
WORLD HERITAGE NOMINATION – IUCN TECHNICAL EVALUATION

SURTSEY (ICELAND) – ID No. 1267

1. DOCUMENTATION

- i) **Date nomination received by IUCN:** April 2007
- ii) **Additional information officially requested from and provided by the State Party:** IUCN requested supplementary information on 7 August 2007 before the field visit, on 31 August 2007 after the field visit and on 19 December 2007 after the first IUCN World Heritage Panel meeting. The first State Party response was officially received by the World Heritage Centre on 5 December 2007, followed by one letter from the State Party to IUCN dated 26 February 2008.
- iii) **UNEP-WCMC Data Sheet:** 11 references (including nomination document)
- iv) **Additional literature consulted:** Dingwall, P., Weighell, T. and Badman, T. (2005) **Geological World Heritage: A Global Framework Strategy**. IUCN, Gland, Switzerland; New, T. (ed.) (2007) **Island Colonisation: The Origin and Development of Island Communities**. Cambridge University Press, 302 p.; Thorarinsson, S. (1967) **Surtsey: The New Island in the North Atlantic**. Viking Press Inc., New York, 115 p.; Thornton, I.W.B. (2000) **The ecology of volcanoes: recovery and reassembly of living communities**. In: Sigurdsson, H. (ed.) *Encyclopedia of Volcanoes*. Published by Academic Press, New York, pp.1057-1081; Vespermann, D. and Schmincke, H.-U. (2000) **Scoria cones and tuff rings**. In: Sigurdsson, H. (ed.) *Encyclopedia of Volcanoes*. Published by Academic Press, New York, pp.683-694; White, J.D.L. and Houghton, B.F. (2000) **Surtseyan and related phreatomagmatic eruptions**. In: Sigurdsson, H. (ed.) *Encyclopedia of Volcanoes*. Published by Academic Press, New York, pp.495-511.
- v) **Consultations:** 12 external reviewers. Extensive consultations were undertaken during the field visit with: the Icelandic Minister and the Secretary General of the Ministry of the Environment, other staff from the Nature Conservation Division of that Ministry and from the Environment and Food Agency and the Ministry of Education, Sciences and Culture; the Mayor of Vestmannaeyjar municipality and local stakeholders; and scientists from the Surtsey Research Society, the Icelandic Institute of Natural History and the Marine Research Institute.
- vi) **Field visit:** Chris Wood, August 2007
- vii) **Date of IUCN approval of this report:** April 2008

2. SUMMARY OF NATURAL VALUES

Surtsey is a volcanic island located in the North Atlantic, approximately 32 km from the south coast of Iceland. It is the newest and second largest island in the Vestmannaeyjar Archipelago, which is one of 44 volcanic systems that have been active in Iceland during the last 11,500 years. The island of Surtsey represents the top of the Surtsey Volcano, which forms a submarine ridge approximately 5.8 km long and up to 2.9 km wide. Surtsey was active between 1963 and 1967. By the end of the eruption, the island had a surface area of 265 ha and the total volume of erupted material was estimated to be 1.1 km³. The shape and size of the island has changed considerably since 1967 due to marine erosion and

deposition, and Surtsey now has a surface area of 141 ha and dimensions of 1.33 km W-E and 1.8 km N-S. The highest point of the island is 155 m above sea level, and the volcano rises 285 m above the ocean floor.

Iceland is volcanically active because it sits astride the Mid-Atlantic Ridge (MAR), one of the world's most active tectonic boundaries, marking the line of separation of the North American and Eurasian crustal plates. The boundary crosses Iceland from the south-west to the north-east, but its southern part has two branches, the western volcanic zone coinciding with the Reykjanes peninsula, and the eastern volcanic zone traversing the middle-south of the island. Topographically the boundary is represented

by a shallow rift, reflecting tectonic forces which are pulling Iceland apart at a rate of about 2 cm per year. The Vestmannaeyjar volcanic system is located at the southern end of the eastern volcanic zone.

Surtsey has scientific importance because of the detailed records that were kept of the eruption, of the island's subsequent modifications by later geological and geomorphic processes, and of its ongoing colonisation by plants and animals. It is notable as the reference site for colonisation of isolated, sterile ground, continuing ecological and biological development of coastal and marine ecosystems, the dispersion and succession of plants, the colonisation by animals and the interactions between the two. It also gives its name to a particular style of phreatomagmatic eruption ('Surtseyan'), a term now adopted by the international geological community.

