ID: 119

Geoparks in volcanic areas and the disaster risk reduction

Setsuya Nakada

National Research Institute for Earth Science and Disaster Resilience (NIED), Tsukuba, Japan

As of 2023, there are 195 UNESCO Global Geoparks in 46 countries, many of which list volcanoes themselves and landforms formed by volcanic activity as geological heritage with international values. Geoparks organically understand the relationship between geological heritage and other natural and cultural heritage, which are utilized for responsible tourism (geotourism), telling the stories among those heritage. Education is the key object of Geoparks, with experts teaching residents and teachers teaching students in schools about volcanic formations and the hazards and disasters posed by volcanic activity, through outdoor learning.

Active volcanoes are included in the UESCO Global Geoparks in Ecuador, Peru, Chile, China, South Korea, Japan, Indonesia, Germany, Spain, Portugal, Tanzania and Iceland. Many of these areas are not only celebrating the blessings of volcanoes and utilizing them for tourism, but are also implementing a variety of initiatives to mitigate disasters caused by volcanic eruptions.

An excellent example for disaster risk reduction initiatives in Geopark can be seen in the Toya-Usu Geopark, Japan. There, “Volcano Meister” system has been adopted for the past 15 years to tradition the experiences of past disasters of Usu volcano to the next generation. Volcano Meisters of now 64 registered members also serve as geo-guides, and by utilizing geological, natural, and cultural heritage, they play a role in disaster prevention by conveying the dynamic nature and blessings of volcanic activity to school children, local residents, and visitors.

ID: 240

Mount St. Helens Visitor Center Exhibit Renovation- Staying Relevant During Changing Times and Remaining Inclusive of All Voices.

Alysa Adams

Parks Interpretive Specialist 2, Washington State Parks and Recreation Commission, Castle Rock, U.S

Mount St. Helens gained international recognition during its 1980 eruption. Soon after, a National Monument was established, and Visitor Centers opened as gateways to welcome the public. They became crucial in the dissemination of volcanic information, from exploring geologically significant recreation sites to recognizing local history and educating on volcano awareness and preparedness. These hubs of activity became proficient at sharing science in engaging ways that visitors could both understand and appreciate. As Mount St. Helens evolved, so too did the need for facility updates, to continue connecting with visitors in meaningful ways. With a large-scale exhibit renovation, we were presented with the opportunity to reassess.

Our goal has been to meet the visitors where they're at, acknowledging that just as science changes people do too. With shrinking attention spans, less time dedicated to learning, accessibility considerations, and diverse interest levels it became clear our exhibits were outdated. We were also aware that not all perspectives had been included, and we were given the chance to share underrepresented voices in coordination with the tribes. Our agency has prioritized these stories throughout, in film, image and text. This presentation will explore the many ways we've addressed these factors and incorporated innovative solutions into our new exhibits to honor place-based education and strengthen visitor engagement and retention. From less text and larger images to audio-visual components and interactive elements, improvements are underway. We're aiming for a seamless visitor experience that evokes curiosity and nourishes their ongoing relationship to science and culture.

ID: 330

Llevando los volcanes al museo: archivar depósitos volcánicos con resina epoxi, un ejemplo en Arequipa (Perú)

Julie Morin[1], Nélida Manrique[2], Rigoberto Aguilar[2], Constanza Perales[3], Jersy Mariño[2], Carla Jenifer Palacios Nuñez[2], César Quispe[2], Rossibel Churata[4], Yrma Linares[5]

[1] Department of Geography, University of Cambridge, Cambridge, UK; [2] Observatorio Vulcanológico del INGEMMET, Instituto Geológico Minero y Metalúrgico, Arequipa, Perú; [3] Servicio Nacional de Geología y Minería, Santiago de Chile, Chile; [4] Departamento Académico de Ingeniería de Materiales, Universidad Nacional de San Agustín de Arequipa, Arequipa, Perú; [5] Instituto Nacional de Defensa Civil – INDECI, Arequipa, Perú.

