, Rb-Sr, and fission track methods, defining the cooling path shown in Figure. B-18. Extrapolating from this cooling curve, ascent of the Oki metamorphic rocks to the surface was complete at about 50 Ma.

Granite (Dogo-Minamidani Granite) intruded the Oki metamorphic rocks. Fission track ages of zircons within the granite range from 53 and 42 Ma (Ohira and Tsutsui, 2000). The fission tracks of all zircon grains show about 10% of reduction of their length, so it is possible that the estimate of the cooling period (240°C) of the granite may be older (Ohira and Tsutsui, 2000).
The oldest strata that directly overlie the Oki metamorphic rocks are the Oligocene to lower Miocene described below. At least part of the Oki metamorphic rocks were therefore exposed at the surface from the end of the Oligocene epoch to the early Miocene.

(2) Sea of Japan Formation Period (Stage Two)

Expansion of the Sea of Japan at the end of the lower Miocene was a key event in determining the distinctiveness of the Oki Islands in the Sea of Japan as isolated islands. This expansion occurred when the Japanese landmass, part of the Eurasian Continent until ~30 to 20 Ma, separated from the continent. This is one of the most closely-studied back-arc spreading events in the world, and is one of the most academically-important topics in the geology of Japan. For that reason, the expansion of the Sea of Japan is one of the most important themes for many of Japan's Geoparks, especially the San'in Kaigan and Oki Geoparks.

Both paleomagnetic and geological evidence clearly show that expansion of the Sea of Japan proceeded rapidly about 15 Ma, with clockwise rotation, at least for SW Japan (Otofuji et al., 1985) (Figure B-20). However, there is as yet no consensus among geologists regarding NE Japan. Differing theories propose that NE Japan turned left (Otofuji et al., 1985); that a lateral strike-slip fault caused a parallel shift (Jolivet and Tamaki, 1992); or that overall it turned left, but with differential rotation due to lateral strike-slip fault activity (Hoshi and Matsubara, 1998).

A record of the dramatic expansion of the Sea of Japan can be seen clearly in the Oki Islands Geopark. The Oki Islands are positioned deeper into the Sea of Japan (toward the continent) than the mainland, and hence different aspects can be learned here when compared to other Japanese Geoparks. Perhaps the most unique among those is a bed of sediment that was deposited in a huge lake along the coast of the Eurasian Continent. Sediments from turbidity currents and debris flows that occurred on the lake slope can be seen at Jodogaura (II-1) (Yamauchi et al., 1995) on Dogo, an excellent scenic site featured on the stamp design of the National Parks of Japan. Although formed mainly of lava and pyroclastic rocks generated during early rift volcanic activity about 30 to 20 Ma, this layer also contains the intercalated lake sediments that can be seen at Jodogaura (Figure B-21). Following that, freshwater sediments (e.g. sandstone, mudstone and conglomerate) formed in the early...
Miocene. These sediments contain pond snails (Figure B-23), freshwater molluscan fossils (Okubo, 1981) and warm-temperate zone plants fossils such as oak and chestnut (Yamauchi et al. 2009). These fossils indicate a warm environment at that time (Figure B-22).

These layers were transformed to a beautiful green hue by later metasomatic effects. In Goka, tuffaceous sandstone has turned to jade. This sandstone was once used as a rock material called “Goka-Ishi”. The vivid-green clay mineral celadonite was generated as a metasomatic phase among these layers at Nagu (II-10). This celadonite may have been used as a green pigment over 2,000 years ago, as it is believed it was used to dye a wooden shield that was uncovered in an archeological dig in Tottori Prefecture (Naruse, 2010). Additional research relating to this shield is currently being carried out. A green pigment called "Oki Roku" is also recorded in old literary records as being a product of this region.

Although marine beds deposited at ~ 17 Ma after the opening of the Sea of Japan can be observed at the San'in Kaigan Geopark and Itoigawa Global Geopark, Oki differs in that neritic deposits dating from the early expansion can be observed here. At Kumi on Dogo Island (II-11), fossils of molluscs and large foraminifers that inhabited rock reefs in a sub-tropical ocean can be seen within sandstones (Okubo and Takayasu, 1979). After deposition of these strata, the Oki Islands sudsided rapidly to form a deep ocean environment, and fine-grained sediments were deposited on both Dogo and Dozen. However, after 12 Ma the environment in Dozen shallowed rapidly, with deposition of shallow marine strata known (Matsubara et al., 2011). Many fossilized cold-water molluscs and fossil relatives of the scallop (Pectinid bivalve) can be observed in these beds. These fossils are used in local elementary school studies (II-15). In contrast, after 12 Ma the ocean environment remained deep in Dogo, and diatomaceous earth was deposited (II-13) which has been mined and used as material for lightweight fireproof aggregate for over 100 years. The excavated volume of this diatomaceous earth is estimated at ~ 4.5 million ton (Tanaka et al., 1963).

Lake strata from the continental coast prior to the Sea of Japan expansion and marine sediments deposited after opening can thus be observed in the Oki Islands Geopark. This allows both residents and visitors to appreciate the phenomenon of back-arc spreading, which is a fascinating geological process, especially from a global standpoint. Observation in other Geoparks on the Sea of Japan coast would also promote a deeper understanding of the opening of the Sea of Japan.

(3) Volcanic Islands Period (Stage Three)

During this period the Oki Islands changed from a submarine environment into volcanic islands. The volcanic activity was characteristically alkalic, in volumes not seen elsewhere in Japan. The islands of Dozen and Dogo were formed in the first half of this stage (6.3 to 5 Ma), by voluminous eruption of alkaline volcanic rocks. This activity continued through to just 400,000 years ago, primarily on Dogo. There is no evidence of
non-alkaline activity throughout, so Stage Three was a period of sustained alkalic volcanic activity. The major events that occurred during this stage are detailed below.

Strata in the interval from 10 to 7 Ma have not yet been found in the Oki Islands, so the environment of the region in this period is unknown. An intrusion of quartz syenite was emplaced at 7.4 Ma, after which only alkali igneous activity occurred. According to Tiba et al. (2000), volcanic activity on Dozen followed the following sequence. A volcano formed at ~6.3 Ma, with Mt. Takahi as the crater. Lava was erupted from fissures radiating from the crater, forming some scoria cones (III-11, 12b). Although these volcanic rocks were primarily erupted onland, the existence of sediments deposited in a shallow marine setting near the shoreline shows that at the time the present Dozen Islands area was actually one island. The volcanic activity eventually produced trachyte lava on the slopes of the volcano, followed immediately by the formation of Dozen Caldera. This caldera had an almost 40 km square outline, with a 500 m topographical contrast between the highest point of the outer rim and the deepest point within, making it smaller than the present-day Aso Caldera in Kyushu. At about 5.4 Ma, a central pyroclastic trachyte cone was formed in the center of the caldera (III-4). Old calderas often lose their shape due to erosion and sedimentation, but Dozen Caldera is a rare example of a caldera where the shape clearly remains (III-13).

A sandstone bed deposited in a shallow sea is distributed in the west of Dogo Island, and features many molluscan fossils (Kakudate, 1988). Marine deposits from this era are rare on the Sea of Japan coast, so shallow marine sediments of both areas are important in determining the depositional environment at the time. A fissure eruption (III-20) of trachyte (IVG-16), rhyolite lava (III-25) and pyroclastic rocks (III-19) began at almost the same time as deposition of the shallow marine sediments, and continued through to about 5.4 Ma. These lava and pyroclastic rocks form the main mountains in the west of the island. Maximum thicknesses of individual units reach approximately 370 m (Sawada et al., 2000). The volcanic activity ceased with eruption and intrusion of shoshonite (III-28) or trachyandesite (Kobayashi et al., 2002, 2009). Note that the rhyolite lava and pyroclastic rocks often contain obsidian (III-25) that was mined as a material for stone tools and artifacts from the Paleolithic Period onwards.

