

Volcanoes and Tourism

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Chapter Outline

1. What is Volcano Tourism?	1296	4. Volcanic Eruptions—Unique Tourist Experiences	1305
2. Volcanoes in History, Culture, and Religion	1296	4.1. Eruptive Activity—Awe-Inspiring Attractions	1306
2.1. Mythology and Mountain Spirits	1298	5. Activities in Volcanic Environments	1307
2.2. Volcanic Hot Springs and Their Cultural Significance	1300	5.1. Recreation and Volcanoes	1308
2.3. The Health and Wellness Benefits of Volcanic Hot Springs	1300	5.2. Volcanic Disaster Tourism	1309
3. Volcanic National Parks, Geoparks, and World Heritage Sites	1302	5.3. Potential Dangers and Visitor Safety	1309
3.1. Protected Sites and Their Educational Value	1305	5.4. Personal Risk Acceptance and Emergency Situations	1310
		6. Summary	1310
		Further Reading	1310

GLOSSARY

volcanic hazards The risk to life and property from volcanic activity, which includes eruptions, ash fall, gas emissions and toxic fumes, lahars and mudflows, lava flows and pyroclastic flows, extreme hot springs, and other geothermal features such as geysers and fumarolic vents.

volcanic heritage Active and dormant areas included in national parks and other protected sites to provide controlled access and to minimize environmental impact. Remnant volcanic landforms and their unique features are increasingly preserved as natural heritage for future generations.

volcanic risk management Identification, assessment, and implementation of suitable strategies to minimize the potential for accidents and injuries. It should include education of tourists about the potential hazards from volcanic activity and how to stay safe.

volcanic springs In a health and wellness tourism context, natural volcanic and nonvolcanic hot springs are used for therapeutic benefits based on their mineral content. Volcanic hot springs such as geysers are also tourist attractions for their visual appeal.

volcano tourism The exploration and study of active volcanic and geothermal landforms. Volcano tourism also includes visits to dormant and extinct volcanic regions where remnants of activity attract visitors interested in geological heritage (Erfurt-Cooper, 2010).

Active and dormant volcanoes provide a valuable natural resource for various tourism sectors, including geotourism, adventure tourism, and ecotourism. Destination development in many countries and regions has profited from the close proximity of volcanoes and geothermal springs with historical links to hot spring spa tourism or thermal tourism. Volcanic regions are major tourist destinations that are visited by people of all age-groups for a variety of reasons. These can include plain curiosity, a scientific interest in volcanoes, the ambition to climb a volcano, taking photos, or just visiting as part of a guided tour. The interesting combination of volcanic attractions and geothermal phenomena presents visitors with an experience of scenic beauty in close contact with nature while learning about the surrounding geodiversity.

1. WHAT IS VOLCANO TOURISM?

With over 1500 volcanoes classed as active worldwide, (Siebert et al., 2011) for many regions **volcano tourism** represents an opportunity to gain independence from changing seasons and climate, as well as an economic advantage. Volcanoes in Japan, for example, are marketed with a special focus on each of the four seasons to encourage repeat visits, e.g., skiing in winter and hiking the same mountain in summer. The development of tourism, including volcano tourism, has evolved from a minority activity of the elite in the eighteenth century into the mass tourism we see today. A global tourism boom, a major consequence of the economy of the 1990s, has continued into our current millennium, despite a brief interruption during the global financial crisis in 2009, when many other economies failed. The last two decades of the twentieth century have seen a strong trend towards nature-based tourism with a focus on ecotourism, geotourism, and adventure travel, generating infrastructure development and economic profits at many destinations. The focus of global tourism destinations has shifted from Europe toward East Asia and the Pacific Region, as people travel farther than in the past. The total economic contribution of travel and tourism during 2012 was USD\$6.6 trillion, supporting 260 million jobs worldwide, either directly in the tourism industry or in related sectors (e.g., air travel, accommodation, service industry). The future outlook for tourism is optimistic based on an average annual growth of 3.4% during the 10-year period from 2000 to 2010 (World Travel & Tourism Council, 2013).

Geotourism is a fast-growing sector within the nature-based tourism industry and takes place in some of the world's most spectacular volcanic regions. In the seventeenth and eighteenth centuries, the northern European aristocracy visited Vesuvius and Etna as part of the Grand Tour. Today, people from all social classes visit volcanic regions for their scenery and for their educational, ecological, and adventurous aspects. And while volcanic geotourism has continued to draw visitors to Vesuvius, Mt St Helens, or Fuji, lesser known volcanic destinations such as Ethiopia, Comoros, Reunion, Vanuatu, and Kamchatka have become increasingly popular and easier to access. To save their geological heritage, many nations protect their unique volcanic tourist attractions for future generations in national parks, geoparks, and World Heritage sites.

Presently, between 450 and 500 million people live within close proximity to volcanoes classed as active. Millions of visitors every year spend time near active volcanoes; sometimes not aware of any potential danger while they learn about these fascinating natural wonders. Large cities in the neighborhood of active volcanoes include Naples in Italy (Vesuvius), Tokyo in Japan (Fuji), Mexico City (Popocatepetl), Jogjakarta in Indonesia (Merapi),

Manila in the Philippines (Pinatubo), Seattle in Washington, USA (Mt Rainier), Nagasaki and Kagoshima in Japan (Unzen and Sakurajima), Goma in the Democratic Republic of Congo (Nyiragongo), Auckland in New Zealand (Auckland Volcanic Fields), as well as numerous others (Erfurt-Cooper, 2014). While some of these volcanoes may have entered a quiet phase, most of them have the potential to add to their record of destructive activity in the future. However, significant progress was made in monitoring volcanoes for signs of unrest over the last three decades. Many locations are now able to communicate to residents and visitors whether eruptive activity is imminent.

2. VOLCANOES IN HISTORY, CULTURE, AND RELIGION

Visiting places of interest dates back to the first pilgrims and the documentation of their journeys. Since then tourism has developed with the advancement of technology and the increasing amount of information available. Historically, the Romans, besides engaging in extensive and well-documented "military travel", used volcanic locations such as the Campi Flegrei and the island of Ischia for recreation because of their preference for natural hot springs. Roman scholars documented all destinations they "visited" most accurately, thereby providing information for posterity.

It was in Europe, particularly in Great Britain, that the tourist industry was invented, refined, and developed as the Grand Tour for the young, well-educated, and wealthy members of the elite. The Grand Tour had its onset around 1660, but increased considerably in the 1760s. At the heart of the Grand Tour was Italy with Naples and Vesuvius as a main attraction. Excursions to the archaeological excavations of Pompeii and Herculaneum began in 1755 and 1738, respectively, while adventurous visitors climbed Vesuvius to see the "fireworks" up close. From the Grand Tour, travel developed with further industrialization and enhanced transportation, particularly the advance of the railways, as well as the growth of an increasingly leisured middle class. These changes in travel and transportation lead to a great leap forward in tourism. In England, Thomas Cook started tours for the masses in 1841 and to Europe in 1855, marking the beginning of mass tourism (Whitey, 1997). Cook was aware of the attraction of volcanoes for tourists and by 1864 he was arranging tours to Pompeii and Vesuvius (Figure 75.1).

In an attempt to further develop volcano tourism, Cook acquired the Vesuvius Railway (Funicolare) that took tourists directly up to the volcano (Figure 75.2). This presented serious competition to the local guides and porters who had earned a living by carrying people to the top in sedan chairs. In protest they damaged the railway, threw the carriages down the volcano, and set fire to the station. Cook



FIGURE 75.1 Nineteenth-century tourists visiting Vesuvius had three choices. Either they could walk, be carried to the crater rim in a chair (left), or be dragged with a rope by Neapolitan porters (right). Woodcuts from *The Illustrated London News*, 1872.

overcame these initial problems and convinced the local porters to allow the railway to operate peacefully while profiting in other ways from the tourists who used it. Over the centuries, the funicular railway was destroyed by lava flows three times, and after the damage from the eruption in 1944 it was not rebuilt again. In its place a chairlift was constructed to carry tourists up to the crater rim, which is also no longer operating. Visitors today have to walk up to the crater rim and visualize the events of the past. The increasing knowledge available online provides access to the original footage from the 1944 eruption, an amazing video that lends a perspective to this major eruption of Vesuvius (Vesuvius Eruption, 1944).