Arequipa (Perú) es una ciudad vulnerable frente a los peligros volcánicos, expuesta a posibles actividades explosivas del volcán Misti. Sin embargo, la concientización sobre el riesgo es bastante baja, ya que no existe en la memoria una erupción reciente. En 2022, los investigadores del proyecto de investigación “actualización del mapa de peligros” identificaron un geositio de ~5 metros de altura con 21 capas de depósitos, que representan los últimos 30.000 años de actividad del Misti.

Nuestro objetivo ha sido archivar este afloramiento con resina epoxi con el fin de: (1) exhibirlo al público en el Centro de Sensibilización de INDECI (Protección Civil Peruana) y en el Observatorio Volcanológico del INGEMMET (Servicio Geológico de Perú), para sensibilizar a la población sobre los peligros volcánicos; (2) preservar el registro geológico, de depósitos expuestos a la degradación debido a su bajo grado de compactación.; y (3) contribuir con la educación en ciencias de la Tierra.

Para ello, hemos impregnado los depósitos estratigráficos "pintando" el afloramiento con resina epoxi. Una vez seca, la resina epoxi forma placas sólidas que pueden retirarse para su reubicación. En esta presentación, queremos describir las etapas del proceso y los problemas técnicos que encontramos incluso durante la implementación en los museos locales para que otros equipos de investigación, museos, geoturismo o geopatrimonio puedan aplicarlo fácilmente en otras regiones.

ID: 425

Time Travel Through Geoheritage Interpretation Develops an Environmental Conservation Ethic

Daniel Tormey

[1]Catalyst Environmental Solutions Corporation, Santa Monica, USA; [2]IUCN Geoheritage Specialist Group

Interpreting geoheritage is true time travel, free and available to people around the world. Threats abound to this geoheritage. Many rocks are hard, and some have been around a long time. But Earth actively erodes and consumes rocks at the surface, and human technology has speeded up this process by affecting climate change and extracting geologic resources for our use. What can we do to protect Earth's geoheritage? We can interpret it for visitors in engaging ways that put them in the geological scene and trust that the wonder of the wet and rocky part of our planet will captivate them so that they become apostles of a true environmental conservation ethic. Another way to put it, from an early interpreter of geoheritage is "through interpretation, understanding; through understanding, appreciation; through appreciation, protection".

Tales of the Earth, like the great chain of volcanoes around the Ring of Fire; the perfect fossil preservation of the first 4-limbed creatures like us, who were learning how to breathe, walk, reproduce and give birth 400 million years ago; or the tiny 4.4 billion year old zircons, the oldest bit of crust we have available to interpret, are themselves preserved in a 3.4 billion year old river deposit in the Jack Hills of Australia: good interpretation of these wonders captures our imagination and cause us to wonder how things have changed since the time preserved in those rocks. The wonder extends to the future because geoheritage provides context for understanding climate change and smart management.

ID: 448

Centro de Visitantes de Armero (CVA) historia, patrimonio y gestión del riesgo volcánico a través de "la lección de Armero"

Hernan Darío Nova Vargas[1] , José Arnaldo Nova Vargas[1]

[1]Centro de Visitantes de Armero, Corporación Memoria de Armero, Armero, Colombia

La ciudad de Armero en Colombia fue fundada en 1908 frente al cañón del río Lagunilla que nace en los glaciares del Volcán Nevado del Ruiz a 5.300 metros snm, prosperó agroindustrialmente, tenía 30.000 habitantes; el 13 de noviembre de 1985 alrededor de las 21:20 el volcán hizo erupción fundiendo parte del glaciar y desencadenando un lahar que destruyó Armero a las 23:15 cobrando la vida de 22.000 de sus habitantes. Los sobrevivientes sufrieron un total desarraigo y afectación del tejido social.