Monitoring of the colonisation of the island by plants and animals started in 1964. The first pioneers were seeds carried by ocean currents. Icelandic scientists have identified distinct stages in the slow colonisation of the island. From 1965-1974 the barren lava and tephra deposits were colonised by coastal species adapted to nutrient poor soils and harsh conditions. Moulds, bacteria and fungi were the first life recorded, followed in 1965 by the first vascular plant, sea rocket *Cakile arctica*. By the end of the first decade 12 species of vascular plants had been recorded, 10 of which became established. From 1975-84, several new plant species were discovered, but only one became established. The period 1985-94 saw a further increase in colonists, largely linked to the development of a seagull colony near the south end of the island, where the soils were enriched with guano. Vigorous vegetation succession and improved survival occurred around the colony. By 2004, a total of 60 vascular plants had been recorded, together with 75 bryophytes, 71 lichens and 24 fungi, within four different vegetation communities.

To date 89 species of birds have been recorded on Surtsey (45 seabirds, 44 land birds), of which 12 have bred on the island and 2 have nested. 57 of these bird species breed elsewhere in Iceland, the rest are winter visitors, migrants and vagrants, mainly from Europe. There are also records of 335 species of invertebrates, of which 174 arrived in the first ten years, and many were contributed subsequently by the seagull colony. A point of reference in the developing ecology of Surtsey has been the success of the snow bunting, an insect eater, and the first land bird to breed on the island.

Monitoring of the marine life around Surtsey also began in 1964. Along the shore algae have 60% coverage, but other species are restricted due to the harsh conditions. To date the rocky littoral and hard-bottom sub-littoral zones have revealed 80 species of macroalgae mostly at depths up to 15 m, and 180

benthic animal species mostly below 15 m depth. With respect to mammals, grey seals began breeding in 1983, and it is considered that common seals may also breed on the island. Killer whales (in pods of 3-70 animals), minke whales, harbour porpoises and dolphins are all regularly seen offshore.

3. COMPARISONS WITH OTHER AREAS

There are currently 34 World Heritage properties with evidence of ancient or contemporary (Holocene) volcanism. 20 of these properties contain or are on small islands, of which 10 have been inscribed for their geological values, while the others have been inscribed for their biological or cultural values. IUCN is currently in the process of developing a theme study on volcanoes and volcanic landscapes in response to the need for further guidance in view of the relatively large number of volcanic World Heritage properties.

Surtsey is a monogenetic basaltic volcano that, if it erupted on dry land, would probably have formed a small lava shield surmounted by a scoria (clinker) cone, the most common type of volcanic cone on land. However, because Surtsey formed initially under water, interaction between the magma and the seawater caused the production and explosive expansion of steam, producing a mildly 'phreatomagmatic' or 'hydromagmatic' eruption and a tephra cone. The 1963-67 eruption of Surtsey is important because it drew the attention of the scientific community to the explosive influence of water on the eruption style of otherwise effusive or only mildly explosive eruptions. While other volcanoes in the world are now closely monitored by staff of volcano observatories (e.g., Asama Volcano Observatory, Hawaii Volcano Observatory and Montserrat Volcano Observatory), in all these cases monitoring is primarily focussed on understanding the hazards posed by an existing (large-scale, long-lived) volcano, and none has tracked the evolution of a volcano from its birth. The only other documented record of the birth of a new volcano is of the 1943-52 eruption of Parícutin, Mexico. In general, there are however many examples of volcanoes of different classes and styles which have and are being closely studied.

The eruption style of Surtsey is known internationally as 'Surtseyan' type; however, this is known to be just one style of phreatomagmatic eruptions, which differ in intensity, depending on their geotectonic location and magma chemistry. The type of composite structure that the Surtsey eruption built is known as a tuya, comparable with the table mountains of Iceland and British Columbia, Canada, which are thought to have been built by eruptions from beneath the Pleistocene ice sheet. At the world scale, there are many other Surtseyan-type tephra cones in the geological record, but the eruption sequence, lithology and stratigraphy of the volcanic sediments of only a handful of these

has been examined and compared in any detail (for example, tuff cones and rings such as Seongsan Ilchulbong and Songaksan in the littoral zone of Jeju Island, Korea, or along the west coast of Lanzarote, Canary Islands, Spain). A global review of comparable recent phreatomagmatic eruptions observed in recent history notes 21 Surtseyan-related phreatomagmatic eruptions, of which six involved seawater although Surtsey is noted as the largest.