At almost the same time as above the volcanism, volcanic activity also occurred in NE Dogo. This activity ejected primarily rhyolite pyroclastic rocks (III-32), and formed a caldera (III-30). The caldera has a rhombic shape with dimensions of 6 km x 4.5 km, trending NNE to SSW. As the shape of the caldera no longer remains due to erosion, it is technically named a cauldron (Yamauchi et al., 2009). Trachytes containing many large alkali feldspar phenocrysts were intruded immediately after this volcanism, forming the “Lizard-shaped Rock” (III-33). It is well known as a local landmark.

Bay and fluvial sediments were deposited on Dogo Island about 5 Ma, after completion of the above two volcanic episodes, due to land subsidence and collapse of the volcanic bodies. Similar strata can be found locally in the Dozen area. Eruption of alkali basalt occurred in east and north Dogo coeval with this bay and fluvial sedimentation. Alkali basalt volcanic activity continued intermittently through to about 400,000 years ago.

These basalts often contain ultramafic and mafic xenoliths or megacrysts, particularly in the alkali basalt lavas distributed in Kuroshima Island, northern Oku, Sakiyama Cape, and Shimogaya (Figure B-26, III-41b). These xenoliths are precious materials which provide information about the composition of the rocks more...
than 25 km beneath the islands, as mentioned above (refer to 2-1). Abundant xenoliths are exposed in the cliffs along and near the coast, but they are also commonly found in the gravels scattered on the beach, and so are utilized not only in research, but also in geoscience education.

In places the alkali basalts erupted at this time flowed along a river valley, as the lavas often contain river gravels (Figure B-27) (Yamauchi et al., 2005). The terrain formed by the lava exists as ridges and hills today. This unusual feature is due the effects of erosion from late Pliocene to early Pleistocene time, which selectively eroded sedimentary rocks forming the ridges adjacent to the valleys. The former valleys, filled by alkali basalts resistant to erosion, now stand as ridges, while the original valley surroundings that were more susceptible to erosion were carved away, causing inversion of relief.

The depositional conditions of high temperature pyroclastic material and flow of magma around a crater of the volcanic cones in this period can be observed in detail in the north of Nakanoshima Island (III-9). A cross section of an explosion crater formed by a phreatic explosion (III-47) can be seen on the shore near the cone on Misaki Peninsula on Dogo Island. The crater can also be observed from the sea.

High and intermediate altitude terraces were formed as a result of changes in sea level due to alternating cold and warm periods at the end of this stage. The Oki Islands were connected to Honshu by land when the sea level dropped significantly.

(4) From Peninsula to Isolated Islands (Stage Four)
The Oki Islands finally became isolated islands in this stage. The difference in temperature between cold and warm periods grew greater from the end of the early Pleistocene, thus increasing eustatic sea level change. In the larger view, there have been nine cold periods since around the middle Pleistocene, (MIS19). The period from approximately 70,000 years ago until ~10,000 years ago (MIS4-MIS2) is called the last glacial age. In this, cold and warm periods oscillated during the overall cooling, reaching its coldest point approximately 18,000 years ago. Mean annual temperature for the Dogo area for 2010 was 14.7°C, whereas the mean annual temperature in the last ice age is calculated to have been only 5.4°C (Matsusue et al., 2000). At the peak of the last glacial age, the sea level of the Sea of Japan is thought been 130 m lower than at present, due to ice sheet formation and lowering of the ocean surface temperature.

The Sea of Japan is connected to the surrounding oceans via five straits. These are the Tatar Strait (deepest point of 25 m), the La Pérouse Strait (70 m), the Tsugaru Strait (400 m), the Kanmon Straits (47 m), and the Korea/Tsushima Strait (northern strait 135m, southern strait 228m). The Tatar, La Pérouse, and Kanmon straits all became land bridges at the peak of the last glacial age (Sakai, 1995). Although the Tsugaru and Korea/Tsushima straits did not become land bridges at this time, it is thought they were so shallow that there was almost no influx of water from the north-flowing Tsushima Current (Ikehara, 2009). As mentioned above (refer to 2-1), there is no exchange of deep water. A depth of more than 300m in the Sea of Japan is occupied by a homogeneous body of seawater with a temperature of 1-2°C and salinity of roughly 34.1‰. This seawater is called “proper water” in the Sea of Japan (Japan Meteorological Agency Website, 2011).

The Oki Islands are located on the continental shelf north of Shimane Peninsula. Maximum water depth between the two points is only 70m, so during the peak of the last glacial age, the islands were positioned at the tip of a peninsula extending northward from Shimane Peninsula. Several millennia after the peak of
the last glacial age, global warming caused sea level to rise, and the shallow between the Oki Islands and Shimane Peninsula was submerged, creating the islands we see today.

Most of the coast of the Oki Islands today is sea cliff, with only a small part of the shore formed from recently deposited sediments. The coastline is still experiencing erosion. The largest factor in this is the seasonal NW winds that blow from the winter high-pressure system over Siberia. This seasonal wind causes frequent winter storms, and the massive waves created by them eat away at the shores of the Oki Islands. Consequently, erosion is considerable on the north and north-west shores of Dozen and Dogo areas, where the highest cliffs are found. Many classic coastal landforms have been created by this erosion, including sea caves, stacks, and arches. The Kuniga Coast in Dozen in particular is noted for such examples of sea erosion, including cliffs, caves, arches, and isolated rocks, and contains some of the highest promontories in Japan.

The following process of erosion can be observed at Tsutenkyo Arch on the Kuniga Coast of Dozen:
1) Sea erosion formed a cliff, followed by caves;
2) Partial cliff collapse turned a cave into an arch;
3) The roof of the arch then collapsed, leaving an isolated stack (Figure B-28).

The rising sea level reactivated river sedimentation on the mainland, forming alluvial plains and deltas. However, as there are no large rivers in the Oki Islands, there are almost no alluvial plains. Relatively large plains occur on Dogo and Nakanoshima, but they are not of alluvial origin.

B-2-3. Scientific Description of Human Activity

Much has been written about the ancient origin of Japan and the continuity of culture throughout the country. The Oki Islands is one of the more appropriate places for gaining an overall understanding of the Japanese culture. The concentration of cultural traditions from numerous ages can be observed here.

The culture of Japan is based on religious values that are specifically Japanese, and these values are seen as being particularly unique. Unlike the leading monotheistic religions such as Judaism, Christianity and Islam, Japanese religion has as its foundation as an ancient religious concept based on polytheism (or animism, veneration of the dead). Rituals that have roots in this primitive religion can be seen in this region.

One example is that many shrines in the region are extremely old, dating back long before records existed in Japan from the 8th century. These include 16 shrines that are noted in records over 1,000 years old (Deities List of Engishiki from AD 927). There are also several primitive shrines where a natural object (large tree or rock) is located in the center of the grounds, but no buildings are present.

One reason why such ancient culture can be observed here is that obsidian was mined in Oki as a material for stone implements, and people either lived here permanently or visited for digs from over 30,000 years ago. Culture of this age cannot be seen in Nara or Kyoto. Religious culture, often easily lost for political reasons, still remains here. Many other examples of culture remain as well, including that of the daily life of the people of Oki (Figure B-29, 30).