Documentaries, books, and movies about the unleashed natural forces of volcanoes have also contributed to the growing interest in famous volcanic destinations such as

Pompeii and Herculaneum (Italy), Yellowstone and Mt St Helens (United States), and Krakatau (Indonesia). Prior to the eruption of Krakatau in 1883, visitors were already fascinated by spectacular displays of smaller eruptive events of the mountain with many observations documented in writing. Today tour groups and individual travelers can visit Anak Krakatau, the new mountain that is replacing the original volcano. Around the same time as the Grand Tour era in Europe, Iceland's volcanic landscapes and the original Geysir in Haukadalur were already visited by tourists.

Times have certainly changed since the turn of the last century, when Englishman Tempest Anderson, a photographer and amateur volcanologist, spent two decades exploring volcanic regions, including Vesuvius, Etna, Lipari Isles, Auvergne, Eifel, Canaries, and Iceland, as well as numerous volcanoes of the Cascades and Yellowstone. In May 1902, when La Soufrière (St. Vincent) and Mont Pelée (Martinique) erupted in the Lesser Antilles, Anderson recorded these events in pictures and gave lectures about his journeys. His published work includes a volume with photographs of volcanic features (Anderson, 1903) and some of his publications about volcanic history have been reprinted recently (*Volcanic Studies in Many Lands*, 2009).

Volcanic eruptions (Table 75.1) are generally accompanied by change, both good and bad. In Japan, eruptions of Mt Unzen (1991–1995) have caused significant new developments for tourism, including infrastructure such as volcano museums and memorial sites for public education (Figure 75.3). Equally, the eruption of Mt St Helens in 1980 launched a new era of tourism in volcanic environments in the years following the event. In Iceland, a growing demand by visitors for information about the eruption of Eyjafjallajökull in 2010 brought about the establishment of a volcano museum (*Þorvaldseyri*) close to the eruption site.

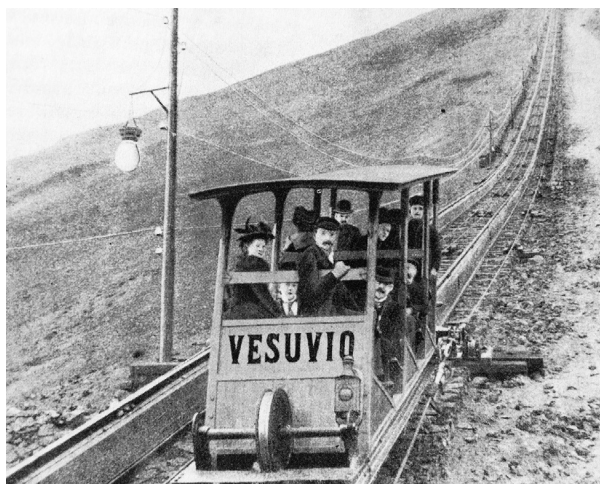


FIGURE 75.2 In 1880, the Thomas Cook Company opened the Funicolare to the top of Vesuvius, an event that transformed tourism to Vesuvius and put many of the volcano's guides out of work.

TABLE 75.1 Historic Volcanic Eruptions

Chaitén, Chile (2008)	Unzen, Japan (1663, 1690, 1792, 1990–1995, 1996)
Puyehue-Cordón Caulle, Chile (2011)	Usu, Japan (1663, 1769, 1822, 1853, 1943, 1977, 2000)
Nevado del Ruiz, Colombia (1985)	Mont Pelée, Martinique (1851, 1902, 1929)
Arenal, Costa Rica (1968, 1988, 1993, 2000, 2010)	Soufriere Hills, Montserrat (1995, 2009, 2010)
Nyiragongo, Democratic Republic of the Congo (1877, 2002)	Ruapehu, New Zealand (1881, 1895, 1945, 1953, 1995, 2007)
Cotopaxi, Ecuador (1744, 1877, 1907)	Taranaki (Egmont), New Zealand (1655)
Santorini, Greece (1610, 1650, 1866, 1950)	Tarawera (Okataina), New Zealand (1310, 1886)
Santa Maria, Guatemala (1902, 2008, 2011, 2013)	Taupo, New Zealand (c.1800 years ago or AD 200)
Askja, Iceland (1875, 1921, 1926, 1961)	Mayon, Philippines (1814, 1897, 1968, 2006, 2009, 2010, 2013)
Eyjafjallajökull, Iceland (1612, 1821, 2010)	Pinatubo, Philippines (1450, 1991)
Grimsvötn, Iceland (1783, 1903, 1983, 1996, 1998, 2004, 2011)	Taal, Philippines (1716, 1749, 1754, 1965, 1977)
Hekla, Iceland (1554, 1766, 1845, 1947, 2000)	Colima, Mexico (1622, 1818, 1890, 1913, 1975)
Krafla, Iceland (1975, 1984)	El Chichón, Mexico (1982)
Laki, Iceland (1783–1785)	Popocatepetl, Mexico (1994, ongoing activity)
Agung, Bali, Indonesia (1808, 1943, 1963)	Bezymianny, Kamchatka, Russia (1956, 1997, 2012, ongoing activity)
Kelud, Indonesia (1586, 1641, 1826, 1919, 1956, 1961, 1990, 2008)	Shiveluch, Kamchatka, Russia (1944, 1990, 1999, 2005, 2010)
Krakatau, Indonesia (1883, 1999, 2009, 2010, 2011, 2012)	La Soufriere, Saint Vincent (1902, 1979)
Merapi, Indonesia (1822, 1872, 1961, 2001, 2006, 2010)	Kilauea, Hawai'i, USA (1983 to present)
Tambora, Indonesia (1812–1815, 1880)	Augustine Volcano, Alaska, USA (1883, 1976, 1986, 2006)
Etna, Italy (2012, ongoing activity)	Novarupta, Alaska Peninsula, USA (1912)
Vesuvius, Italy (AD 79, 1875, 1944)	Redoubt Volcano, Alaska, USA (1902, 1967, 1989, 2009)
Fuji, Japan (1560, 1700, 1707)	Mt St Helens, USA (1480, 1482, 1800, 1980)
Sakurajima, Japan (1471, 1779, 1914, ongoing activity)	

The table shows examples of eruptions from the last 2000 years. Some volcanoes erupt on a daily basis for years (Sakurajima, Japan), others erupt frequently (Etna, Italy), and some reawaken after several thousand years of quiescence (Chaitén, Chile) and surprise the world.

2.1. Mythology and Mountain Spirits

Volcanoes have a fixed place in many cultural and religious practices. Vulcan was worshiped by the Romans as their god of fire and Pele to this day is considered by many people as the goddess of fire, and features in traditional



FIGURE 75.3 The Unzen Disaster Memorial Hall complex (Gama-das Dome) includes a volcanic rock garden; a geopark information center; a library, museum shop, and restaurant; conference facilities; and, most importantly, the volcano museum showcasing the Unzen eruption and its aftermath in great detail. The monument in the foreground reflects the “power of the universe.” Photo: P. Erfurt-Cooper.

Hawai’ian legends. Ancient mythologies claim volcanic craters as entrances to the underworld; a world where deities and demons dwell. Hence, volcanoes were worshiped and sacrifices were offered to appease the fiery mountain spirits. The practice of sacrificial offerings is still maintained in Indonesia, Japan, Hawai’i, and several other countries, although the rather ineffective custom of human sacrifice is fortunately no longer acceptable. Appeasement ceremonies in Indonesia include processions to active craters lead by a priest in charge with offerings carried up the mountain. The gifts include flowers, money, live animals, and food items and in some regions have become an event for tourists. Mt Merapi, for example, is an additional attraction for tourists who visit the World Heritage listed Borobudur Temple, close to Jogjakarta on the Indonesian Island of Java.