There have also been innumerable submarine eruptions which have built islands that were subsequently destroyed by the sea (e.g., previous eruptions off the Reykjanes Peninsula, Iceland, in 1211, 1422 and 1783; the 1831 eruption that formed the Graham Shoal, south of Sicily, Italy; and the 1969 eruption that formed the Metis Shoal, Tonga Islands), while there have been other submarine eruptions where the volcanic cone has not broken the surface of the sea (e.g., Kavachi, Solomon Islands; Kick'em Jenny, between Grenada and St Lucia; Loihi seamount, south of Hawaii Island; Fukutoku-Okanoba, near Izu Island, Japan). Nevertheless, none of these have been so meticulously observed and recorded as the Surtsey eruption, which remains a classic in the geological literature.

Beyond the above analysis, comparison with Surtsey is difficult because of questions of scientific definition, scale and poor information. Many of the larger island and/or volcanic World Heritage properties are composite structures, built over a long period of time, and may contain many different volcanic forms, including calderas, pit craters, rift zones, lava tubes, caves, maars, scoria and tephra cones. In any description of a larger oceanic volcano (e.g., Fernandina, Galapagos; Kilauea, Hawaii; Las Cañadas, Tenerife), subsidiary tuff cones are not usually included, even though they are likely to be present in the littoral zone. The description of Jeju Island (Korea) is an exception, however, where Seongsan Ilchulbong represents one of 13 other littoral tuff cones or tuff rings.

Thus, although it has been particularly closely studied, it is clear that as a volcanic property Surtsey is certainly not unique and that properties with comparable geological values are widely distributed and are well represented on the World Heritage List. It is also noted that Surtsey is a small site (less than 2 km across) and is an ephemeral geological feature, whose extent has been reduced considerably by natural processes since the creation of the island. It is anticipated that in 120 years only the palagonite core of the island will remain, i.e. about 30% of its current size.

Surtsey has a more distinctive significance because the process of its biological colonisation has been closely monitored from its birth to the present day. This has not occurred so comprehensively on any other volcano in the world. Evidence from new sterile habitats such as lava and tephra deposits from emergent

volcanoes such as Surtsey have been particularly important in providing evidence of how new land is colonised by life. A global review of the development of new biotas on emergent volcanic islands describes just three cases, including Surtsey, as scientifically significant. The other two being Motmot, Long Island, Papua New Guinea and Anak Krakatau, Indonesia - part of the Ujung Kulon National Park World Heritage property. Along with Surtsey, Anak Krakatau is the most intensely studied emergent volcanic island in the world. It was colonised by plants and animals, probably largely from the neighbouring older islands 1-3 km away, themselves in the process of recovery from the 1883 eruption. An initial biota was eradicated by eruptions in 1952-53, and newer colonisation has constantly been set back by repeated eruptions, including lavas from the 1960s onward. Lava now covers about half of the island. Renewed volcanic activity in the 1990s again set back the colonisation process and its monitoring for some years. However, the level of protection from human influence has not been as complete and consistent as that for Surtsey. Hence, Surtsey has been providing a unique scientific record of the process of colonisation of land by plants, animals and marine organisms. It provides the world with a pristine natural laboratory, free from human interference, and will continue to provide invaluable data on biological colonisation long into the future. No other area of emergent new and sterile land has been so well protected and monitored as a living laboratory.

In conclusion, IUCN considers that the natural values of Surtsey are certainly of international importance; however, the claim for Outstanding Universal Value is much stronger in relation to the demonstration of ecological and biological processes than in relation to the demonstration of volcanic values, which are already well represented on the World Heritage List.

4. INTEGRITY

4.1 Legal status

The nominated property is owned by the Icelandic State and is protected as a Nature Reserve under the Act No. 44/1999 on Nature Conservation. This superseded a previous Act No. 48/1956 on Nature Conservation, according to which Surtsey was gazetted on 19 May 1965, and a subsequently revised Act No. 47/1971 on Nature Conservation. The Municipality of Vestmannaeyjar is the planning authority for the area.

Surtsey falls within the IUCN Protected Area Management Category 1a (Strict Nature Reserve). In January 2006, the boundary of the Surtsey Nature Reserve was expanded to its current position and a revised Declaration of Surtsey Nature Reserve was issued in order to ensure protection of the entire

Surtsey volcanic system above the surface of the sea and underwater, including the craters Jólnir, Syrtlingur and Surtla, together with a surrounding marine area. There are further restrictions in place in relation to fishing and other resource use.