The second cultural characteristic of Oki is that a variety of cultural factors are preserved in each village, making for extremely high diversity throughout the whole region. The terrain of the islands is one factor that gave birth to this cultural characteristic. Cultural diversity is particularly high on Dogo, where the terrain is mountainous, with only small isolated flat areas on the shore. This terrain made for severe isolation, with boats or mountain paths the only available means of travel between villages. Sealed roads and tunnels connect these settlements today.
(1) Movement of Obsidian and Culture

Oki Obsidian was formed by volcanic activity some 5 Ma (III-24, 25, IV F-10). This rock is an important resource not only for the many people who used it in the past, but also for people today. Through this resource we can observe the activities of the ancient people of Oki.

Obsidian was used throughout the world as a material for chipped stone tools during the Old Stone Age. It is formed when silica-rich (felsic) magma rises to the surface quickly and chills to form volcanic glass. Although over 100 occurrences of obsidian are known in Japan, only a few of those have been exploited as material for stone tools. In many occurrences, minor components within the obsidian precluded its fitness for fabrication or use that precludes its fitness for fabrication or use. The ratio of minor components differs in each occurrence, allowing items produced at each site to be traced through component analysis.

By following that path of when and where obsidian produced on Oki was carried, the scope of trade and exchange predating Japanese statehood can be understood. The result is that a cultural zone is found centered on the coast of the west part of the Sea of Japan that covers almost the same area as a unique type of burial mound (four-cornered projecting-type tumulus) (Tsutsumi, 2004). While obsidian is important from the standpoint of the use of geological resources, it is also a valuable tool for learning about the geographical spread of culture and exchange.

(2) Independence Movement on the Border Islands

The democratic secession movement called the "Oki Rebellion" is an important topic in regional history. This occurred in 1868, when the local populace ousted the government representative of the time and established an autonomous government. While the movement was suppressed militarily in only 80 days, it was a movement that emphasized virtues, sending off the ousted leader with a parting present, and preventing any bloodshed during negotiations.

This movement occurred during the period of the rapid growth of Japanese society from modern to contemporary times. At the time, Japan pursued a policy of national isolation that limited diplomacy and trade with foreign countries. However, technological advances in steam propulsion meant scale-ships capable of long distance shipping became prevalent, and other nations began to request that Japan be opened as a supply point. At this time, many foreign vessels plied the seas surrounding the Oki Islands, and from time to time crews landed on the islands. The social trends and geographical position gave the islanders a sense of concern, giving them enough strength to establish a county.

(3) Banishment to the Oki Islands

From ancient to modern times, the Oki Islands were known as "islands of banishment". Particularly, for 900 years after it was stipulated by law in ancient times (up to AD 724), it was a place where priests, lords, and royalty who had been defeated in war or committed crimes were sent. Two emperors, Emperor Gotoba and Emperor Godaigo, were sent to Oki after military defeat. Some legends claim that four emperors were sent. These exiled emperors were welcomed by the people of Oki.

In addition to being an isolated island group with rough geography, another reason behind the choice of the islands as a place for banishment was that life was not difficult there. In Japan, there has long been a belief that those who are attacked and killed can return as revengeful ghosts, even if guilty, causing problems to the living. Consequently, when previously powerful individuals were exiled, the utmost care was taken for their safety. Although the Oki Islands are isolated, there was an ample water supply. People had moved to Oki and settled the land from early on, and the area was thus an ideal place for banishment.
(4) Diverse Folk Culture
Practices and rituals from many different ages remain in the region. Four geographic and terrain-based factors can be identified:
1) Culture could come from anywhere, through the maritime connections to surrounding regions;
2) Continuous change did not occur, because exchange with the outside was sporadic and discrete;
3) Villages could not grow very large due to the mountainous territory, and the number of small villages thus increased;
4) Cultural unification did not take place, because many villages were separated from their neighbors by physical barriers.

While these factors have been solved today through a regularly operated public transport system and tunnels (IV F-11), the effects can still be observed in local rituals, culture, and dialects, features that have not been retained in many other regions.

The abundant mountains, ocean and flat areas, agriculture and fishing are the focus of village life in this region.

(5) Traditional Agricultural and Pastoral Culture

Figure B-31. Makihata (Wheel or Four-Field Stock Farming) Land Use

Figure B-30. Various Festival in the Oki Islands

Renge Dance  Traditional Oki Sumo  Bull Fighting
While the land has since been converted to firmland, ancient agricultural and pastoral culture dating from at least before the 12th century through to 1970 was observable in the Oki Islands. This was the *makihata* (wheel or four-field stock farming) agricultural method, in which cattle and horse grazing, beans, millet, and barley or wheat were rotated over four years, but with many variations (Mitsuhashi, 1969) (Figure B-31). There were few coastal plains, and this technique thus evolved for the sustainable use of the limited and meager soils present. According to records from 1795, 90% of the arable land on Dozen and 60% on Dogo was used for stock farming (Tanaka, 1977).

The remnants of this can be seen today in the pastures on Dozen, in the form of the stone walls spread across the scenic landscape. These walls were used to separate the crops, and were called *aigaki* and *myogaki* (IV F-1, 3). Almost all the land on Dozen that was not used for housing was used for stock farming, and the firewood that was one of life's essentials was cut and carried out from the forests on Mt. Takuhi.

B-3. Listing and description of the Geological Sites within the proposed Geopark

A Geosite List is included in the Appendix of this Application Dossier. The principal geosites are described in detail below.

B-3-1. Principal Geosites (1) Continental Age

**I-3 Oki Gneiss at Choshi Dam, Dogo Island**

The rocks in the cliff are metamorphic rocks (gneisses) that were formed deep in the crust (approximately 15 km) at high temperature conditions (750-820 ℃) 250 Ma. The black and white parallel banding seen on the surface was formed when rock-forming minerals such as quartz, feldspar, and biotite were segregated due to shearing at high temperature. White veins can be seen injecting along the banding or cutting across it; these formed when the parent gneiss partially melted. The small pretty red crystals in the black bands are garnets. This rock contains detritus zircon grains dating from 3 billion years ago. These were originally part of the sedimentary rocks that were the parents of the gneisses, and hence represent pieces of the nearby old continent (Eurasian Continent).

B-3-2. Principal Geosites (2) Sea of Japan Formation Period

**II-1 Lacustrine Formations and Volcanic Rocks, Jodogaura Coast, Dogo Island**

Jodogaura features beautiful scenery comprised of an archipelago and mature pines. This scene is straight out of a Chinese style of landscape painting (an eastern style using ink). It is widely known as a leading sight-seeing spot on Dogo, and has been used as a design for postage stamps. The rocks making up this landscape are from the Tokibariyama Formation, dating from 30 to 20 Ma. Cross-bedded sandstones in these lacustrine strata were deposited in continental coastal lakes before the Sea of Japan formed. Lavas and volcanic breccias from the active volcanoes of the Sea of Japan formation stage can be observed in the sea cliffs and on the wave-cut benches at Jodogaura.

**II-7 Non-marine Fauna Fossils, Ganya Coast, Dogo Island**

Large blocks of basalt 2.8 to 2.3 Ma and sandstone and gravel from the
Kori Formation (19 to 17 Ma) can be observed on the pebble beach on the Ganya Coast. The sedimentary rock blocks include numerous fossils such as plant fossils suggesting a warm environment, such as oaks, and freshwater mollusks such as the pond snail. These fossils are evidence of lake and river environments dating from the coastal continental period before the birth of the Sea of Japan. This location is often used for school studies, because fossils can easily be observed.

Il-13 Diatomite Formation, Shionohama Coast, Dogo Island
The sunset on Shionohama Coast is spectacular, but there is also much to see in the mountains behind it. The cliffs across from the beach and roadway feature exposed diatomite, built from the remains of diatoms. In the past, this diatomite was mined as a raw material for manufacture of lightweight aggregate. The diatomites belong to the upper Kumi Formation, dating from 15 to 10 Ma, and record a marine environment and rapid subsidence after formation of the Sea of Japan. Sandstones from the Tsuma Formation 5 and 7 Ma unconformably overlie the Kumi Formation at the top of the cliffs. The unconformity surface features fossilized sand pipes intruding from the Tsuma Formation toward the Kumi Formation.