The list of volcanoes, taking into account ancient remnants of volcanism, that feature in legends and mythology is long. Some examples include Mayon (Philippines), Popocatepetl and Ixtaccíhuatl (Mexico), Etna in Sicily (Italy), Fuji (Japan), Crater Lake in Oregon (USA), Tongariro, Tarawera, and Ruapehu (New Zealand), Glass House Mountains, Seven Sisters, and Mt Warning (Australia), Hekla and Katla (Iceland), Giant’s Causeway (Ireland), Arthur’s Seat (Scotland), and Poás and Arenal (Costa Rica). There are many more volcanoes, both active and dormant, that are intricately connected to cultural and religious traditions worldwide with enough legends to fill several books.

In Japan, volcano tourism involves the acknowledgment of different mountain spirits, and shrines can be found all over the countryside. Torii gates, a common sight, lead to places of worship on mountain sides and volcanic hot springs throughout Japan (Figure 75.4). The city of Beppu on Kyushu Island (Japan) is famous for its over 4000 hot



FIGURE 75.4 An old stone Torii gate leads to a shrine near the summit of Mt Unzen. Photo: P. Erfurt-Cooper.

springs and onsen resorts. A unique attraction for Beppu's visitors are the **jigoku**, which means hell in Japanese. The "jigoku meguri" is a tour or pilgrimage to individual small geoparks showcasing different types of geothermal phenomena. Here visitors can observe boiling lakes of different colors, gushing geysers, bubbling mud ponds, small mud volcanoes, and hissing steam vents (Figure 75.5). While for foreign visitors this "pilgrimage" is not necessarily religious, for Japanese tourists each "hell" has several shrines for prayer (Figure 75.6). Jigoku are also a common tourist attraction in other active volcanic areas in Japan.

New Zealand's ancient mythology has its own interpretation of volcanoes and their creation. For the Māori, volcanic landscapes are of special cultural and spiritual significance, and the peaks of the mountains are considered sacred. According to their belief, some of New Zealand's volcanoes including Tongariro, Taranaki, Ngauruhoe, and Ruapehu were once warriors and gods who fought with each other, using volcanic eruptions and earthquakes.



FIGURE 75.5 At the geothermal park Umi Jigoku in Beppu a boiling hot spring is feeding a rock pool with terracotta colored water. Photo: P. Erfurt-Cooper.



FIGURE 75.6 Torii Gates at the Umi Jigoku are leading to a small shrine. The turquoise pond in the foreground is a crater lake, which emerged after a volcanic explosion 1200 years ago. Photo: P. Erfurt-Cooper.

Other legends state that the volcanoes were created by fire sent from heaven. In 1993, the Tongariro National Park was listed as a World Heritage site because of the cultural and religious significance of the mountains for the Māori people and their spiritual connection to the natural environment.

Another significant destination for volcano connoisseurs is the Snæfellsjökull National Park in the west of Iceland. Snæfells, a stratovolcano, has historically been linked to the book *Journey to the Center of the Earth* by the French author Jules Verne, who chose this volcano as the entrance to the underworld. Visitor and heritage centers throughout the region provide information about the geology and cultural history of the Snæfellsjökull National Park. According to legend, the nearby located volcanic mountain Stapafell (Figure 75.7) is home to the "hidden



FIGURE 75.7 Stapafell (526 m), an eroded mount of palagonite in the Snæfells National Park. Photo: P. Erfurt-Cooper.

people” or elves that feature in folk tales throughout Iceland. Other volcanoes associated with legends include Katla, Askja, Hekla, and Laki, all commonly linked to the gates of hell and to meeting places for witches, trolls, and demons.

2.2. Volcanic Hot Springs and Their Cultural Significance

Volcanic hot springs have a tradition as centers of cultural activity and socializing in many countries. The significance of such springs in a spiritual (cultural) sense stems from the belief that natural springs are divine gifts to human beings for the purpose of purification and renewal, which must be honored and worshiped. In countries such as Iceland, hot spring water has on occasion been used for baptism since the introduction of Christianity. Today, hotels and guesthouses in Iceland offer their visitors hot tubs and outdoor baths fed by local hot springs (e.g., Viking Pool in Leirubakki with Mt Hekla in the background), and spiritual significance is purely personal to the individual tourist.

Many other volcanic areas offer tourists the experience of volcanic hot springs; especially health resorts and spas are taking full advantage of the cultural significance of this natural phenomenon. Japanese hot spring resorts (Onsen) have maintained a time-honored atmosphere for centuries, based on a distinct preference for authentic hot spring water. The close cultural and historical connection of active volcanoes with social cohesion and recreation in Japan has provided a sustainable foundation for the tourism industry. Over 90% of tourists in Japan are of domestic origin, and visitors from other prefectures usually combine onsen tourism with visits to the nearby volcanic attractions. For the Japanese people the famous Mt Fuji (Figure 75.8) has immense cultural and spiritual significance, which was officially recognized by the



FIGURE 75.8 During a short climbing season of only 2 months during summer around 300,000 people hike up Mt Fuji (3776 m).
Photo: P. Erfurt-Cooper.

UNESCO in 2013 by awarding World Heritage status. More than 100 million people visit the area around Mt Fuji every year throughout the four seasons. The threat of a possible future eruption has not affected tourism in the large Fuji–Hakone–Izu National Park or in the many resort towns located around Mt Fuji.

Japan with over 20,000 hot springs of volcanic origin attracts over 150 million predominantly domestic visitors every year. Resorts and health clinics are built in close proximity to the natural springs, which have been used for centuries to improve health and provide relaxation after work. Traditional onsen resorts in quiet rural settings with a reputation as pleasant, peaceful, and healthy getaways are highly sought after and can be found in historical onsen towns such as Toyako, Yufuin and Kusatsu. Each of these locations is located close to a volcano that offers attractive activities like hiking, climbing, crater viewing, and skiing. Apart from supplying health spas with natural hot spring water, many areas in Japan have established geothermal parks or jigoku that feature various types of geothermal phenomena, where visitors are offered warm foot and hand spas, as well as various types of food cooked over steam vents.

Turkey is another country with an immense **volcanic heritage** that includes an abundance of hot springs, which have a long history of being used for health purposes. Between 1680 and 1193 BC, the Hittite Empire is said to have used natural hot springs for recreation and therapeutic treatments (Özgüler & Kasap, 1999). Today, approximately 1300–1500 volcanic hot springs are used for health and wellness tourism in over 700 areas throughout Turkey. One rather unusual hot spring though has only a mythological attraction; the **Plutonium** at the ancient city of Hierapolis (above the travertine terraces of Pamukkale) in Turkey’s southwest, is a sacred cave, which is located among the ruins of the city. Here the Roman god Pluto is said to have entered the underworld domain. Undoubtedly, toxic fumes and the volcanic origin of this hot spring have contributed to the mythology and “sacredness” of the Plutonium. To prevent people from entering the cave the entrance was closed a long time ago, leaving only a small opening (Figure 75.9).

Extensive research into the cultural use of geothermal resources has shown that most countries with volcanic hot springs are using them successfully as unique tourist attractions and as a foundation for sustainable destination development (Erfurt-Cooper & Cooper, 2010).

2.3. The Health and Wellness Benefits of Volcanic Hot Springs

The key geological processes causing the natural discharge of hot springs involve the rise of water to the surface from unconfined aquifers, assisted by pressure, friction, and the



FIGURE 75.9 The Plutonium, also known as “gate to hell,” is connected to a cave below, where toxic fumes are said to have poisoned people and animals in the past. While the sound of gushing water can be heard, no toxic fumes were experienced during research on site. Photo: P. Erfurt-Cooper.

geothermal temperature gradient while passing through faults and fissures. In areas with volcanic activity the water temperature increases through circulation close to magma reservoirs below the surface and can reach boiling point or even flash into steam, causing geyser eruptions (Figure 75.10).

Volcanic hot springs are highly mineralized due to increased water temperatures dissolving the surrounding host rock, thereby releasing high concentrations of minerals and trace elements into the rising spring water. The amount of dissolved minerals is influenced by the flow rate, flow path, and length of time the water is in contact with the surrounding rock. Other factors affecting the mineral concentration include the type of rocks the water passes



FIGURE 75.10 Litli Geysir is located close to the original great Geysir (Iceland), which only infrequently sends up giant spouts of boiling water. Today’s crowd pleaser is Strokkur, which erupts every few minutes. Photo: P. Erfurt-Cooper.

through as well as the possible addition of seawater, if near an ocean, or the quality of the recharge water (see Chapters 46 and 71 for more details).

