Jeju Volcanic Island and Lava Tubes

2020 Conservation Outlook Assessment

SITE INFORMATION

Country: Republic of Korea (South Korea)
Inscribed in: 2007
Criteria: (vii) (viii)

Jeju Volcanic Island and Lava Tubes together comprise three sites that make up 18,846 ha. It includes Geomunoreum, regarded as the finest lava tube system of caves anywhere, with its multicoloured carbonate roofs and floors, and dark-coloured lava walls; the fortress-like Seongsan Ilchulbong tuff cone, rising out of the ocean, a dramatic landscape; and Mount Halla, the highest in Korea, with its waterfalls, multi-shaped rock formations, and lake-filled crater. The site, of outstanding aesthetic beauty, also bears testimony to the history of the planet, its features and processes. © UNESCO

SUMMARY

2020 Conservation Outlook

Finalised on 01 Dec 2020

The Outstanding Universal Value of the World Heritage site is well recognized, is under no immediate threat and generally effectively managed and protected. Inscription of the site has had a very positive outcome in raising awareness of conservation and the World Heritage Convention among the general public and key stakeholders. The site has brought considerable benefits to the local community through employment and through promotion of tourism, which is a major generator of revenue in the Province. Key threats include further increases in visitor numbers and in development of tourist infrastructure, which will require vigilance and continual monitoring to avoid any undesirable impacts. Recent studies on groundwater are showing this to be a potentially concerning threat given the geoheritage values of the site and sensitivity to geohydrological changes that may be exacerbated by climate change and sea level rise. The site is pioneering better integrated approaches with other internationally designated areas, four of which overlap on Jeju, and a commendable holistic approach to island management is evident from the authorities. There is still considerable potential for strengthening the protection of the World Heritage site through further purchases of private lands, and there is scope for extending the Jeju Volcanic Island and Lava Tubes site to include more volcanic features and to protect the significant biodiversity values.
FULL ASSESSMENT

Description of values

Values

World Heritage values

► An outstanding shield volcano with an extensive lava tube system

The Geomunoreum lava tube system is regarded as the finest such cave system in the world, displaying a unique spectacle of multi-coloured carbonate decorations adorning the roofs and floors, and dark-coloured lava walls partially covered by a mural of carbonate deposits. The fortress-like Seongsan Ilchulbong tuff cone, with its near-vertical walls rising from the ocean, is a dramatic landscape feature. Mount Halla, with its array of textures and colours through the changing seasons, waterfalls, multi-shaped rock formations and columnar-jointed cliffs, and the towering summit with its lake-filled crater, further adds to the scenic and aesthetic appeal of the World Heritage site (World Heritage Committee, 2007).

► One of few shield volcanoes in the world on a stationary continental crust plate, with the world's best developed system of lava tubes

The Jeju Volcanic Island and Lava Tubes World Heritage site, centred on the Mount Halla volcanic complex, is of outstanding importance in protecting one of the few large shield volcanoes in the world built by fissure eruption on a stationary continental crust plate. The volcano is distinguished by the most impressive and significant series of protected lava tube caves in the world - the Geomunoreum system - which includes a spectacular array of secondary carbonate speleothems (stalactites, stalagmites and other decorations) with an abundance and diversity unknown elsewhere within lava caves. The Seongsan Ilchulbong tuff cone has exceptional exposures of its structural and sedimentological characteristics, making it a world-class location for understanding Surtseyan-type volcanic eruptions (World Heritage Committee, 2007).

Jeju island was endorsed as a UNESCO Global Geopark in 2010. Mount Halla, Seongsan Ilchulbong tuff cone and Manjanggul Cave (which is a part of the Geomunoreum cave system) are active geosites for tourism.

Other important biodiversity values

► Regionally significant biodiversity including endemic and rare species.

The Jeju Island UNESCO/MAB Biosphere Reserve, which is included in the World Heritage site, recognizes regionally significant biodiversity values, including species endemic to Jeju Island and Korea, and species at their northern and southern distributional limits. Four of 20 mammal spp. and 24 of 1,600 insect spp. are Jeju endemics. Rare cave spiders occur (IUCN, 2007).