Il-15 Marine Molluscan Fossils, Ichibu Coast, Nishinoshima Island
The Ichibu Formation was the product of shallow sea sedimentation roughly 12 Ma, and is exposed at Ichibu, on Nishinoshima in the Dozen Islands. The Ichibu Formation consists primarily of sandstone, and features many molluscan fossils, including relatives of the Pectinidae family. About 20 different varieties have been confirmed to date. Few warm-current species are present. Most are temperate species typically distributed in the north-west Pacific, and for which the western part of Honshu is the southern extent. There are also some species considered to represent cold-current varieties, and indigenous species not found elsewhere. The Ichibu fossil assemblage suggests that the effect from warm currents flowing into the Sea of Japan from the south was weak in the area around Oki at the time. The seashell fossils seen here are vastly different from those of the same age on the side of Honshu, which mostly consist of warm current species.

B-3-3. Principle Geosites (3) Volcanic Island Period

Il-4 Mt. Takuhi (Central Cone) and Takuhi Shrine, Nishinoshima Island
Mt. Takuhi, located in the center of the Dozen Islands, is the central core of Dozen Caldera, which was formed between 6.3 and 5.4 Ma. This central core consists of welded and unwelded trachytic pyroclastic rocks. The welding surfaces and bedding planes are inclined at 20-90 degrees inward toward the center of Mt. Takuhi in a roughly concentric circle, but dip outward on the shoreline of the inner sea. From this it is evident that the pyroclastic rocks forming most of Mt. Takuhi were deposited on the inside of the crater. A shrine (Takuhi Shrine) is situated near the peak of Mt. Takuhi, and the main shrine is located within an open grotto of pyroclastic rock. Due to its geographic prominence, Mt. Takuhi has been used as a landmark from the sea since ancient times.

Il-9 Pyroclastic Cone, Akiya Coast, Nakanoshima Island
A cross section of a volcano that erupted 2.8 Ma is exposed in the sea cliff at Akiya, Nakanoshima Island. The cliffs at the western end of the beach are formed from volcanic material such as porous reddish-brown...
basalt occurring as lapilli, blocks and bombs. The reddish-brown color is due to deposition of splashes of magma at temperatures of several hundred degrees. The iron within these lava splashes was subsequently oxidized when exposed to the air. Furthermore, some welding occurred, because high-temperature volcanic material also fell and accumulated in and around the cone.

Ejecta deposits of this type are called agglutinates. The spindle-shaped bombs in the agglutinates allow detailed observation of how they changed their shapes and then solidified as they flew through the air. Note that the lava erupted here flowed to the southwest, reaching Suwa Bay.

III-11,12b Pyroclastic Cone at Sekiheki (Red Cliff), Chiburijima Island

The west coast of Chiburijima Island is made up of cliffs ranging from 10 to 200m in height. The southern portion features vivid colors in red, yellow, and brown along a distance of roughly one kilometer. The view of the sunset hitting the cliffs as seen from the sea can be breathtaking. These cliffs are composed of a combination of pyroclastic material, including lapilli, blocks, and bombs of porous trachybasalt and basaltic trachyandesite. The red color comes from oxidation of the splashes of hot magma ejected in large quantity and contacting the air. The deposits of pyroclastic material at the base of the cone have a diameter of several hundred meters and a relative elevation of several dozen meters. A dyke intrusion of porous trachybasalt and basaltic trachyandesite in the center of the pyroclastic cone is covered with similar material, and it is thus thought to be a feeder for the eruption.

III-13 Dozen Caldera seen from Mt. Akahage, Chiburijima Island

A volcano formed in the Dozen area about 6.3 Ma, with Mt. Takuhi as the crater. Lava was ejected from cracks radiating from the crater. Trachyte lava was ejected on to the slope of the volcano, and Dozen Caldera formed immediately afterwards. Dozen Caldera has an almost square 40 km outline, with a 500 m difference in altitude between the highest point of the outer rim and the deepest point within the crater. A central pyroclastic trachyte cone was formed in the center of the caldera around 5.4 Ma. This pyroclastic cone is the Mt. Takuhi of today. It is common for old calderas to lose their shape, but the Dozen caldera is a rare example of one in which the shape clearly remains. Looking north from the Mt. Akahage observatory, the mountains of Nakanoshima and Nishinoshima can be seen forming the outer crater rim, with Mt. Takuhi forming the pycroclastic cone at the center.

III-20 Feeder Dyke, Shiro Coast, Dogo Island

Alkali rhyolite and trachyte lavas and pyroclastic rocks which erupted between 6.0 and 5.3 Ma are distributed throughout Dogo Island, except in its center and in its east.

A trachyte dyke intrusion can be seen on the cliffs on the south of Shiro Harbor, as shown in the photograph below. Rhyolite lava is found on the north (left) side, while rhyolite tuff breccia crops out on the south (right) side. A chilled margin is present on both sides of the dyke. This type of dyke is called a feeder dyke. Furthermore, branch-shaped intrusions of trachyte magma occur within the rhyolite tuff breccia, along with a rare phenomenon where the rhyolite gravel surface is coated with trachyte. This dyke fills a vent through which the trachyte magma rose, and eventually solidified to remain in its feeder dyke, leaving the present structure.
Ill-25 Obsidian and Vent, Kishihama Pass, Dogo Island

Kishihama Pass on the west of Imazu Harbor is a feeder dyke formed when alkali rhyolite magma ascended between 6 and 5.3 Ma. This feeder dyke is filled with pyroclastic rocks that contain several types of vitreous rock that formed from rapid cooling of the rhyolite magma. Black vitreous rocks with water contents of less than 1% and featuring clamshell-shaped (conchoidal) fractures are obsidian. Pearlite and pitchstone also occur. The pearlites show concentric or whorled cracks and contain 1-4% water, whereas the pitchstones featuring pine-resin like glazing in dark black, green, and purple hues, and contain 4-10% water.

The pearlites and pitchstones occur within the pyroclastic rocks as lens/shaped agglomerates which contain obsidian beads. This shows that magma in the core of the vent with lower water content produced obsidian, and pitchstone with higher water content was produced at its outer part. The parts beyond the pitchstone consist of pyroclastic rocks showing strong vesiculation which formed during ascent of the rhyolite magma in the vent.

Ill-33 Tokage-iwa (Lizard-shaped Rock), Dogo Island

Looking toward Mt. Tsuzurao from the lookout at the highest point of the central valley on the northeast of Dogo, a 30 m long rock shaped like a lizard appears to be climbing the 100m cliff. This feature is known as the “Lizard-shaped Rock”, and is one of more oddly-shaped rocks in Japan.

The rock is part of a largely vertical and cylindrical trachyte dyke which has joints developed in both vertical and horizontal direction. The lizard shape was formed as the dyke failed along the joints. The front legs of the lizard fell off in the West Tottori Earthquake of autumn 2000, leaving the shape seen today. The trachytes forming this dyke contain very high concentrations of alkali elements, perhaps the highest of any volcanic rocks in Japan.

Ill-41b Xenoliths in Basalt, Kuroshima Island, Dogo

Kuroshima Island, off the east coast of Dogo, consists of basalt erupted about 3.3 Ma. The basalt has well-developed columnar joints and contains many kinds of rock fragments such as peridotite, composed mainly of olive-colored olivine; pyroxenite, composed mainly of dark green pyroxene; and gabbro. These fragments are known as xenoliths, and are pieces of wall rock picked up by basalt magma during its ascent to the surface from the upper mantle, more than 30 km beneath the islands. Similar xenoliths occur at Ill-39, 43. Based on studies of these xenoliths, it is thought that the mantle below Dogo Island has both continental and oceanic characteristics. Furthermore, the magma originated from a depth of less than 70 km, and is estimated to have ascended at a speed of more than 10 m per second.