At the larger scale, a large part of the Vestmannaeyjar Archipelago, including Surtsey, is scheduled for protection in Iceland's Nature Conservation Strategy 2004-2008. The reasons for including Vestmannaeyjar are its outstanding seabird populations, together with the archipelago's landscape values and geomorphological features. In addition, the Municipal Plan for Vestmannaeyjar, principally the local development plan, confirms the government's intentions to protect the entire archipelago as a managed nature reserve, while allowing sustainable use of its resources.

4.2 Boundaries

The nominated property includes the whole island (141 ha) and a surrounding marine area (3,230 ha), together representing the strictly protected area of the Surtsey Nature Reserve, and these boundaries are clearly defined and understood. The remaining 3,190 ha of the Surtsey Nature Reserve provide a relatively small but functional marine buffer zone to the nominated property.

4.3 Management

From its creation, Surtsey has been strictly protected and the present state of management is excellent. The supervision of the nature reserve is the responsibility of the Environment and Food Agency through a six member advisory panel which includes representatives from the Agency, the Surtsey Research Society, the Icelandic Institute of Natural History, the Marine Research Institute, and the Municipality of Vestmannaeyjar. By special agreement of the Ministry of Environment, the Surtsey Research Society co-ordinates all research on the island and advises on other activities.

A draft Surtsey Nature Reserve Management Plan covering the period 2007-2017 has been produced and provides a long term vision for management of the Reserve, along with a series of detailed goals and objectives that include the necessary measures for integrated conservation, research, monitoring and interpretation. The Surtsey Research Society receives a small annual sum from the State and in kind support from a range of institutions, although its work is mostly voluntary.

The purpose of strictly prohibiting visits to Surtsey is to ensure that colonisation by plants and animals, biotic succession and the shaping of geological formations will be as natural as possible and that human disruption will be minimised. It is prohibited

to go ashore or dive by the island, to disturb natural features, introduce organisms, minerals and soils or leave waste on the island. Any planned construction on or extraction from the nominated property must have the approval of the Environment and Food Agency and Vestmannaeyjar Municipal Council, on advice from the Surtsey Research Society, although maintenance of the existing helicopter pad and the research society's hut (Palsbaer) is permitted. In addition to these latter two structures, the only other man-made construction on the island is a concrete blockhouse which is the remains of an abandoned lighthouse on the summit of Austerbunki. There are plans to remove this from the island in the near future. In 2006, bottom-towed net fishing was banned in the nominated property, although such fishing is allowed in the buffer zone. Fishing with gill nets, lines and traps are not considered to be a threat and thus are allowed within the nominated property.

The Vestmannaeyjar community also has considerable interest in Surtsey, including as a part of its tourism development programme. Aerial sightseeing and boat tours are available, and Surtsey is also passed by cruise liners en route for Reykjavik. A new Surtsey visitor centre on Heimaey is planned for 2008 and will also provide a base for a new post of permanent Warden for the archipelago.

4.4 Threats and human use

Surtsey is a highly controlled, isolated environment and threats are very limited. Marine debris is an issue that is difficult to control; however, the principal threat is from a possible maritime pollution incident. The main sailing routes between Iceland and Europe pass in the vicinity of the Surtsey Nature Reserve, although larger ships do not usually come close to the island because of difficult sea conditions and limited water depth. The Surtsey Nature Reserve is included within the Icelandic contingency plan for oil pollution incidents and equipment to combat oil pollution is kept at the town of Vestmannaeyjar, with back-up in Reykjavik. By law, ship-wrecks on beaches must be removed by the owner and the Environment and Food Agency can order removal of sunken ships.

In summary IUCN considers that the property meets the necessary conditions of integrity as set out in the Operational Guidelines.

5. APPLICATION OF CRITERIA

The property has been nominated under criteria (viii) and (ix). IUCN considers that the nominated property meets criterion (ix) based on the following assessment:

Criterion (ix): Ecological and biological processes

Surtsey was born as a new volcanic island in 1963-67 and since that time has played a major role in studies of succession and colonisation. It has been the site of one of the few long term studies worldwide on primary succession, providing a unique scientific record of the process of colonisation of land by plants, animals and marine organisms. Not only is it geographically isolated, but it has been legally protected from its birth, providing the world with a pristine natural laboratory, free from human interference. Above all, because of its continuing protection, Surtsey will continue to provide invaluable data on biological colonisation long into the future.