Assessment information

Threats
Current Threats

Most of the identified threats are well recognized by the authorities, are documented in the management plan and are being managed effectively at present. Thus, the overall current threat for the World Heritage site remains low. High tourism interest remains a potentially significant threat to the site and some of its delicate lava tube systems. The planned new airport in Seogwipo will likely contribute to additional visitor pressure. The new naval and potential cruise boat facility at Gangjeong Village on the south Jeju coast could also contribute to this pressure. The effective management of tourism will continue to be a priority.

> Utility / Service Lines

*(Communication towers and power lines)*

Towers have been removed within the World Heritage site but remain in the buffer zone (IUCN, 2007). Some visual impacts from communication infrastructure.

> Tourism/ Recreation Areas

*(Hotel and tourist infrastructure development)*

Hotels have been removed from the World Heritage site but development is occurring in the buffer zone (IUCN, 2007). Jeju Island is a popular tourism destination and there is generally high development pressure on the island due to increased visitors and mainland immigrants (many mainland Koreans retire to the warmer climate of Jeju). Demand is increasing for land, urban areas, and transport infrastructure (Lee et al., 2014).

> Roads/ Railroads

*(Ground disturbance from roads)*

Many roads have been removed from the core zones, or closed and/or converted into trails. Some roads have been upgraded and new improved paving is planned and budgeted, especially to minimize any vibration from traffic that might affect the lava tubes (IUCN, 2007). Congestion on Mount Halla roads and a severe shortage of parking space have caused challenges for the authorities. Jeju government will seek to build a large transfer parking lot for Mount Halla hikers at the foot of the mountain (The Korea Times, 2020).

> Invasive Non-Native/ Alien Species

*(Introduction of exotic plant species)*

Some exotic species are present in the Hallasan National Park within the World Heritage site.

> Agricultural effluents

*(Fertilizer application with runoff potentially seeping into caves.)*

Some instances of fertilizers being applied to agricultural land inside and outside the World Heritage site. There are no known impacts at present and only about 15% of the land above the caves is in private ownership and not all this is being used for gardening and farming purposes. At the time of inscription the private lands were planned to be progressively purchased up to 2013, retired from such uses and restored to natural vegetation cover (IUCN, 2007). Most of private land have now been purchased and restored to original natural conditions (IUCN Consultation, 2017).

> Tourism/ visitors/ recreation

*(Tourist overcrowding)*

Overall tourism numbers are increasing on Jeju from negligible numbers in 1996 to 12.2 million visitors in 2014 (Fisher et al., 2019). User density levels of 16.2 persons/km²/day have been estimated (Lee et al., 2014). Some volcanic features and caves are vulnerable to trampling damage, and cave speleothems are very delicate and readily damaged unless carefully protected. The caves with delicate carbonate speleothems are not open to public, thus they are well protected. At the time of inscription
the World Heritage site already received significant visitation (2.3m people in 2005) (IUCN, 2007) and tourist numbers have since increased. Especially, the maximum number of visitors as well as visitor pressure on the Manjang Cave and the Seongsan Ilchulbong Tuff Cone needs to be monitored. Overcrowding and impacts such as excessive trampling and erosion of soils and damage to sensitive ground and geological features (especially speleothems in caves) could occur. Careful monitoring and management are required. Visitaton on Jeju Island is concentrated along the north, south and east coasts, as well as Hallasan National Park (Fisher et al., 2019). The number of visitors to the five Mount Halla trails reached a record 1.25 million in 2015. Since February 2020, hikers wanting to climb to the top of Mount Halla are required to book a visit in advance as part of a pilot reservation system. Jeju government said the reservation system is being introduced as the mountain's ecology and environment have been threatened by a rapid growth in hikers (The Korea Times, 2020).

**War, Civil Unrest/ Military Exercises**

*Naval base construction*

A locally controversial naval base was finally opened in Dec 2015. To deliver economic benefit to the island it was developed as a joint military-civilian facility that also caters for cruise boats (The National Interest - Euan Graham, 2016). The construction has no direct impact on the World Heritage site (IUCN Consultation, 2017). The changed operation to accommodate cruise boats may bring additional visitor pressure to bear on the island and the site.