Ill-47b Explosion Crater at the mouth of Saigo Bay, Dogo Island

Continuous cliffs to the west of the entrance to Saigo Bay on Dogo range from 50m to 100 m in height, and are topped by a gently sloping highland. This highland formed from basalt which was erupted at 0.55 Ma. The cliffs are composed of basalt lavas and pyroclastic rocks. When viewed from the sea, this basalt eruption cone resembles a large bowl that has been cut in half. The pyroclastic rocks consist of
volcanic materials such as ash, lapilli, and bombs, and exhibit well-developed cross-stratification. Red strata produced by high temperature oxidation delineate the shape of the cone. The cone is 250 m in diameter and 100m in height. This site is an example of a pyroclastic cone which has a low elevation compared to the cone diameter. It was formed by an explosive phreatomagmatic eruption, in which huge volumes of high pressure steam were generated when magma met ground water just beneath the surface.

B-3-4. Principle Geosites (4) From Peninsula to Isolated Islands

IV G-5b Erosion on the Kuniga Coast seen from the sea, Nishinoshima Island
Various erosional features can be seen along the Kuniga Coast on the western side of Nishinoshima. Although it is possible to observe some features from the land, such as sea cliffs (e.g. Matengai Cliff), arches (Tsutenkyo Arch), and isolated stacks (Tenjokai), the best way to observe the erosional features is from the regularly scheduled sightseeing boat. Viewing the coast from the sea allows visitors to see the entire coastline in a single sweep, as well as the inside of an impressive sea cave formed from several connected caverns (Akekureno-iwaya Cavern). The cavern cannot be entered in rough weather.

IV G-11b Candle Island, Dogo
The peculiar rock known as Candle Island is another famous tourist spot in the Dogo area. This columnar rock stands alone in the sea, and has been isolated from the adjacent rocky coast by sea erosion. A small protrusion from the top of the column resembles the wick of a candle. Near sunset the sinking sun appears to light the candle. A sightseeing boat times its departure to allow passengers to photograph the sunset and the instant when the sun descends to align with the candle wick. This is a popular attraction on Dogo.

Views of Candle Island can be obtained from two observation points on land, but the alignment of the sunset and the candle cannot be seen from these sites. Candle Island consists of trachyte with well-developed columnar and plate joints.

IV G-14 Scar from a massive collapse and landslide on Mt. Omine, Dogo Island

Mt. Omine is a unique formation in the north of Dogo. It has a flattened peak and is surrounded by several steep horseshoe-shaped cliffs. The mountain consists of basalt lavas erupted from 4.7 to 4.1 Ma which rest on sediments deposited in marine and river environments about 5 to 4.7 Ma. Fluvial gravel beds are intercalated between each lava flow. This combination of lithologies and down-slope dip of the strata make
this area highly susceptible to landslides. The steep horseshoe-shaped 2 km-long cliff on the mountainside of Mt. Omine is a scar left from an ancient massive landslide caused by uplift since 4.7 Ma. Massive blocks from this landslide reached the ocean. The small-scale landslides where that can be seen today also formed in the sediments described above.

IV B-7 Oki Salamander, Nakatani Valley, Dogo Island
The Oki Salamander is the only endemic land vertebrate on Oki. This amphibian is found only on Dogo, but is widely distributed there, except on the lowlands and in high mountain areas. Adults live primarily on the forest floor and are rarely seen, whereas larval forms live in river valleys and streams for several years, and can be seen all year round. Areas that allow easy observation have been designated as geosites. This species has several characteristics that are fascinating from the evolutionary viewpoint. It is possible to consider its changing characteristics in combination with geological history.

IV B-11 Subalpine Plants along the Kumi River, Dogo Island
Subalpine plants can be seen along the northern slope above the paved road that follows the river, while plants from the southern floral zone can be found to the south. Alkali rhyolites of the Omosu Formation forming the cliff exhibit beautiful red and white flow structures.

Although subalpine and southern plants can be observed in many places, this site is fascinating because the vegetation is segregated by the facing of the slope, and hence likely by the amount of sunlight. The Japanese arborvitae in the center of the photograph is a subalpine index species, but grows in this location just 20 m above sea level.

IV B-15 Chichi-sugi and Wind Holes, Dogo Island
The view here is commanded by the very impressive sugi (Japanese cedar), but there are further surprises if attention is paid to the surroundings. The area surrounding the tree is formed of boulders that rolled there. The spaces between are called "wind holes" through which the wind passes. Further, because air currents of differing temperature and humidity are combined here, the site is very warm, and the area is filled with plants that usually prefer riverside or wetland areas. The sugi is estimated to be 800 years old. A mountain spirit is enshrined in this spot, and Mt. Daimanji, the highest peak in the Oki Islands (607m), appears behind the sugi beyond the Shinto gate.

IV F-2 Stock-Farming Stone Walls, Mt. Akahage, Chiburijima Island
These stone walls are an artifact of the unique regional form of stock-farming carried out here from the Middle Ages through to the 1960s. They can also be seen clearly from nearby Geosite III-13 (Dozen Caldera seen from Akahage Mountain). These walls demarcate the fields, and were called aigaki and myogaki. The systematic primary industry based on this technique to utilize the meager and shallow soil is noteworthy. This style of farming was carried out on a large scale on Chiburijima, where the island was divided by long stone walls and wooden fences to separate land for stock-farming and crop rotation.
IV F-11 Fukuura Tunnel, Dogo Island
Tunnels dug in the early and late Meiji Periods (1870s and 1900s, respectively) are seen here side by side. The only method of digging available for the older and more seaward tunnel was digging by hand, so only the bare minimum was dug, making use of a corridor resulting from wave erosion. The younger tunnel was excavated using explosives, to allow full passage of larger vehicles. This tunnel was further expanded in the 1970s. These tunnels show the evolution of the land transportation methods available, describing the change from walking, to horse and carriage, and then to automobiles. They can be seen as evidence of the isolation of the villages, and the eventual solution of the problem.

IV F-15 Dangyo Waterfall, Dogo Island
There are many sheer cliffs on the western coast of Dogo, and many waterfalls can be seen. These sheer cliffs and waterfalls were formed by erosion and collapse of the volcanic rocks erupted in the age when the islands were being built by volcanic activity. Dangyo Waterfall is one of these, and the water here has long been thought to have special properties. It was called “winning water” because one would win if one drank it before engaging in some kind of competition. Even today, people involved in competitions such as traditional bull-fighting and sumo climb the mountain to drink this water before they compete.

B-4. Details on the interest of these sites in terms of their international, national, regional or local value

While it is acknowledged that there are many unique species of flora and fauna in the Oki Region (AEZ, 2010), there are many areas which need to be further researched. Rapid progress is being made in the area of regional ecosystem interpretation based on recent gene analysis, and further developments can be expected.

Recently there have been many written geological descriptions and fundamental investigations made in the area of geological studies (Tiba et al, 2000, Yamauchi et al., 2009). While there is a lot of information available to us, studies and reports into how the geo-history of Oki connects to other areas of the Earth are yet to be made. Currently international research is being carried out related to mantle xenoliths (Abe et al., 2003; Nagao et al., 1993; Yamamoto et al., 2007; Arai & Ishimaru, 2008 etc.). Mantle xenoliths in the Oki Region have a role in resolving the composition and components of the mantle wedge in the subduction zone.