The benefits of volcanic hot springs for health and wellness from their mineral content have been known in many countries for several thousand years. Often referred to as “medicinal waters,” these natural resources are traditionally linked to health improvements. Based on their unique properties and their occurrence worldwide, hot springs are a major resource in health and spa tourism in many countries. Ongoing research by scientists in Asia, Oceania, and Europe (e.g., Taiwan, Japan, France, Germany, and New Zealand) confirms the benefits of minerals and trace elements in assisting the healing process and rehabilitation of a large number of health conditions. The curative effect is said to be directly related to the ability of the human body to absorb minerals and metallic trace elements contained in the hot spring water (Erfurt-Cooper, 2012; Ghersetich and Lotti, 1996).

Even dormant volcanic regions such as the Auvergne (France) and the Vulkaneifel (Germany) are rich in volcanic hot springs, which have been utilized as health and wellness destinations since the Romans built the first thermal baths. In the Auvergne, approximately 100 dormant volcanoes provide the heat source for 109 hot springs, including the spa town Vichy. In the Vulkaneifel, also referred to as a “therapeutic landscape,” the Romans already used the volcanic hot springs 2000 years ago to relax after battle. Other examples of European hot spring destinations include Budapest (Hungary) and Ischia (Italy), both destinations also popular with the Romans. During their occupation of various Mediterranean countries the Romans established hot spring baths wherever they discovered geothermal resources. The volcanic heritage of Greece, Turkey, the Middle East, and several north African countries has left a legacy of countless historical hot springs that are still used as tourist destinations today.

Long after the Romans, in the eighteenth century Sir William Hamilton used to ride from Naples to La Solfatara to enjoy the hot spring baths. Destinations such as the mud baths in nearby Ischia and Vulcano in the Aeolian Islands have remained popular to this day and have kept their reputation of fulfilling the needs of health-conscious visitors who are seeking cures and restoration.

The use of volcanic hot springs for healing purposes was practiced by the native Indian tribes of America who were aware of the beneficial mineral content and considered sites with volcanic hot springs as sacred and neutral ground. In Mexico the Aztecs enjoyed hot springs (e.g., Agua Hedionda) for medicinal reasons as did the Maya in Central America and the Incas of Peru. In Oregon the Modoc Indians used Klamath Hot Springs for bathing and to build sweat huts (Theodoratus et al., 1990), while Shoshone Indians believed in the healing powers of the hot

springs of Yellowstone. In Costa Rica, the Tabacon thermal spa resort claims to have the perfect combination of water volume, temperature, and mineral content for health purposes with attractions such as steaming waterfalls and thermal pools heated by Arenal's magma chamber.

The therapeutic use of volcanic hot springs in New Zealand also has a very long social and cultural history. For centuries the Māori traveled to Waiwera just north of Auckland, to heal themselves in the therapeutic warm waters. The Māori as well as the European settlers would dig holes along the beach and soak in the hot springs that seeped through the sand. Volcanic valleys, geothermal wonderlands, and hot spring spas are the main attractions of Rotorua (New Zealand), a city that is known for its rather unpleasant sulfur smell but still attracts over three million visitors every year. The city's Queen Elizabeth Hospital has a long tradition of using hot springs and volcanic mud for health treatments and rehabilitation. The Polynesian Spa offers therapies based on Rotorua's hot springs and thermal mud with 26 pools at different temperatures and mineral compositions. At "Hells Gate," one of the geothermal nature parks near Rotorua, again reference is made to the underworld. In addition to its visual "hellish" attractions, the park also operates a health spa with hot spring pools and mud baths.

Very similar to New Zealand, Iceland's abundance of volcanic hot springs has been used for tourism, as well as domestic and industrial purposes since the early 20th century. In Hveragerði, the NLFÍ Spa and Medical Clinic specializes in rehabilitation after accident or illness using mud from the local hot springs. The Blue Lagoon (Figure 75.11) is one of Iceland's most visited destinations and has a reputation for effectively treating psoriasis and other health conditions. This popular geothermal spa is located between Keflavik and Reykjavik, directly next to the Svartsengi geothermal power station. This makes the large lagoon, which is fed by surplus geothermal water from the power plant, a truly unique attraction, although the



FIGURE 75.11 The Blue Lagoon is a major stopover for tourists between the international airport in Keflavik and the capital Reykjavik. Photo: P. Erfurt-Cooper.

Mývatn Nature Baths in Iceland's northeast are a similar tourist destination.

Taiwan also has an established health tourism industry, based on more than 130 hot springs originating from the Datun volcano group, an active volcanic system, with the highest concentration of springs found in the north of the island. While this is not volcano tourism as such, the natural resources originate from volcanic activity and have provided not just health benefits but also economic advantages through a booming hot spring tourism industry. The Datun volcano group is part of the cultural and natural landscape of the Yangmingshan National Park, where visitors can hike the multipeak trail or the Datun Nature Park trail. Nearby, the Beitou District north of Taipei City has developed into a famous hot spring destination with over 30 resorts, where local and international visitors enjoy the many volcanic hot springs. A former public bath house, which was established in 1913 under Japanese rule, is now a "Hot Spring Museum."

3. VOLCANIC NATIONAL PARKS, GEOPARKS, AND WORLD HERITAGE SITES

Volcanic regions throughout the world have been designated as protected sites such as National Parks, Geoparks, and World Heritage listed areas. Other conservation settings include National Heritage Areas, National Landscapes (Australia), Quasi National Parks and Prefectural Parks (Japan), National Geoparks or State Parks, Global Geoparks, Volcanic Island Reserves, and private properties. Unlike national parks, geoparks are a rather new entity (Table 75.2). They frequently include a number of national parks and other protected sites within their boundaries, as well as townships and other urban areas. Currently China has the highest number of global geoparks (27 areas officially recognized by UNESCO) with several of them containing volcanic heritage.

More common however are national parks with the first park in the world created in 1872, when the spectacular geologic and natural wonders of the Yellowstone caldera were protected for future generations. In Japan, the first 12 national parks were established between 1934 and 1936 and included the volcanic areas of Unzen, Kirishima, and Aso in Kyushu, as well as Akan and Daisetsusan in Hokkaido. In effect, 11 of the initial 12 Japanese national parks were created around volcanoes such as Fuji-Hakone, Towada, Yoshino-Kumano, Daisen, Nikko, and the Japanese Alps. National parks are also frequently included in World Heritage listed areas as preexisting protected sites of outstanding value.

In comparison, the Vesuvius National Park in Italy was only established in 1995 and the French Réunion National

TABLE 75.2 Volcanic National and Global Geoparks**Active**

Katla Geopark, **Iceland**
 Batur Global Geopark, **Indonesia**
 Toya Caldera and Usu Volcano Global Geopark, **Japan**
 Unzen Volcanic Geopark, **Japan**
 Aso Geopark, **Japan**
 Azores Geopark, **Portugal**

Dormant or Extinct

Shimonita Geopark, **Japan**
 Itoigawa Global Geopark, **Japan**
 Yehliu Geopark, **Taiwan**
 Shishan Volcanic Geopark, Hainan, **China**
 Tengchong Volcanic Global Geopark, **China**
 Wudalianchi Geopark, **China**
 Hexigten Geopark, **China**
 Sai Kung Volcanic Rock Region, Hongkong, **China**
 Vulkaneifel Geopark, **Germany**
 Jeju Island Geopark, **Korea**
 Magma Geopark, **Norway**
 Shetland Geopark, **UK**
 Lochaber Geopark, **UK**
 Bohemian Paradise Geopark, **Czech Republic**
 Kanawinka Geopark, **Australia**
 Geopark Shetland, **UK**

Active and dormant volcanic areas are included in geoparks, either on a national basis, incorporated in the European Geoparks Network or as a Global Geopark.

Park in the southern Indian Ocean was established in 2007. France has also set up a number of “regional natural parks,” one of which includes the volcanoes of the Auvergne (Parc Naturel Régional des Volcans d’Auvergne) and dates back to 1977. Turkey’s extensive volcanic heritage is protected in national parks including Mt Nemrut and Göreme/Cappadocia, which are also listed as World Heritage sites based on their unique landscape and rock formations.