**Other Activities**

*Second airport construction*

There are plans to build a second airport on Jeju Island with capacity for 19 million passengers. The new airport will be built in Seogwipo and construction will last from 2020-2025 (The Chosun Ilbo, 2019). According to estimates, with the new airport, number of visitors is expected to triple to 45 million by 2035 (The Korea Times, 2018). Local residents and environmental activists oppose the plan, fearing that excess development and tourism will impact Jeju's environment (The Korea Times, 2018; The Chosun Ilbo, 2019).

**Potential Threats**

All the potential threats are recognized and are being addressed in so far as possible. Some such as a volcanic eruption has only a very remote chance of occurring. However, research into the groundwater dynamics shows declining groundwater levels and condition, which may threaten the geohydrology of the World Heritage site.

**Volcanic activity**

*Dormant volcano*

Jeju volcano is not extinct but probability of re-eruption is exceptionally low.

**Dams/ Water Management or Use**

*Changes in ground water*

Research in 2012 reveals increasing demand for groundwater extraction thereby reducing quantities. There is also deterioration in quality due to seawater intrusion and other contaminants (Choi and Lee, 2012; Lee at al., 2014). Seawater intrusion is occurring throughout Jeju due to the hydrogeological heterogeneity and different anthropogenic activities depending on the region (Chang et al., 2019). The government has established a seawater intrusion monitoring network on the shoreline and collected basic data about groundwater level and quality (Chang et al, 2019). Seawater intrusion will probably increase in the future due to climate change and drought (El-Kadi et al., 2014). There is no evidence to date to show that changes in groundwater have adversely impacted values but these changes could have potentially serious impacts on the geohydrology of the World Heritage site.
IUCN World Heritage Outlook: https://worldheritageoutlook.iucn.org/
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Overall assessment of threats

<table>
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<th>Low Threat</th>
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<tr>
<td>Overall, the level of both actual and potential threats to the World Heritage site remains low. Management authorities are well aware of the threats, which are being effectively prevented or mitigated. High tourism interest remains a potentially significant problem for the site and some of its delicate lava tube systems, and will need effective management. Declining levels and quality of groundwater could potentially impact on the site’s geohydrology.</td>
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Protection and management

Assessing Protection and Management

▶ Management system

Management policies, provisions and plans are exemplary. A General Plan for Jeju World Natural Heritage Conservation and Utilization was set up by the Province in 2008. The World Heritage site management plan is due for revision (IUCN, 2018).

▶ Effectiveness of management system

In two Protected Area Management Effectiveness Evaluations for Korea the Hallasan National Park was deemed to be well managed, in fact at a higher standard than many mainland parks in Korea due to the higher attention given by Jeju Province who administer the park (KNPS/MoE, 2009; Hockings and Shadie 2016 unpub). IUCN’s evaluation of the nomination also found management to be mostly effective (IUCN, 2007). Apart from the show cave section of Manjang, there are strict access controls on all caves in the Geumun system and entry to Yongcheon Cave is very tightly controlled (Brush, 2010).

▶ Boundaries

Boundaries of the existing World Heritage site and buffer zone are adequate (IUCN, 2007), but there remains potential for adding further areas to the site to include more tuff cones and lava tubes. New component parts of the Upper Geomunoreum Lava Tube System have been added to the site (World Heritage Committee, 2018). The World Heritage Committee recommends resubmission of the additional component parts Suwolbong Tuff Ring, Chagwido Tuff Cone Complex and Socheongul Lava Tube, with revisions to clarify the boundaries of the nominated components and their buffer zones (World Heritage Committee, 2018).

▶ Integration into regional and national planning systems

The management plan for the World Heritage site has government approval and is legally binding on national and provincial governments and all administering authorities (State Party of the Republic of Korea, 2006). The widely consulted plan also reflects the consensus view of national and local institutions and communities (IUCN, 2007; State Party of the Republic of Korea, 2010). Commendable efforts are being made to manage Jeju Island in a holistic manner. At this time, the island is the only place in the world subject to four overlapping international designations. Efforts are ongoing to better harmonize policy, planning and management practice to achieve more comprehensive and integrated management strategies (Schaaf and Clamote Rodrigues, 2016).