Actualmente en las ruinas de Armero existe el Centro de Visitantes de Armero (CVA) a cargo de los hermanos José y Darío Nova quienes de niños y jóvenes habitaron aquella ciudad y ahora se dedican a difundir la historia de su pueblo antes, durante y después de aquella fatídica noche, Darío artista plástico ha elaborado los memoriales que dan identidad al lugar, diseña suvenires, posters e infografías para el CVA. Ambos se han capacitado como guías turísticos oficiales para mostrar cómo era la ciudad antes sirviéndose fotografías y sus memorias personales, pues hoy el lugar es un inmenso bosque, dictan a los visitantes las charlas de contexto o "la lección de Armero" con énfasis en gestión del riesgo Volcánico, gracias a los procesos de interacción con el Servicio Geológico Colombiano a través del Observatorio Vulcanológico y Sismológico de Manizales, que ha fortalecido el discurso sobre el contexto Vulcanológico en los procesos de gestión de las ruinas de Armero como sitio patrimonial y sus actividades de geoeducación y geoturismo.

ID: 540

Scientific interpretation for community understanding and engagement in the Cuicocha Cotacachi Imbabura UNESCO Global Geopark, Ecuador

Zulay Micaela Villarroel, Harvey Andrés Reascos , Andrés Israel Chalampuente, Celine Mandón

Escuela de Ciencias de la Tierra, Energía y Ambiente, Universidad de Investigación de Tecnología Experimental YACHAY, Imbabura, Ecuador

Cotacachi-Cuicocha Volcanic Complex is one of the 12 geosites of the IMBABURA UNESCO World Geopark. This volcanic complex comprises the potentially active volcano Cotacachi, four domes, and the crateric lake "Cuicocha". The geosite contains nine communities, and its main attraction is Cuicocha Lake, which exhibits CO_2 emissions inside the lake. Cuicocha Lake receives around 62,000 tourists annually, and its tourism is mainly community-based. Additionally, it has archaeological sites corresponding to the Cotacachi-Cayapas culture.

A scientific communication project was developed to inform communities and tourists of the geological history, risks, and dangers related to the volcanic complex. The applied methodology consisted of the geological characterization of the Cotacachi-Cuicocha Volcanic Complex and the implementing of assertive scientific communication to communities. Part of the process was performing a bibliographic compilation, field technical outings, trail evaluation, recognition of potential tourist sites, and knowledge assessment surveys at each community. Virtual dissemination conferences and an informative brochure suitable for the non-scientific public were held based on the surveys and the information collected.

The project was based on creating interpretative narratives that effectively promote respectful coexistence between local communities, visitors, and nature. It can also contribute to the sustainable development of geosites by generating economic opportunities for local communities.

ID: 15

Análisis de datos aeromagnéticos en el volcán Amado Nervo, Nayarit, México para la estimación del potencial geotermico.

Jimena Itzel Castellanos-Villalpando[1], Mario Alberto Fuentes–Arreazola[2], Nancy Vázquez-Hernández[3].

[1]Licenciatura en Ingeniería en Geofísica, CUSUR-UDG, [2]Departamento de Ciencias Exactas, CUCOSTA–UDG, [3]Licenciatura en Ingeniería en energía, CUT-UDG.

Amado Nervo (21.1503 N, -104.7566 W, 1,447 msnm) es un volcán tipo escudo del cuaternario (0.22 Ma) ubicado en la porción occidental del Cinturón Volcánico Trans-Mexicano, en el graben San Pedro-Tepetiltic. Con base en el contexto geológico-tectónico regional, el volcán Amado Nervo es un interesante prospecto de aprovechamiento geotérmico. Por lo tanto, el objetivo de este estudio fue realizar un modelo preliminar del probable sistema hidrotermal asociado al volcán. El modelo geológico conceptual fue construido a partir de datos de libre acceso disponibles en las bases de datos del Servicio Geológico Mexicano (SGM) e INEGI. Para el modelo geofísico utilizamos datos aeromagnéticos del SGM debido a que han demostrado ser una herramienta eficaz para la evaluación preliminar de zonas geotérmicas. En particular, el volcán mostró estar caracterizado por una intensa anomalía magnética positiva (~ 900 nT). En este sentido, el análisis espectral de la anomalía magnética observada permitió determinar una profundidad de ~ 2 km para la base de las rocas con características magnéticas. Consultando información publicada relacionada con gradientes geotérmicos en las inmediaciones de la zona de estudio (~ 103 °C · km^{-1}) determinamos que la posible fuente de calor se encuentra a por lo menos 11 km por debajo del volcán. Finalmente, se calculó un potencial geotérmico aproximado de 28 MW como resultado de implementar el método volumétrico con simulación de Montecarlo. Los hallazgos de esta investigación pretenden establecer un marco de referencia para evaluar la factibilidad de los probables recursos geotérmicos del sistema hidrotermal asociado al volcán.