IUCN considers the nominated property meets this criterion.

IUCN considers, however, that the nominated property does not meet criterion (viii) based on the following assessment:

Criterion (viii): Earth's history, geological and geomorphic features and processes

Surtsey is a well known global volcanic site and is one of a small number of volcanoes that has been studied since its creation. However, it is an example of a common phenomenon and there are many comparable sites to Surtsey including properties already inscribed on the World Heritage List. It is also noted that Surtsey is a small site (less than 2 km across) and is an ephemeral geological feature, whose extent has been reduced considerably by natural processes since the creation of the island. It is anticipated that in 120 years only the palagonite core of the island will remain, i.e. about 30% of its current size. Thus its value as a volcanological site is primarily related to its history of study, and taken alone is not sufficient to support a claim of Outstanding Universal Value.

IUCN considers the nominated property does not meet this criterion.

IUCN notes that, in relation to volcanic values, Iceland has a series of other important volcanic sites. Þingvellir is currently inscribed as a cultural property, but also has significant volcanic values, and there are three other volcanic sites on Iceland's Tentative List (Skaftafells, Myvatn-Laxa, and Herdubreidarlindar and Askja) that are located in the country's neovolcanic zone and have associations with the Mid-Atlantic Ridge. IUCN notes that Surtsey might therefore provide an important element in a serial nomination of Icelandic volcanic sites which could be considered further in relation to the application of criterion (viii). Iceland has also been a leading country in the ongoing discussion of the potential for the development of a serial transnational nomination of sites representative

of the significant values of the Mid-Atlantic Ridge, and the values of Surtsey and other Icelandic sites might also be further considered in this context.

6. RECOMMENDATIONS AND STATEMENT OF OUTSTANDING UNIVERSAL VALUE

IUCN recommends that the World Heritage Committee adopt the following decision:

The World Heritage Committee,

1. *Having examined Documents **WHC-08/32.COM/8B** and **WHC-08/32.COM/INF.8B2**,*
2. *Inscribes **Surtsey, Iceland**, on the World Heritage List on the basis of **criterion (ix)**;*
3. *Adopts the following Statement of Outstanding Universal Value:*

Values

Surtsey is a new island formed by volcanic eruptions in 1963-67. It has been legally protected from its birth and provides the world with a pristine natural laboratory. Free from human interference, Surtsey has produced long-term information on the colonisation process of new land by plant and animal life.

Criterion (ix) – Ongoing biological and ecological processes: *Surtsey was born as a new volcanic island in 1963-67 and since that time has played a major role in studies of succession and colonisation. It has been the site of one of the few long term studies worldwide on primary succession, providing a unique scientific record of the process of colonisation of land by plants, animals and marine organisms. Not only is it geographically isolated, but it has been legally protected from its birth, providing the world with a pristine natural laboratory, free from human interference. Above all, because of its continuing protection, Surtsey will continue to provide invaluable data on biological colonisation long into the future.*