▶ Relationships with local people

At the time of inscription, there was a high degree of public awareness and support for World Heritage. Local communities directly contribute to some decisions relating to management and indigenous peoples have some input into discussions relating to management but no direct role (IUCN, 2007; State Party of the Republic of Korea, 2010). The globally unique overlap of four international designations on Jeju Island (UNESCO World Heritage, Biosphere Reserve and Global Geopark; and a Ramsar site) has
significantly raised conservation awareness and bolstered a more holistic approach to balancing conservation and development on the island.

**Legal framework**  
Highly Effective

A strong statutory and regulatory basis exists at both national and provincial level for strict legal protection of all components of the World Heritage site (State Party of the Republic of Korea, 2006; IUCN, 2007). Manjanggul lava tube, Seongsan Ilchulbong tuff cone and Hallasan National Park became Global Geopark sites in 2010 (State Party of the Republic of Korea, 2010).

**Law enforcement**  
Some Concern

The World Heritage site has several smaller and sensitive components which receive substantial visitation and this is the most significant challenge in managing the site. It will be essential that sufficient capacity and funding is maintained in the long term (IUCN, 2007).

**Implementation of Committee decisions and recommendations**  
Mostly Effective

Management of visitors and tourism infrastructure is generally satisfactory. Improvements in management of some agricultural activities in the buffer zone have been achieved through new regulations. No obvious consideration has been given to management of significant volcanic features outside the World Heritage site, but there has been research to improve knowledge of biodiversity values. In 2018, new components were added to the site. The Committee recommends resubmission of the additional components, Suwolbong Tuff Ring, Chagwido Tuff Cone Complex and Socheongul Lava Tube, with revisions to clarify the boundaries of the nominated components and their buffer zones (World Heritage Committee, 2018).

**Sustainable use**  
Some Concern

Groundwater extraction, whilst not directly a use of the World Heritage site, has the potential to indirectly threaten underground systems. Korea’s “Groundwater Law” (1994) regulates all kinds of groundwater development activities on the Korean mainland. There is a “Special Law of the Jeju Special Self-Governing Province” established in 2006 which controls more strictly all groundwater development activities on the island. The Jeju Government is also harvesting rainwater and artificially recharging groundwater through a system of wells. Studies have also modeled the groundwater dynamics of the island (Park et al., 2013). Despite the law and these measures, groundwater use has continuously increased due to increasing freshwater demand. Groundwater quality has also deteriorated due to seawater intrusion and other contaminants (Lee and Choi, 2012; Chang et al., 2019).

**Sustainable finance**  
Mostly Effective

Substantial investment was made in the World Heritage site at the time of nomination and following inscription (IUCN, 2018). Korea’s input to Periodic Reporting conceded that the available annual budget was acceptable but could be further increased to fully meet the current management needs (State Party of the Republic of Korea, 2010). Efforts are being made to develop a better financial model to sustain the site in the context of other internationally designated areas on Jeju (Lee et al., 2014).

**Staff capacity, training, and development**  
Mostly Effective

Week-long educational and training programs to foster management skills were reported as part of the periodic reporting of 2010. At that time, some 230 managers had been trained and the number of managers was expected to increase year by year because of the educational/training programs (State Party of the Republic of Korea, 2010).

**Education and interpretation programs**  
Highly Effective

The World Heritage logo is displayed in many localities and is readily visible to visitors. The World Heritage status has been an important influence on public education, information and awareness building activities. The Jeju World Natural Heritage Centre constructed in 2012 has greatly improved
education and interpretation programs (State Party of the Republic of Korea, 2010) and is a world class centre, with an Exhibition Hall, a 4D Room and an Education Room. One of the developed programs is the training and use of World Natural Heritage local commentators (guides) (Korean Ministry of Environment, 2019). Education and interpretation is also provided at the Seongsan tuff cone Information Centre, the Manjanggul cave Information Centre, and the Mount Halla Information Centre. As noted above the multiple international designations for Jeju have increased public environmental awareness.