ID: 124

Park interpretation contributes powerful strategies for coordinated volcano awareness campaigns.

Carolyn Driedger [(1)], Todd Cullings [(2)], Patti Wold [(3)]

[(1)] USGS-Cascades Volcano Observatory, Vancouver, Washington, USA

[(2)] Olympic National Park, Port Angeles, Washington, USA

[(3)] Mount Rainier National Park, Ashford, Washington, USA

Coordinated public awareness campaigns are successful when information disseminators unite to convey compelling, consistent, and complementary messages about living safely near volcanoes. Park interpretive staff, as managers of public lands, have a natural interest in visitor learning, safety, and resource appreciation, and they can contribute to positive campaign outcomes.

Park interpretive rangers promote learning in ways that complement customary communication styles used by scientific, educational, and emergency management organizations. Interpretive rangers are trained to use thematic interpretation that appeals to visitors' intellect and emotions by forging meaningful connections, usually through exhibits and multi-media, thoughtful personal interpretation, and educational programming. Park interpretation methods go beyond the presentation of facts. They explain relationships between elements of a park resource; provoke thought; and stimulate visitors to take action. Exhibits, digital media, and personal interpretation based on these methods can encourage on-site 'see for myself' experiences that inspire both clear insights, and long-term emotional and intellectual connections about volcanoes, personal safety, and preparedness.

Public awareness campaigns succeed through cooperation, collaborations, and awareness of each profession's strengths and limitations. Together, many professions can contribute to broad community immersion in volcano-related information. Scientists can aid park interpretive rangers by becoming familiar with interpretation methods, and by contributing essential knowledge and visual aids that assist park staff as they interpret the wonder and hazards of volcanoes.

ID: 459

Local Knowledge and Information Provision: Enhancing the Role of National Park Rangers in Icelandic Hazard Preparedness

Pauliina Vesaluoma

Institute for Risk and Disaster Reduction, University College London, London, United Kingdom

Volcanic environments are a prominent feature of Iceland's national parks, Snæfellsjökull, Thingvellir and Vatnajökull, attracting significant levels of geotourism. Park rangers in Iceland are central to the daily running of these parks, serving as a key link between nature and the public by carrying out conservation activities and providing nature interpretation to visitors. Rangers are also crucial for ensuring public safety in these hazard-prone settings, striving for the safe and sustainable management of geotouristic volcanic sites. This recent study provides a novel contribution to the Icelandic volcanic risk literature by exploring how park rangers in Iceland perceive volcanic risk and their role in local hazard preparedness through a qualitative interview approach. Findings shed light on the intersection of rangers' highly localised environmental knowledge, and the potential for rangers to enhance local preparedness for volcanic hazards by acting as information providers. Interviewed rangers had relatively high volcanic risk perceptions, compared to other groups previously studied in Iceland, characterised by strong hazard knowledge and direct hazard experience. The educational and interpretative role of rangers signified that they possess immense local knowledge of volcanic environments, valuable for monitoring, evacuation, risk communication and emergency planning in collaboration with other stakeholders, such as scientists and civil protection. With first aid training, practical skills and robust knowledge, rangers are experts in their local risk environment, making them important contributors to scientific hazard communication, education, and preparedness. The role of rangers should be further recognised in Iceland as part of a holistic long-term risk management approach.