In fact, most volcanoes worldwide, whether dormant or active, are located in protected areas. The legendary Krakatau, which erupted in 1883 and destroyed itself in the process, created a large caldera in the Sunda Strait between Sumatra and Java. Today the Krakatau Nature Reserve is part of the Ujung Kulon National Park, which is also inscribed as a World Heritage site. The growing vent of Anak Krakatau (Child of Krakatau) maintains its reputation as a potentially dangerous mountain, which nonetheless attracts volcano tourists who can join special tours. However, access to the volcano itself depends on the state and level of its activity.

In the Iranian Alborz Mountains north of Tehran the volcano Damavand (5671 m) is the highest peak in the Middle East. Although there are no recent recorded eruptions of Mt Damavand, the volcano is classed as potentially active with numerous hot springs and fumaroles on the



FIGURE 75.12 Mt Damavand in northern Iran is a popular tourist destination, although climbing requires several days and special equipment to cope with extreme temperatures at higher elevations. Photo: P. Erfurt-Cooper.

mountain sides. In 2008, Damavand was placed on the tentative UNESCO World Heritage list and one year later was registered as a national heritage site to protect the unique landscape and ecology, as well as the natural resources of the region (Figure 75.12). According to ancient stone reliefs the volcano was used by Persian kings for recreational purposes including climbing and hunting (Vafadari, 2010). Today trekking and climbing tours are promoted online for groups (beginner to advanced) and led by experienced mountain guides.

In Asian countries like Indonesia and the Philippines, volcanoes have become major tourist attractions. Indonesia is a volcanic island arc with close to 130 active volcanoes. Mt Merapi on the island of Java is especially worth mentioning because this active volcano is promoted as a tourist destination despite an eruption history that has claimed thousands of lives. However, the close location of Merapi to the World Heritage site of Borobudur makes it a popular destination, activity status permitting. On the Indonesian island of Bali, volcano tourism includes climbing Mt Batur in the early hours of the morning to watch the sunrise as a worthwhile adventure (Figure 75.13). Although accidents happen occasionally as mentioned by local tour guides, the geodiversity of Bali’s volcanoes presents an enormous potential for the local tourism industry. In fact, so enormous that in 2012, the geological heritage of the Mt Batur caldera was officially recognized as a UNESCO Global Geopark.

On the African continent, particularly in the Great Rift Valley, volcanoes are included in national parks and other protected areas. The Virunga National Park (Mt Nyiragongo) is World Heritage listed and the Ngorongoro Crater (Tanzania) is a conservation area. Other protected volcanic sites include Mount Kenya National

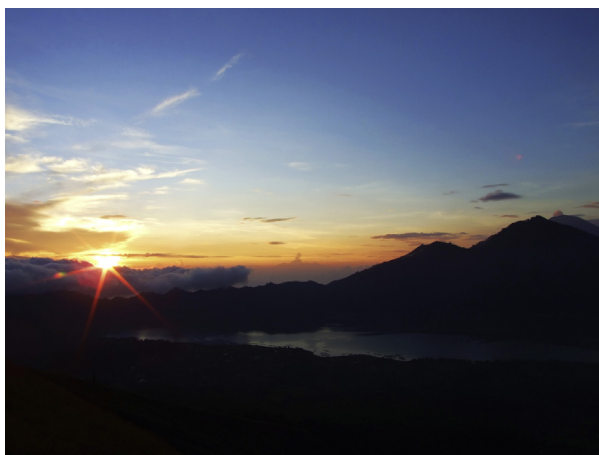


FIGURE 75.13 On the Indonesian island of Bali “sunrise trekking” to the summit of Mt Batur is part of the popular day tours. Tourists can see the sunrise above Lake Batur with Mt Abang and Mt Agung to the right. In the middle distance, Mt Rinjani (Lombok Island) was erupting together with the sunrise, making it a very special experience. *Photo: P. Erfurt-Cooper.*

Park and Meru National Park (Kenya), Volcans National Park (Rwanda), Kilimanjaro National Park (Tanzania), Rwenzori National Park (Uganda), Mount Cameroon National Park (Cameroon), and the Fogo National Park on the Cape Verde Islands.

Apart from the famous Yellowstone, the United States offers a wide range of volcanic national parks. The entire west coast with the Cascades mountain range has been recognized as a unique volcanic area, and includes four national parks. In 1902, Crater Lake National Park was established to preserve the spectacular Mazama caldera, its unique lake, and the surrounding environment. Other national parks in the Cascades include Lassen National Park (established 1916), which includes a vast hydrothermal area and a dozen smaller volcanoes. The creation of Mt St Helens National Monument was prompted by the cataclysmic events of 1980 that changed the local landscape. The aim to preserve a unique volcanic setting was also behind the creation of the Sunset Crater National Monument in Arizona.

Many countries have followed various models of preserving spectacular volcanic regions, with a significant increase in the number of national parks alone over the last three decades. However, developing countries frequently have limited resources to either establish or maintain protected sites including World Heritage listed areas (Table 75.3).

In Latin America, several of Costa Rica’s volcanoes are protected in national parks. Ecuador also preserves many of its volcanic regions as national parks, including the Galápagos Islands and Cotopaxi, whereby the Galápagos Islands are also World Heritage listed. Chile and Argentina have established national parks to protect the Andean

TABLE 75.3 Volcanic World Heritage Listed Properties

Active	Dormant or Extinct
Heard and McDonald Islands, Australia (1997) Area de Conservación Guanacaste (Rincon de la Vieja), Costa Rica (1997) Virunga National Park, DR Congo (1979) Morne Trois Pitons National Park, Dominica , Lesser Antilles (1997) Galápagos Islands, Ecuador (1978; Ext. 2001) Sangay National Park, Ecuador (1983) Pitons, Cirques and Remparts of Reunion Island, France (2010) Surtsey, Iceland (2008) Bali Cultured Landscape, Indonesia (2012) Borobudur Temple (Merapi), Java, Indonesia (1991) Ujung Kulon National Park (Krakatau), Indonesia (1991) Aeolian Islands, Italy (2000) Mt Etna, Sicily, Italy (2013) Pompeii, Herculaneum and Torre Annunziata (Vesuvius), Italy (1997) Mt Fuji, Japan (2013) Tongariro National Park, New Zealand (1993) Pico Island Vineyard Culture, Azores, Portugal (2004) Garajonay National Park, La Gomera, Spain (1986) Teide National Park, Tenerife, Spain (2007) Volcanoes of Kamchatka, Russia (1996; Ext. 2001) Hawai’i Volcanoes National Park, USA (1987) Yellowstone National Park, USA (1978)	Gondwana Rainforests of Australia (1994) Lord Howe Island Group, Australia (1982) Macquarie Island, Australia (1997) Wet Tropics of Queensland, Australia (1988) Fernando de Noronha, Brazil (2001) Rapa Nui National Park, Chile (1995) Mt Huangshan, China (2012) Cocos Island National Park, Costa Rica (1997) Þingvellir National Park, Iceland (2004) Komodo National Park, Indonesia (1991) Giant’s Causeway, Ireland (1986) Taï National Park, Ivory Coast (1982) Shiretoko National Park, Hokkaido, Japan (2005) Mt Kenya Natural Park, Kenya (1997; Ext. 2013) Jeju Volcanic Island and Lava Tubes, Korea (2007) Pitons Management Area, St. Lucia, Lesser Antilles (2004) El Pinacate and Gran Desierto de Altar Biosphere Reserve, Mexico (2013) Rock Islands Southern Lagoon, Palau (2012) Old and New Towns of Edinburgh (Arthurs Seat), Scotland (1995) Kilimanjaro National Park, Tanzania (1987) Ngorongoro Conservation Area, Tanzania (1979; Ext. 2010) Göreme National Park Cappadocia, Turkey (1985) Hierapolis-Pamukkale, Turkey (1980) Yosemite National Park, California, USA (1984)

Active, dormant, and extinct volcanic areas contribute at least 5% to the current total of 981 World Heritage sites. The year of the original listing is included in brackets.

volcanic environments including Villarica, while Colombia’s notorious Nevado del Ruiz is located within the Los Nevados National Park.