**Tourism and visitation management**

Tourism numbers immediately following inscription were not reported to increase dramatically (State Party of the Republic of Korea, 2010) however, visitor numbers were already high for often small areas (IUCN, 2007) and numbers have increased more recently. Overall visitation to Jeju has risen dramatically since 1996 (Lee et al., 2014). There is significant overcrowding in some areas of the World Heritage site. There is only limited co-operation with the tourism industry. The number of visitors is monitored daily. Carrying capacity surveys have been conducted to determine improved methods for managing the large numbers of visitors on Mount Halla (State Party of the Republic of Korea, 2010). The number of visitors to the five Mount Halla trails reached a record 1.25 million in 2015. Since February 2020, hikers wanting to climb to the top of Mount Halla are required to book a visit in advance as part of a pilot reservation system. Two of five trails are affected, Seongpanak and Gwaneumsa, with only 1,500 visitors allowed per day. Reservation system will be formally implemented next year after the 11-month pilot period (The Korea Times, 2020).

**Monitoring**

Since the inscription, a comprehensive monitoring program has been conducted and regular monitoring reports produced. Values and key indicators have been defined but monitoring the status of indicators could be intensified (State Party of the Republic of Korea, 2010). Remote sensing [DEM (Digital Elevation Mapping) by LiDAR (Light Detection and Ranging)] is being used to monitor changes to natural systems (Lee et al., 2014).

**Research**

Knowledge of the values and attributes of the World Heritage site are mostly sufficient but there are gaps. There is a comprehensive, integrated program of research, covering all components in the site, and results have been published in scientific journals and on the web (State Party of the Republic of Korea, 2010). Research on geophysics and geological values (Song et al., 2018; Woo et al., 2019), groundwater level and quality (Chang et al, 2019), tourism (Fischer et al., 2019) and even new discovered species (Lee, 2019; Lee et al., 2019) in Jeju Island is ongoing. Jeju Island is currently the only site in the world where all four international, area-based conservation designations overlap in the same location. In fact, UNESCO recently approved the establishment of the Global Research and Training Centre for Internationally Designated Areas (GCIDA) in Jeju Island as a centre under the auspices of UNESCO (category 2) (UNESCO General Conference, 2019).

**Overall assessment of protection and management**

Overall protection and management of the World Heritage site are satisfactory and at present the values of the site do not appear to be threatened. Commendable efforts are being made to manage Jeju Island in a holistic manner to balance development, use and conservation. Matters giving some concern are the challenges of managing increasing tourism demand in small very popular areas and finding a feasible funding model to support the site in the long term.

**Assessment of the effectiveness of protection and management in addressing threats outside the site**

High levels of public awareness were noted in the IUCN evaluation of the World Heritage nomination in 2007. There is evidence that this continues to be the case and the central importance of the World Heritage designation to Jeju Island as a whole is strongly emphasized in planning,
development investment. A holistic approach is clearly evident from the Jeju Provincial Government, which has embraced the multiple international designations that overlap on the island. There are nonetheless concerns about external threats such as groundwater dynamics, increasing tourism demand and infrastructure and resultant pressure on the smaller and more delicate areas of the World Heritage site (Geomunoreum lava tube system, Seongsan Ilchulbong tuff cone and scenic values of the Hallasan National Park).

**Best practice examples**

At the time of the nomination, the State Party instigated a hugely successful and influential national World Heritage awareness-raising and promotional campaign led by politicians, and involving government officials, the business community and the media, which is an excellent model for involving civil society in the World Heritage Convention.

The State Party has negotiated a twinning arrangement with the Tongariro National Park World Heritage site in New Zealand and the Hawaii Volcanoes National Park in the USA (Jeju World Heritage Management Bureau and Hawaii Volcanoes National Park, 2008).

Jeju Island is currently the only site in the world where all four international, area-based conservation designations overlap in the same location. In fact, UNESCO recently approved the establishment of the Global Research and Training Centre for Internationally Designated Areas (GCIDA) in Jeju Island as a centre under the auspices of UNESCO (category 2) (UNESCO General Conference, 2019). One of the biggest benefits of Jeju Island being a multi-internationally designated area with four overlapping international designations is the level of the local communities' awareness of conservation and sustainability (Schaaf and Clamote Rodrigues, 2016). This has translated into high levels of active volunteer engagement in conservation, a heightened awareness of any environmentally threatening developments and better tourism co-branding of the World Heritage site.