It may be difficult for people around the world to understand exactly about the diverse regionality of the cultural and lifestyle features of the Oki Region. One example of a uniquely “Oki” way of life that is currently being introduced by the Japanese Ministry of the Environment and the “Satoyama Initiative” promoted by the United Nations University, is makihata (stock-farming and crop rotation). This is an example of a sustainable primary industry that ties in with mountain forest management (Ministry of the Environment, 2011DL).

At a national level, sites within the Oki Region have already been given the title of National Park, Top 100 Geological Sites of Japan, National Natural Treasure and National Important Cultural Property. These geosites are well-used in local school education programs and social education programs, as well as by researchers. Many places listed as geosites are already popular sightseeing spots for visitors (refer to Geosite List).
C. Geoconservation

C-1. Current or potential pressure on the proposed Geopark

The two major ongoing issues that the Oki Islands Region continues to struggle with are the ongoing reduction in economic activity and depopulation. Other problems include rubbish being washed ashore, illegal removal of vegetation, poaching, and illegal dumping of waste. These problems reflect a decline in society as a whole, the root of the problem. Local residents must come together and play a vital role in changing this mindset, so that Oki citizens will re-evaluate the Oki Region and discover the value of Oki.

C-2. Current status in terms of protection of geological sites within the proposed Geopark

We believe the most important aspect of our Geopark work is to ensure that the people of Oki correctly understand the extreme value of this region’s land heritage, a regional resource which is unique to Oki. There are many fascinating landscapes within Oki, but the value of these places has, to date, been underestimated by the local community. For the future of Oki, we believe that it is essential to reassess the value of our region and its resources, and have thus committed to providing Geopark information sessions and workshops that arouse peoples’ way of thinking. One emerging example of this change is a decline in the theft of precious vegetation from alongside walking courses.

Utilization of the land heritage within Oki in ways which do not destroy regional resources, but are tools which can stimulate the local economy, is the driving force behind geo-tourism in this region. It is critical that local residents have an accurate understanding of the high value of the region’s resources, and act collectively to protect these resources as a region.

C-3. Data on the management and maintenance of these sites

Most of the region’s coastline is part of a national park, and features important flora, fauna, minerals and landscapes. The national, prefectural and municipal governments have established laws to protect these treasures. Conservation of living species listed in the Red Data List, produced by both the Japanese government and Shimane Prefecture is also essential. Unfortunately, many of the unique species from Oki, which have been created by the environment of this remote island group, are on these lists.

We are working actively to ensure that the geosites and precious species of the Oki Islands Geopark are protected. Eight natural park officers certified by the Ministry of the Environment have been carrying out patrols of the Oki Region twice a month, but in 2011 a further 14 nature observation officers were trained and are now working hard to ensure the region’s treasures are protected.

Geo-tours, which have increased in number in recent years, are being guided by experts in their field, so the tour group itself forms part of the network of people patrolling the area to protect these species.

Until recently, the Oki Salamander was not recognized under any legislation. However, this amphibian was officially listed as a “Town Protected Species” in 2010. This is one example of recent conservation achievements within the Geopark. The species is now protected under a cultural property ordinance.

C-4. Listing and description of non-geological sites and how they are integrated into the proposed Geopark
Several sites on Oki have an indirect connection with geological elements, and are therefore not specified as geosites. However, these sites are included in tours, and connections between them and the existing geosites are explained by tour guides. Examples of such non-geosites are detailed below (Table C-1).

Table C-1. Non-Geological Sites
Dg; Dogo Island, Ns; Nishinoshima Island, Nk; Nakanoshima Island, Ch; Chiburijima Island

<table>
<thead>
<tr>
<th>Site Name</th>
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<td>Kururi “Imperial Palace” Site</td>
<td>Emporer Gozairu, Island of Banishment</td>
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<tr>
<td>Shrines and Temples</td>
<td>Folk Culture, Oki Revival</td>
<td>Dg</td>
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<tr>
<td>Isenikko Shrine</td>
<td>Otsuketen, Folk Culture</td>
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<td>Gannongy Temple</td>
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<td>Dg</td>
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<tr>
<td>Aganozai Wood Statue</td>
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<td>Oki Shrine</td>
<td>Emperor Gotoba, Island of banishment</td>
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<tr>
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<td>Yononoi-kuraka (Cherry Trees)</td>
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<td>Nago Cape</td>
<td>Sightseeing, Geothermal Landform</td>
<td>Dg</td>
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<tr>
<td>Awa-tanzan (Underwater-viewing Boat)</td>
<td>Marine Organisms, Ocean Culture</td>
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<td>Yabi River Kappa Cruise Boat</td>
<td>Beets, Deep Sea, Biodiversity, Marine Plant, Folklore</td>
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<td>Subaikano Plant, Island of Banishment</td>
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<td>Cultural Facilities</td>
<td>Local Historical Museum</td>
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<td>Sasa Island Jyuzuki</td>
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<td>Shibu-ko Museum</td>
<td>Museum of Oceanography</td>
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<tr>
<td>Gokubya Shipy-kan</td>
<td>Museum of Oceanography, Oki and Local History</td>
<td>NK</td>
</tr>
</tbody>
</table>

Ruins
Historical ruins within the Oki Region are not sufficiently maintained as tourism resources, so these are not explained in detail. However, a few notable examples are listed below.

Shrines and Temples
There are more than 150 shrines in the Oki Region, many of which have a deep relationship with the history and geographical background of the islands. These shrines are utilized during geo-tours and are very popular with tour participants.

Natural Landscapes
Precious plant communities are present throughout Oki and these are introduced accordingly depending on the interest level of the study course or tour participants.

Cultural Facilities
These are frequently visited as part of the course of a geo-tour.

D. Economic Activity & Business Plan

D-1. Economic activity in the proposed Geopark

Main economic activities that utilize the Oki Islands Geopark are in the areas of tour guiding and tourism. Well-established companies within the Oki Islands operate nature observation tours from the sea (sea kayak, sightseeing boat) and in the sea (diving, underwater-viewing boat). Museums and cultural facilities also contribute to the existing geo-tourism activities in the area.

Recently, the Oki Islands Geopark staff are working towards a new style of geo-tourism, establishing tours run by paid guides, cultivating human resources, and developing geo-tourism for the mass-tourism level.

D-2. Existing and planned facilities for the proposed Geopark

The central information facility for the Oki Islands Geopark is the Oki Nature Museum. It was re-modeled in 2009 to be a core facility featuring Geopark information resources and exhibitions. By March 2012, the main committee aims to complete exhibitions that feature Geoparks around the world (GGN) and within Japan (JGN).

Geopark information corners in each of the four ferry terminals, the gateway to each island, will be completed by March 2012. Here the interesting features and points of interest within the Oki Islands Geopark will be introduced, as well as information given about Geoparks around Japan. Planning is underway to make use of already existing facilities such as the local museum in Nishinoshima and the development centers in Nakanoshima and Chiburijima. From 2013 these facilities will feature specific Geopark exhibitions (Figure D-1).
D-3. Analysis of geo-tourism potential of the proposed Geopark

The Oki Islands Region has an abundance of resources that can be utilized in the area of geo-tourism. The future of successful geo-tourism in Oki will be dependent on a succinct environmental plan and geo-tourism management system.

One issue that we must deal with is a shortage of local guides. There is also insufficient information and support for tour groups who do not use tour guides, or for mass tourism groups that visit the sightseeing spots using large buses.

We are working hard to ensure that by the end of Fiscal Year 2011, a succinct guide training system will be implemented, maps detailing all of the geosites in Oki will be complete, and information signboards will be erected at all of the geosites. We are also in the process of setting up foreign language assistance. One of our goals for this financial year is to have multilingual information available, with English as our first focus.