3.1. Protected Sites and Their Educational Value

Protected areas such as national parks, geoparks, and World Heritage sites play an important role in volcano tourism by offering education about the geological heritage of active and dormant areas, as well as showcasing the overall geodiversity. The quest for knowledge is a driving force in tourism and volcanic environments are an ideal place to learn about geology. Volcanoes attract people of all ages with visitors making use of educational displays in museums and information centers (Table 75.4) or hiking the trails leading to fumaroles, crater lakes, and other volcanic features.

The Hawai'i Volcano National Park (established 1916) preserves a large fraction of Mauna Loa and most of Kilauea, two of the world's most active volcanoes. The spectacular scenery and frequent eruptions attract on average 4000 visitors per day, who hike the park's well-laid out trails or use stopover viewing points when driving. A large number of plaques with explanations are placed at points of interest along the trails and roads. Located inside the park is the Thomas A. Jagger Museum, an educational facility with informative displays that opened in 1987.

TABLE 75.4 Volcano Museums—Education, Information, Interpretation

Penshurst Volcano Discovery Centre, Australia	Sakurajima Volcano Museum, Kyushu, Japan
Volcano Museum Huilo Huilo, Chile	Toyako Science Visitor Centre, Hokkaido, Japan
Arenal Observatory Lodge Museum, Costa Rica	Unzen Volcano Museum (several), Kyushu, Japan
Volcano House, Reunion Island, France	Volcano Museum Martinique, Caribbean
Volcano Park of Lemptégy, France	Volcanic Activity Centre Taupo, New Zealand
Vulcania Theme Park and Museum, France	Volcanic Forces—Auckland Museum, New Zealand
Maarmuseum Manderscheidt, Germany	Te Papa Museum, Wellington, New Zealand
Vulkanmuseum Daun, Vulkanneifel, Germany	Masaya Volcano Visitor Centre, Nicaragua
Eldfjallasafn Volcano Museum, Stykkishólmur, Iceland	Vulcão dos Capelinhos Exhibition, Azores, Portugal
Þorvaldseyri Visitor Centre, Iceland	Visitor Centre Teide National Park, Tenerife, Spain
Volcano House Reykjavik, Iceland	International Museum of Volcanoes, Lanzarote, Spain
Batur Volcano Museum Bali, Indonesia	Jagger Museum, Hawai'i Volcanoes National Park, USA
Merapi Volcano Museum, Indonesia	Mt St Helens Visitor Centers, Washington, USA
Aso Volcano Museum, Kyushu, Japan	

Volcano museums have been established worldwide and are important educational facilities, which are part of the visitor experience in national parks, geoparks, and world heritage areas.

4. VOLCANIC ERUPTIONS—UNIQUE TOURIST EXPERIENCES

Volcanic eruptions can have a large impact on the tourism industry of a region, and often the aftermath of a violent eruption will bring increased numbers of visitors. Once a catastrophe is over and the tourism industry is on the path of recovery, tourists arrive in growing numbers to witness the destruction and also to provide an economic boost for the affected region. A famous example in more recent times (2010) was the eruption of Eyjafjallajökull in Iceland—the event that closed European airspace with consequences that affected passenger movement all over the globe. While the eruption initially attracted tourists to watch the fiery fissures from as close as possible, the next eruption stage generated vast ash clouds, a major hazard to aviation, which effectively prevented aircraft at many European airports from takeoff or landing. This was a forceful reminder of how exposure to a natural disaster can cause widespread damage and economic loss, while at the same time putting an area on the map and increasing visitor numbers after the event.

The unexpected explosive eruption of Chaitén volcano in Chile in 2008 after thousands of years of quiescence caused significant damage from pyroclastic flows and lahars. Although there is now a realistic expectation of future eruptions of the Chaitén volcano, tourism in this region has seen an increase of visitors interested in the volcano and the damage it caused. Other well-known examples of areas that benefit from past eruptive events include the Greek island of Santorini, which is a thriving tourist destination surrounded by physical evidence from one of the largest eruptions in history (Thera). In Sicily, Mt Etna's ongoing activity has influenced the lives of people who live in its vicinity (Figure 75.14). Although lava flows have caused disruptions and threatened not just local towns such as Linguaglossa, Nicolosi, Zafferana, and Randazzo but also Catania's large population (during the 1669 eruption), Mt



FIGURE 75.14 Mt Etna was listed as a UNESCO World Heritage Site in 2013 because of its great scientific interest and its value as a key destination for education and research. Photo: P. Erfurt-Cooper.

Etna has remained an attractive destination for volcano tourists who enjoy hiking and skiing.

Other European volcanic regions that attract tourists with their spectacular scenery include the Canary Islands (Spain) and the Azores (Portugal). Although the volcanoes of these two island groups are not currently erupting, they are nevertheless classed as active based on their recent history. Volcanic attractions feature throughout the tourism industry with popular tours to the Teide caldera Las Cañadas on Tenerife, volcano walks in Timanfaja National Park on Lanzarote, or rock climbing on the volcanic walls in the Azores.

4.1. Eruptive Activity—Awe-Inspiring Attractions

Heightened volcanic activity encourages volcano tourists to explore volcanic features such as Strombolian eruptions, lava flows, geysers and hot springs, lava lakes, crater lakes, fumaroles, boiling mud ponds, hot rivers, and travertine terraces created by volcanic hot springs and their mineral deposits. These volcanic features are generally included as attractive highlights for volcano tourists.

Volcanic eruptions are among nature's most awesome spectacles; however, while an active volcano can contribute significantly to the economy of a region, it can also destroy infrastructure and negatively affect the local tourism industry. From a tourism point of view, the best types of volcanic activity are long-lived Hawai'ian or Strombolian eruptions. These eruptions allow tourists to observe the activity from a reasonably close range and in relative safety. If the eruption lasts for months or years, the local economy can truly prosper from the sustained number of visitors. However, other factors—notably, ease of access—are important for turning an active volcano into a major tourist destination. Stromboli, for example, which has been continuously active for over 2000 years, is one of the world's top destinations for those who want to see a live volcano. However, its remote location and its dependence on the weather (access restricted to summer) make it far less popular than many other volcanic regions around the world.

Mt Yasur (Tanna Island, Vanuatu) is another example of a volcano that sustains long-lived Strombolian activity and has attracted growing numbers of visitors in recent years, despite its rather remote location in the South Pacific. According to tourism statistics for the last quarter of 2012, Vanuatu registered a 14% increase in international visitor arrivals (Vanuatu National Statistics Office, 2013). Although not all of these visitors may be volcano tourists, the figures clearly indicate that destinations, formerly avoided as too remote or inaccessible, receive growing numbers of international visitors. Online video footage of Yasur erupting is used as a major attraction in tourism

marketing. To see a boiling lava lake on Vanuatu's Ambrym Island, visitors can take a helicopter flight to view the active craters of Benbow and Mbeulesu.

In fact, using helicopters is a common way of accessing unique volcanoes in remote locations; i.e., visitors of the Kamchatka volcanoes (Russia) rely on a fly-in-fly-out system as do tourists in Ethiopia who want to have quick access to the lava lake of Erta Ale. Scenic flights by helicopter are also used at Mt Aso in Kyushu (Japan), especially during times when the crater emits toxic fumes and access to the summit by car or ropeway is suspended. Helicopter tours are also popular in Hawai'i, Costa Rica, Chile, and New Zealand. The volcano White Island, located 50 km off the coast of New Zealand's north island, is accessed by boat and by helicopter with both services continuing during periods of heightened activity. Moreover, the tour operators and visitors agree that the best time to visit White Island is when volcanic tremors and degassing are accompanied by minor eruptive activity.

However, volcanoes do not have to be active to attract adventure-seeking tourists. The unique rock formations of central Turkey are visited all year round, although the area is not promoted directly as a volcanic destination but as an outstanding geological and cultural experience that is also World Heritage listed. Located between the dormant volcanoes Erciyes, Melendiz, and Hasan, the plains of Cappadocia are attracting growing numbers of tourists with a 15% growth in January 2013 compared to the previous year. The unusual landforms were created by erosional forces, which carved the bizarre tuff towers capped with basalt layers out of alternating layers of welded tuff and basaltic lava flows. The resulting "Fairy Chimneys" are remnants of the up to 150-m-thick tuff beds that were laid down during historic volcanic eruptions (Figure 75.15).