### State and trend of values

**Assessing the current state and trend of values**

**World Heritage values**

**An outstanding shield volcano with an extensive lava tube system**

Since inscription in 2007 the high scenic and aesthetic values remain generally very well protected. Obtrusive impacts of hotels, roads, communication towers and transmission lines were removed from the World Heritage site, though they do remain in the buffer zone.

**One of few shield volcanoes in the world on a stationary continental crust plate, with the world’s best developed system of lava tubes**

Geological values and attributes are generally resilient and resistant to impacts and changes. Protection of the lava tubes and their delicate carbonate speleothems is a major task requiring constant monitoring and effective management intervention if necessary. The management regime is well designed and resourced to undertake this task and no problems have been reported to date. Potential impacts from growing tourist numbers and changes to groundwater require vigilance.

**Summary of the Values**
IUCN World Heritage Outlook: https://worldheritageoutlook.iucn.org/
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Assessment of the current state and trend of World Heritage values

Assessment of the current state and trend of World Heritage values

There remain no immediate concerns with the current state and trend of the natural values and attributes of the World Heritage site, which are generally well protected under the current management regime. Developments in the buffer zone need monitoring to avoid any possible negative effects on the site. Priority attention will be needed to carefully monitor the impacts of high visitation and any adverse impacts from changes to groundwater.

Assessment of the current state and trend of other important biodiversity values

Assessment of the current state and trend of other important biodiversity values

Regionally significant biodiversity, mainly located within Hallasan National Park, continues to be in good condition. The site’s World Heritage values are managed in an integrated way, mindful of the broader array of values in the protected areas.

Additional information

Benefits

Understanding Benefits

Importance for research, Contribution to education

Inscription of the Jeju World Heritage site has resulted in very positive outcomes for raising conservation awareness in the general public and among key stakeholders. Interpretation and promotion of the site also contribute significantly to promotion of the World Heritage Convention. A comprehensive research program is conducted. The site is used extensively in geological and environmental education programs within the Jeju community as well as for tourists.

Direct employment, Tourism-related income

The World Heritage site employs significant numbers of professional and non-professional staff. Training programs are extensive and well-targeted. Tourism provides extensive employment opportunities and is a very significant generator of revenue.

Outdoor recreation and tourism

Tourism is a major industry on Jeju Island and the site plays a central role in promoting tourist operations.

Factors negatively affecting provision of this benefit:
- Overexploitation: Impact level - High, Trend - Increasing

Natural beauty and scenery

The most common reason for tourists to visit Jeju Island is for appreciation of natural scenery. Here tourists prefer to visit beaches, sea cliffs, hiking trails and established viewpoints - likely because of the aesthetic quality of these places (Fisher et al., 2019).

Summary of benefits

The World Heritage site clearly has intrinsic biodiversity, geoheritage and ecosystem service benefits. The key benefit of the site, as far as Jeju residents and stakeholders are concerned, rests in its tourism and the flow-on economic value from this to the tourism sector. The site provides a natural and scenically attractive foundation for Jeju and contributes to the residential amenity of the entire island. The site is
used extensively in research as well as education programs within the Jeju community and its visitors.

Projects

Compilation of active conservation projects

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<tr>
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<th>Organization</th>
<th>Brief description of Active Projects</th>
<th>Website</th>
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<tbody>
<tr>
<td>1</td>
<td>SP, Jeju Province and site management authorities.</td>
<td>Construction of a World Natural Heritage Centre in the site (completed in 2012).</td>
<td>jejwnh.jeju.go.kr</td>
</tr>
<tr>
<td>2</td>
<td>Site management authorities.</td>
<td>On-going research and monitoring programs and projects, including scientific publications.</td>
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<tr>
<td>3</td>
<td>Hallasan Preservation Centre, Hallasan Research Institute.</td>
<td>Five-year program for exotic species research and control/elimination.</td>
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REFERENCES

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