A well-organized “hands-on” activity program operates here in the Oki Region. These examples show how geo-tourism is already being implemented in Oki. Activities include striking a flame using manpower, using obsidian to make arrowheads, cooking local delicacies on traditional bamboo rice cookers, and viewing the erosional features of the coastline from sea kayaks. We are also hosting “universal tours” for people with special needs and disabilities, to ensure that everyone can enjoy their experience of a Geopark.
D-4. Overview and policies for the sustainable development of geo-tourism, geo-education and geo-heritage

For the Oki Islands Geopark, regional development through geo-tourism and promotion of environmental protection and education are the main pillars.

Up until now, the economy of this region has been supported by public works projects and the tourism industry, but recently there has been a gradual reduction in public works projects. There has also been a changing trend in travel.Previously visitors traveled in a large tour group but many now prefer to travel alone or in a small group. A delayed response to this trend has seen visitor numbers drop every year. These two factors have contributed to the waning Oki economy. In spite of this, activities in the area of ecotourism have been carried out since 2004, and through our efforts we have been able to see a positive tourism development in the area of geo-tourism since 2008. By utilizing the geological features of Oki as a source for new tourism ventures, there has been an increase in the number of independent travelers who come for university field work or to join a geo-tour. We plan to work proactively in the area of information transmission and use internet sources such as Facebook to promote throughout Japan and around the world.

As a result of geo-tours being conducted within the Oki Islands Geopark, there is a decline in the number of cases of illegal removal of flora, a positive step in the area of environmental protection. By taking locals and visitors to the mountainous areas of Oki on geo-tours and field workshops, areas of Oki areas not normally included in regular sightseeing courses, we have been able to patrol the geosites more effectively, stop the theft of flora, and establish a coordinated operation and maintenance program for the geosites.

The natural environment can be damaged by visitors to the region. As such, the main committee plans to cooperate with people connected to the tourism industry, stipulate areas that can only be accessed with a guide, and place a limit on visitor numbers to certain areas.

From 2000 environmental conservation projects had been sporadically carried out in cooperation with local schools. In 2009 Geopark lessons have been part of elementary school education throughout the Oki Region, and from 2010 Geopark seminars and workshops have been held for local senior high school students. Currently the Geopark education program does not run from elementary school right through until senior high school. We will hold discussions with the relevant education institutions to ensure that each school establishes a curriculum plan that features Geopark education and has continuity from start (elementary) to finish (senior high school).

The project plan for the Oki Islands Geopark has the promotion committee at the center, with the support of Shimane Prefecture and local municipal governments. From here onwards, we will endeavor to expand projects in a wide range of areas for the sustainable development and future of this Geopark (Figure D-1).

D-5. Policies for, and examples of, community empowerment in the proposed Geopark

Development of a regional society through this Geopark project can be achieved through advancement of the tourism industry as it makes continual use of the region’s resources. An important factor in this development is having a paid tour guide system. The core aspect of Geopark promotion is the training of local Oki Geopark guides. There are four main merits of having a regional guide system:

1) Having an increased number of Geopark guides results in an improvement in geo-tour capacity;
2) Guides who promote the uniqueness of the region are also local researchers (experts), and this leads to an improvement in the quality of available human resources in the region;
3) Knowledge and up-to-date information regarding regional resources and Geopark activities can be shared among local guides at guide training workshops;
4) Geo-tourism guides will in turn become advertisers and promoters of the Geopark.

There are many merits to having trained guides. However, for this to be a successful system, knowledgeable teachers, a continual series of guide workshops, and an organization that supports these activities is vital. We have so far had positive results from this.
In Oki, there is an excellent example of cooperation between the government and local residents. In 2004, a town development group known as the *Kaze-machi-kaido* Club (a member of the Oki Islands Geopark Promotion Committee), established the *Kaze-machi-kaido* Ecotourism School, providing specialist ecotourism courses (Figure D-2). Since 2009, university professors have been invited to give lectures and share their expert knowledge. This positive change shows an improvement in the area of geo-tourism.

This ecotourism school has three main themes behind their activities:—
1) Establish a new style of tourism.
2) Create a system that boosts the local economy.
3) Encourage people to have pride in the Oki Region.

Based on these themes, the school has developed a program of three educational workshops and lectures: Natural Environment – Sea Course; Natural Environment – Land Course; and Historical Science. To date, over 1800 people have participated in these lectures and workshops, run successfully by 14 well-accomplished guides.

We want our guides to know in-detail about the geo-heritage of the Oki Islands. A special characteristic of geo-tourism in this Geopark is the information guides share with visitors about the unique ecosystem and diverse history and culture of Oki. We have received very positive feedback from people who have taken part in tours facilitated by specialist guides, and who are interested in many aspects of the Geopark. Seventy tours have been carried out since 2008. We are working hard to build upon past performance and produce consistent results (Figure D-3).

**D-6. Policies for, and examples of, public and stakeholder awareness in the proposed Geopark**

The central core of conservation and utilization of regional resources are the Geopark workshops. There are two important ways in which we believe regional resources can be fostered in Oki:
1) Oki residents will recognize this value, and will intervene if they observe anyone trying to damage or take away a resource;
2) Oki residents will be aware of the islands’ resources and not damage or take them.

It is difficult to impose regulations relating to the theft of geological resources or the poaching of wildlife, no matter how aware the public is, and how well the laws are maintained. Residents may be witness to acts of theft or poaching, but may not be aware of their illegality. On the other hand, if residents are aware of these legal regulations, and cooperate with concerned authorities to enforce these, an excellent resource conservation structure will exist. This idea links to the formulation and establishment of a framework of cooperation and understanding of the importance of this Geopark.

**D-6-1. Workshops at Educational Facilities**

The Oki Islands Geopark Promotion Committee works with all Oki educational facilities (elementary schools, junior high schools and senior high schools) with the aim of providing educational information relating to the region’s resources, while at the same time, fostering pride and love for one’s hometown.
From its implementation in 2010 until September 2011, more than 900 students have taken part in an Oki Islands Geopark lesson (Figure D-4). In 2010, elementary school students who joined the Geopark lessons gave special presentations about what they learned about this Geopark, produced a play about the Oki Islands Geopark, and shared their impressions of the Geopark with people in their neighborhood. The play featured characters such as “Henmagan-kun” (Gneiss Boy), “Genbugan-kun” (Basalt Boy) and “Arukari-ryumongan-kun” (Alkali-Rhyolite Boy), making it easy to understand about rocks in Oki, something which people have rarely had a chance to learn about. What these young students achieved was well beyond everyone’s expectations (Figure D-5).

D-6-2. Workshops for Local Residents

The Oki Islands Geopark Promotion Committee is running workshops and lectures for employees of municipal governments, chambers of commerce, and community centers, as well as for local residents (Figure D-6, 7).

Most of these workshops are conducted in classroom lecture style, but fieldwork is undertaken where possible. Walking through the Geopark during fieldwork is a “hands-on” way to experience the site, developing better understandings and can lead to new discoveries. From 2010 until 5 October 2011, 647 people have taken part in fieldwork and/or workshops.

Unfortunately, the number of locals taking part in these workshops aimed at raising peoples’ awareness is fewer than we have hoped for. There has been limited support from workers outside the tourism or transport sectors, and this continues to be a problem.