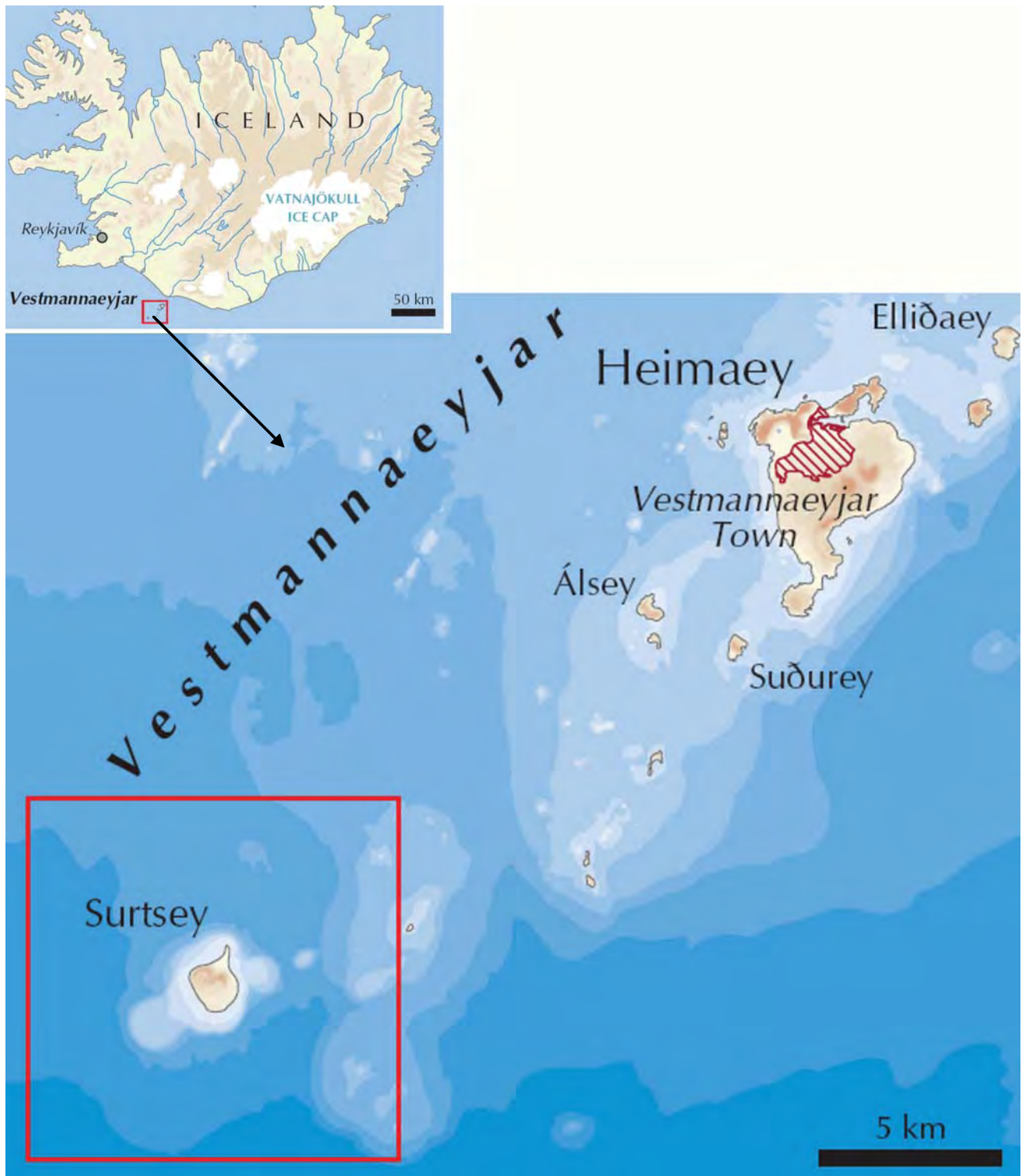
Integrity

The property includes the whole island and an adequate surrounding marine area, and thus all the areas that are essential for the long term conservation of the ecological processes on Surtsey. There is also a relatively small but functional marine buffer zone that is not part of the inscribed property. It is noted that part of the evolution of Surtsey is the process of coastal erosion which has already halved the area of the island and over time is predicted to remove another two thirds leaving only the most resistant core.

Requirements for Protection and Management

Surtsey is a highly controlled, isolated environment and so threats are very limited. The purpose of strictly prohibiting visits to Surtsey is to ensure that colonisation by plants and animals, biotic succession and the shaping of geological formations will be as natural as possible and that human disruption will be minimised. It is prohibited to go ashore or dive by the island, to disturb the natural features, introduce organisms, minerals and soils or leave waste on the island. Nearby construction is also strictly controlled. The most significant management issue will be to retain the level of control and protection from human influence that has characterised the protective history of Surtsey. It is noted that, as an island ecosystem, there is the potential for human disturbance and pollution from a very wide area. Contingency planning, for example for oil spills, is required for the property and its wider surroundings. Given the lack of access a creative and positive approach to presenting the property will be required to ensure that visitors are able to appreciate, but not disturb, its values.

4. *Recommends the State Party to give consideration to a serial re-nomination and extension of Surtsey in relation to its geological values (criterion viii) to include a suite of sites that represents the great variety of unique geological features that are characteristic of tectonic plate margin separation. This could potentially be developed in the context of a serial nomination related to the Mid-Atlantic Ridge, or as a serial nomination within Iceland which might include volcanic properties on Iceland's Tentative List, and the potential recognition of the significant geological values of Þingvellir National Park, a World Heritage property currently recognised only for its cultural values.*

Map 1: Location of the nominated property

Map 2: Boundaries of the nominated property

Surtsey – Nominated Area

Map of Surtsey, showing boundaries of the nominated area (red line) and buffer zone (black line).