FIGURE 75.15 Cappadocia's Fairy Chimneys are part of the unique volcanic landscape around Göreme (Central Turkey), a World Heritage listed area. Photo: P. Erfurt-Cooper.

Some volcanoes are so visually spectacular that this alone makes them major tourism destinations. Crater Lake in Oregon (USA) is surrounded by forests and volcanic peaks and lies inside the Mt Mazama caldera. After a cataclysmic eruption, the caldera developed and was eventually filled with water from rain and snow, forming a lake 589 m (1932 ft) deep with the volcanic cinder cone of Wizard Island at the western end of the lake. The purity of the water and the great depth of the caldera are responsible for its startling indigo blue. Another “Blue Lake” is part of the Mt Gambier maar complex in South Australia. The crystal clear water of this Blue Lake changes its color every November from steel blue to brilliant turquoise and back again in March to steel blue. While the Blue Lake provides the water supply for the city of Mt Gambier, the crater lakes are a State Heritage Area and are located within the boundaries of the Kanawinka Geopark, which includes large parts of the Newer Volcanic Province in western Victoria.

One of the most popular active volcanoes in the world is Kīlauea on Hawai‘i. Kīlauea has attracted tourists since the early twentieth century, when a lava lake filled Halemau-mau crater. A hotel, Volcano House, was built in 1846 on the edge of Kīlauea caldera, with full view of Halemau-mau. Another leading example of spectacular volcanic scenery is the vast summit crater of Haleakalā (on the island of Maui), a breathtaking sight and an impressive geologic wonder. The most magnificent sight offered by this volcano is early in the morning, when tourists hike to the summit, starting their ascent in darkness to watch the sunrise. The Pu‘u ‘Ō‘ō-Kūpaianaha eruption, ongoing since 1983, is the longest eruptive event on record in Hawai‘i. The sustained activity has benefitted local tourism and has spawned businesses ranging from new hotels to helicopter tours.

Before the 1980 eruption of Mt St Helens, visitors were attracted to Spirit Lake and its magnificent setting. When the lake and its surrounding forests were destroyed, it seemed that tourism in the area would not recover. However, the devastated landscape became a major attraction with many people wanting to see the eruption’s effect, which has made the area considerably more popular than it was before 1980. A landmark event was the creation of the Mt St Helens National Monument in 1982. In 1993, the Coldwater Ridge Center was opened, and during that year alone received about one million visitors. The Center was permanently closed in 2007 due to federal budget constraints, but reopened in 2012 as the “Science and Learning Center at Coldwater.” The climb to Mt St Helens’ crater rim, from where one can see the impressive dome growing inside the gaping crater, is still one of the most popular activities in the Cascades.

Costa Rica’s Arenal was not recognized as an active volcano until it started to erupt in 1968. The ongoing eruption (until 2010) contributed to the development of

Arenal’s surrounding areas into one of the most popular destinations in Costa Rica. Hotels and lodges with views of the volcano were built to watch Arenal’s activity at times of eruption. Many visitors stayed up all night to observe glowing lava flowing down the volcano’s steep flanks. However, Arenal has not erupted since 2010 and although in September 2013 some activity including steam plumes and rock falls was observed, by January 2014 the volcano failed to show further signs of reawakening. And while there is a reasonable expectation that Arenal will erupt again in the future, tourists will include the volcano in their travel plans.

Finally, one of the most unique, although remote volcanic destinations is Deception Island in Antarctica, the only place in the world where cruise ships sail directly into a volcanic caldera. Entering the center of the horseshoe-shaped island is only possible under calm conditions through Neptune’s Bellows, a narrow channel at the caldera entrance. This major stopover is hailed as a highlight by visitors and provides the opportunity to learn about volcanic history, local wildlife, and aspects of the unique Antarctic ecology. Apart from penguin colonies, a barren volcanic landscape, and black volcanic sand beaches, steaming hot springs emerge through the black sand at the beach and mix with cold seawater; a unique opportunity for cruise guests to soak in a hot spring in Antarctica. Owing to Deception Island’s eruption history, it is classed as a restless caldera with the potential for further eruptions at any time. Deception Island is one of the most frequently visited sites in Antarctica by tourists (Deception Island, 2012), which shows a growing demand for remote volcanic locations.

5. ACTIVITIES IN VOLCANIC ENVIRONMENTS

Tourism in volcanic environments incorporates a number of elements ranging from geotourism to ecotourism and adventure tourism. The study of geological phenomena in extreme environments requires education and interpretation, which is provided via on-site information centers and volcano museums. Tour guides and sign boards present additional learning experiences while sightseeing and exploring. Depending on the volcanic activity level, a sense of adventure plays an important role for many volcano tourists. It is common in most regions where volcanic geotourism is practiced, that local history and culture are part of the visitor experience, adding to the overall geodiversity. The aspect of sustainability also plays a significant role in nature-based (volcano) tourism with the awareness about environmental protection at an ever-increasing level.

Volcanic geoheritage, which includes active and dormant landscapes, is often co-located with natural hot springs, which are also included as volcanic attractions in sightseeing tours as shown above. Due to easier access to remote locations and more affordable air travel, the number of visitors is constantly increasing. In Sicily, eruption viewing during the night is available in villages and townships surrounding Mt Etna. In New Zealand, the Chateau Tongariro Hotel is located in the Tongariro National Park in the foothills of Mt Ruapehu; in Costa Rica, the Arenal Observatory Lodge offers volcano views; and in Kagoshima, hotel rooms with views of Sakurajima in eruption are highly sought after.

5.1. Recreation and Volcanoes

Apart from hiking, trekking, backpacking, climbing, and mountain biking, some rather unusual sporting activities have emerged in recent years. On the slopes of the Cerro Negro volcano in Nicaragua “volcano surfing” is a favorite with adventure tourists, who rank it as a major attraction. After climbing to the summit of Cerro Negro, adventure-minded visitors use toboggans to race down the coarse cinder slopes at speeds of up to 80 km/h. The potential for injury is readily accepted, as well as the possibility of an unexpected eruption of the active volcano. According to the Huffington Post (2011), volcano surfing “is the ‘latest hot extreme sport’ among the travel adventure community, with over 10,000 people having tried it” despite the fact that Cerro Negro was last active in 1999 with a potential for renewed activity at any time. Another extreme activity has groups of tourists running down the slopes of the Cerro Negro and El Misti volcanoes, in a similar fashion to scree running in nonvolcanic environments. For the extreme sports enthusiast, volcano abseiling into an active volcanic crater (e.g., Ambrym, Vanuatu) offers a certain adrenaline rush, although the need for special equipment restricts this activity to a minority of visitors.

Possibly one of the most exciting, although dangerous tourist attractions is bungee jumping from a helicopter above the active crater of Chile’s Villarica volcano. So far no casualties have been reported but the excitement for dedicated adventure seekers comes with a price tag of around USD\$10,000 for a 5-day trip to Pucon, which includes this unusual highlight. Alternatively, hot air balloon tours can prove fatal. An accident in Turkey in 2013 claimed 3 lives and injured 21 passengers in a midair collision of two balloons. Because Turkey’s volcanic heritage is completely integrated in the tourism industry, many activities include hiking, trekking, climbing, and skiing the volcanic landscape. However, most famous are the above mentioned hot air balloon trips, which have taken place since 1997. Cappadocia is known as one of the most important hot air balloon centers worldwide, and over the



FIGURE 75.16 Hot air balloon flights in Göreme start early in the morning before the wind can become a hazard to the many individual balloons and their passengers. The eroded tuff landscape and the cave buildings of Cappadocia are major attractions and are best viewed from above. *Photo: P. Erfurt-Cooper.*

last two decades this activity has grown in popularity. Early in the morning, colorful balloons rise to the skies and take tourists over the bizarre volcanic landscape. Passengers can choose varying levels of height to accommodate people who are not comfortable at higher levels (Figure 75.16). As with any adventure activity there is a risk involved that people should be aware of when they decide to participate, although the view of the spectacular landscape of Cappadocia is definitely worth it.