D-6-3. Workshops around Japan

We are also making introductory presentations about the Oki Islands Geopark outside the region. Four lectures have been given at Kwansei Gakuin University and the University of Nagasaki in 2010 and 2011. As well as this, information about the Oki Islands Geopark has been presented in the form of workshops at government official training sessions, poster displays made at symposiums, and articles published in magazines (Nobe, 2010 a, b), (Figure D-8). More than 2000 people have taken part in lectures and workshops, both inside and outside of the Oki Islands Region.
Publication of Research and Results related to Regional Resources

There are many academic areas regarding regional resources that even now are not yet well understood. Researchers frequently come to Oki to conduct investigations, and the Geopark promotion committee cooperates with these specialists. We continue to deliver the findings of this research to the public through community workshops. Several workshops have been facilitated by the promotion committee advisory researchers to share research findings with the public, giving local people a chance to rediscover the value of the resources in their region.

Repetition of Geopark tours and workshops creates a unique opportunity to make new discoveries. Through these, new ideas and information are generated, issues are encountered, and new opportunities arise – all of which can be put to good use. They are useful when making improvements to the guide system, changes to Geopark documents, and in other respects. Currently, we are not giving presentations at symposiums or writing reports to academic journals, but we would like to use these methods in the future.

It is crucial for us to put disaster prevention education into practical use. Natural disasters differ from area to area. Having an understanding of the climate, geology, geography and land formation of the area can lead to risk reduction and effective responses in emergencies. Potential disasters in the Oki Region can be easily predicted and planned for (refer to Section A-2-6 (4)).

A disaster information workshop was held in Dogo in 2008 in conjunction with a construction consultancy group. Here participants learned about specific types of disaster, the location of emergency evacuation shelters and safe evacuation routes to these shelters, ending the course by completing a hazard map related directly to their own environment. We would like to intensify our efforts to carry out this type of project in the future.

Interest and arguments for joining the GGN

We identify two main contributions that we can make as a member of the Global Geoparks Network (GGN).

The first contribution is an example of tourism created from an interdisciplinary background. With the development of scientific technology, and the continuing subdivision of academic disciplines, broader scientific fields of view are becoming lost. Geohistory, ecosystems, lifestyles and cultures are all intimately interconnected. These elements must be studied together, not as separate topics, in order to fully understand how the present world we live in has been created. The Oki Islands have a semi-enclosed remote island environment, and have clearly evident geological and evolutionary events. Within Oki there is the potential for connections between various phenomena to be understood in an interdisciplinary way, and shared with the tourists who visit these islands. In this Geopark, we will provide a learning system where one can experience and discover how all of these elements present in Oki combine in a holistic way.

The second contribution is, by joining the GGN, the perspective of compatibility between environmental conservation and regional development, something which is already being steered by Oki residents. Many Geoparks in Japan have been led by local governments with the primary objective of regional development and promotion. However, the basis of our work here in the Oki Islands Geopark since 2004 (Japan Geoparks Network Member (2009)) runs in conjunction with the principles of community activities carried out at the local level. This form of geo-tourism has come about through a project driven by the private sector, in the hope that Oki residents will proactively come to understand the value of their region, realize the importance of conservation and protection, and be able to proudly explain about Oki to visitors to the islands.

The Oki Islands Geopark can contribute to the Global Geoparks Network in these two main ways, as well as contributing to the world by spreading the value and appeal of the Geopark concept and the global Geopark network. By doing so, we can show people around the world they have the ability to carry out Geopark activities, irrespective of where they may live. We can become a model for Geoparks in less-advantaged
areas that struggle with numerous issues of disparity, and show a new way to achieve sustainable regional
development and promotion.

We have our own Geopark goals, and are working towards achieving these through our Geopark activities. However, there are three issues that we are currently grappling with.

The first issue is an “identity crisis” for the residents of the Oki Islands. The rapid progress of globalization has led to many people seeing everything, everywhere, as the same, and losing sight of the value of their own culture. As a result, some people born in Oki miss out on important knowledge about their own land, lose sight of the value of their region and lack pride in Oki. People who may lack appreciation of the special qualities of Oki see merits in big-city living, and so move away from the islands, resulting in urban drift. With declining population, inevitably fewer children are born in Oki and educated here. This crisis can be seen as one reason for the falling population of the Oki Region, and relates to the issue of children's education. As more people become aware of the uniqueness of Oki, more people will remain here, or will move back from the mainland cities.

The second issue is a natural environment crisis. With the spread of the internet and easy access to a wealth of information, the number of cases of exploitation and trading of precious flora and fauna has increased, unbeknown to local residents. Local governments are embarking on protection activities and continuing to raise public awareness of the issue. The most effective preventative measure is to have the local residents correctly understand the value of the flora and fauna, and have a direct interest in protecting these resources.

The third and final issue is that of an economic crisis. Tourism and construction have supported the regional economy in Oki in recent years. However, the economic recession which has shaken the world economy has seen a significant reduction of activity in both of these areas. This issue is also linked to the problem of population decline. The working population on Oki is aging, and the region has an aging society overall. Consequently the number of children being born and educated in Oki is decreasing, leading to the closure of some elementary schools.

We can solve these three inter-connected issues. If we can express our ideas carefully and clearly, both Oki residents and those living outside of the region will come to fully appreciate the value of the Oki Islands. We are working hard in the areas of further developing the guide training and employment system, geo-tourism, and consequently enhancing Geopark activities. Having an in depth understanding and full appreciation of the values of the region’s traditions and assets forms the foundation for the protection of these resources, which can then be shared with future generations.

Since becoming a member of the Japan Geoparks Network, positive progress has been made in these areas, and Oki residents are rediscovering the resources in their region. There has been a greater demand for Geopark lectures and workshops within Oki, and people in the community are actively seeking to know

![Figure E-1. Changing Oki](image-url)
about the value of Oki. Legislation protecting important flora and fauna has been implemented, and there have been fewer cases of illegal collection of flora and fauna. There are also many more people taking part in geo-tours. We are confident that our initiatives in this Geopark will be an effective method for overcoming these three major issues.

Our wish is that Oki will become an appealing region for people to gather together, and that children, the next generation, will flow back into the community.

In order to further develop the Oki Islands Geopark, we believe it is vital for the current members of this Geopark committee to keep working positively towards implementing our initiatives. What is even more important is the development of a larger community network of peoples within Oki, around Japan and around the world who share this same feeling and who will work together towards the goals of this Geopark. We believe this will be possible in the Oki Islands Geopark as a member of the GGN.

As a member of the GGN, we wish to exchange and cooperate with overseas Geopark representatives and tourists. Through a concrete evaluation of our Geopark by people from outside the Oki region, we want to further promote Oki to local residents, across Japan and around the world, so that they too can appreciate this important geo-heritage and discover its true value. By doing so, the regional resources of Oki will be passed down to future generations.

We hereby express our desire to join the Global Geoparks Network and make a contribution to its activities, to our community, to Japan, and to the world.
Appendix 1 References

**App. 1-1. Geology**


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**App. 1-2. Biology**


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**App. 1-3. Social and Behavioural Sciences**


**Appendix**

**OKI ISLANDS GEOARK**
## OKI ISLANDS GEOPARK Appendix

<table>
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<tr>
<th>Area</th>
<th>Site Name</th>
<th>Geomorphology Type</th>
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<th>Geographical Feature</th>
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### Geological Geomorphological Feature

- **Ch**: Chichijima Island
- **Ma**: Maegashira Island
- **K**: Kōbō Island
- **N**: Nakanoshima Island

### Legend

- **Geological Geomorphological Feature**: Indicates the specific geological or geomorphological feature of the site.
- **Research**: Indicates the type of research conducted at the site.
- **Scientific Research**: Indicates the necessity of scientific research at the site.
- **Type**: Indicates the type of park or national park associated with the site.
- **Tōzan National Park**: Indicates the specific national park associated with the site.
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**From Peninsula to Isolated Islands (Stage Four)**

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**Landscape and Traditions**

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GEOSITE MAP
OKI ISLANDS GEOPARK

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