In the French Auvergne, hot air ballooning is promoted as “a truly magical meeting with nature,” where passengers can view the dormant volcanic landscape from above. In Australia, hot air balloons take visitors on sunrise flights to experience the breathtaking view of the volcanic caldera of Mt Warning (Wollumbin), also known as the Green Cauldron, one of Australia’s “National Landscapes” and part of the World Heritage listed Gondwana Rainforest on the border of Queensland and New South Wales. Here, the remnants of an ancient shield volcano are presented together with lush rainforests and the unusual Australian wildlife, as well as the cultural aspects of the local indigenous heritage. Further north in the “Wet Tropics” World Heritage area, balloon rides take off from Mareeba to fly above the volcanic landscape of the Atherton Tablelands. For volcano tourists visiting this area, the Undara Volcanic National Park, 320 km west of Cairns, lets visitors explore some of the largest and best preserved lava tubes worldwide (Figure 75.17); for geotourists this is an amazing destination surrounded by the Great Australian Outback.

In Spain, hot air balloons take flight above the landscape of the Garrotxa Volcanic Zone Natural Park; in Costa Rica, ballooning includes views of Arenal volcano as a special attraction; and in Southern California, tourists have the



FIGURE 75.17 Some of the Undara lava tubes have caved in over time and access to the remaining caves is only possible with a guided tour. The Undara Volcanic National Park is part of the Wet Tropics of Queensland World Heritage area. *Photo: P. Erfurt-Cooper.*

opportunity to enjoy the panoramic views of ancient volcanoes below. Scenic flights by airplane or helicopter are a popular way in Oceania to access volcanoes such as White Island, Tongariro, Ruapehu, and Tarawera in New Zealand and Lopevi, Ambrym, and Yasur in Vanuatu. In the northern hemisphere, “flightseeing” includes the national parks of the Alaskan Ranges and the Aleutians with a number of active volcanoes and spectacular glaciers as visitor experience.

5.2. Volcanic Disaster Tourism

The revenue raised through volcano tourism is an opportunity to counteract economic shortfalls caused by natural disasters such as eruptions that can cause widespread losses. In response to visitor expectations, information centers in volcanic areas frequently show video footage as forceful reminders of the destruction caused by different types of eruptions. Consequently, volcano tourism can sometimes overlap into what is known as “disaster tourism” or “dark tourism.” After a volcanic eruption, affected regions on the path to recovery need a boost to the economy, and the tourism industry often incorporates the devastating changes to the landscape to attract visitors. Well-known disaster tourism sites are Pompeii and Herculaneum in Italy, with some modern day examples located in Iceland (Pompeii of the North) and in Japan (Mt Unzen). In the city of Shimabara, posteruption lahars from Mt Unzen were caused by a disastrous combination of thick layers of volcanic ash and heavy rainfall, and consequently buried numerous buildings that were located in the flow path (Figure 75.18). Some of these buildings are under cover to protect them from the elements and are known as the Mizunashi River Memorial Park, an important stopover for tourists. At the seafont of



FIGURE 75.18 A number of houses were buried by lahars from Unzen volcano, Japan, and have been covered to protect them from erosion and to make them available to visitors all year round. *Photo: P. Erfurt-Cooper.*

Shimabara, built on volcanic debris, and surrounded by open spaces, the Unzen Disaster Memorial Hall (Unzendake Saigai Kinenkan) provides vital information about the effects of exposure to pyroclastic flows and lahars. During excavations, several cameras buried by pyroclastic flows were found; one of them with a few seconds of footage showing a superheated cloud of volcanic gas and ash heading toward a group of 43 people, who perished in the immense heat.

5.3. Potential Dangers and Visitor Safety

Volcano tourists who are venturing into the mountains are facing potential dangers that are common in many mountain areas. These dangers include hiking accidents; getting lost; sudden weather changes causing rain, fog, or snow; rock falls, mud slides, and snow avalanches; as well as altitude sickness and hypothermia. While people can prepare for these risks to a certain degree, there are other hazards related directly to volcanic environments. Unexpected eruptions, gas emissions and toxic fumes, earthquakes, lahars, steam vents, pyroclastic flows, and thermal burns from lava flows or hydrothermal springs add a host of potential risks that should be given some serious thought before embarking into an area where help may not be available. Potential problems can stem from a lack of preparedness that is frequently related to a lack of safety instructions for visitors, as these are not available at every volcanic destination. Existing safety guidelines are usually available for national parks and local communities, but this information is not always made available to temporary visitors in active volcanic environments. Information about the local area including escape routes and directions to shelters and emergency phones in several major languages is essential. Visitors who are not familiar with the local terrain also need a basic hazard map to keep them in safer

zones. Especially important is that interpretive signage and warning signs should be in more than one language with images or pictograms for immediate visual recognition.

5.4. Personal Risk Acceptance and Emergency Situations

Volcano tourism is growing in popularity, and in Iceland, Japan, Costa Rica, and New Zealand geotourism in volcanic regions already has the dimensions of mass tourism. Back in 2007, the Philippines advertised Mt Pinatubo as the “hottest” tourist destination in Luzon and encouraged ecotourism groups to visit the devastation area around the mountain (Reyes, 2007). That this can in some instances have tragic outcomes was evident when Mt Mayon (also in the Philippines) erupted in May 2013. An explosion caused the death of five tourists, with several more injured. A permanent exclusion zone of several kilometers around Mt Mayon either was not adequate or was ignored due to the assumed quiescence of the volcano. It is therefore important that volcano tourism is made as safe as possible by raising awareness about potential hazards in these extreme environments, as people often underestimate possible dangers and overestimate their own abilities to cope with challenging situations. In many active volcanic and geothermal areas, existing safety standards or guidelines do not include tourists, whose risk perception frequently can be impaired without appropriate safety advice from local authorities.

6. SUMMARY

Millions of visitors every year travel to the most active volcanoes of the world to experience the added element of adventure with volcanic features used as attractions throughout the tourism industry. While some volcanic areas are popular mainly for their magnificent scenery, the combination of volcanoes, adventure, risk, vegetation, and unusual wildlife can bring visitors to the remotest island destinations. Volcanoes in countries such as Indonesia, the Philippines, and Vanuatu have become major tourist attractions, despite their often dangerous activity levels. Even more remote regions such as Antarctica draw cruise ships to volcanic attractions such as the active caldera of Deception Island, while on the Russian Kamchatka helicopter tours provide access to the volcanic wilderness.

Throughout the world, active and dormant volcanic regions have been protected as national parks, geoparks, and World Heritage areas. Protected sites such as these play an important role in volcanic geotourism, as they offer education about the geological heritage, as well as a variety of recreational activities including adventure and extreme sports. For the tourism sectors of geotourism, adventure tourism, and ecotourism, volcanoes are priceless natural

resources. The educational aspect of volcanoes in terms of their role in nature and society is one of the major attractions for volcano tourists, especially for those who are exploring and studying volcanic and geothermal landforms. Volcanoes have also played a significant role in history and culture, as well as in religious legends and in the mythology of many regions.

Volcanic geoheritage is often co-located with natural hot springs. While some hydrothermal features like geysers and boiling lakes are only for visual enjoyment, the pleasant addition of volcanic hot springs for bathing purposes has traditionally supported health and wellness tourism. Many destinations take full advantage of the therapeutic use of this natural phenomenon and offer tourists the experience of health resorts and spas based on volcanic hot springs and their beneficial mineral content. This is particularly evident in countries such as Japan, New Zealand, Iceland, Germany, France, and Taiwan, where the close proximity of volcanoes and hot springs has historical links to health and wellness tourism.

Volcanic eruptions can have a significant impact on the tourism potential of a region, as heightened volcanic activity can encourage visitors to stay longer to explore exciting volcanic features. Depending on the level of activity a sense of adventure plays an important role for many volcano tourists. As a result, volcano tourism is frequently linked to disaster tourism or dark tourism, with Pompeii and Herculaneum as classic examples. To have a safe experience and to avoid accidents and injuries, volcano tourists need to have sufficient up-to-date information before they embark on their adventure. The main objective in volcano tourism, especially in active environments, is the safety of all visitors.

FURTHER READING

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