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Pop-Up Experiences to Engage Youth Audiences with Geothermal

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ABSTRACT

There is a common misconception about science outreach, which starts by stating that science communication needs to bring people closer to science. At the Andean Geothermal Center of Excellence –a university based research center in Chile– we believe that we must bring science closer to people. This is not simple wordplay, it implies a series of editorial decisions about how we promote geothermal energy among our key audiences. And one of our target groups are school children and teachers. An obvious choice would be to bring geothermal information to the classrooms, where audience is captive. But we want our audiences to get excited about geothermal, and our school system in Chile is still old-fashioned in a way that it is still committed to delivering academic information, when our goal is to interest and entertain young people with the hot and exciting universe beneath our feet. So we decided to experiment with pop-up experiences, which are short term outdoor exhibitions. We took over public spaces and showcased the power of the volcanic Andes to the people. Because, yes, we also use volcanoes as a gateway to talk about geothermal with young audiences. So, during the last 5 years, we experimented with a nomad circuit of book releases about volcanoes, springs and heritage; a temporary science mural; talks about the geology in popular TV shows at science fairs; and a virtual reality experience to take a journey to the underground in a geo-submarine that we landed at a subway station. In a way, we operate as a guerrilla, we ambush our audience and hope they will fall for their captor's message: geothermal, the hottest energy there is, and also so cool too!

1. INTRODUCTION

The Andean Geothermal Centre of Excellence (CEGA) started operations in 2010 becoming the only national research center devoted to geothermal energy in Chile up to date. Its creation responds to the personal concern of a group of Earth scientists who wanted to explore the development of geothermal energy in Chile, the country with the largest untapped geothermal potential in the world until that moment (Lahsen, 2005). Thus, a team of geologists and geophysicists from two main universities in Chile (Universidad de Chile and Pontificia Universidad Católica) applied to a national call for proposals from the National Commission for Scientific and Technological Research (CONICYT) that seeked to create new local excellence research centers. The public funding was awarded, covering a 10 year life cycle, after which the center is expected to run independently by strengthening links with the industry. Something particularly difficult in the area of geothermal in Chile, where there is only one power plant in operations since late 2017 and no second power plant on the horizon. The local industry is not consolidated, and there are no public policies to promote geothermal energy beyond declarations of good intentions of the last governments where they stablish that geothermal must be fostered (Ministerio de Energía, 2018; Ministerio de Energía, 2014), but no concrete development programs have yet been launched despite that the progress of geothermal in Chile has historically been determined by the existence or absence of public policies (Sánchez-Alfaro et al., 2015).

In brief, during almost a decade CEGA developed its work in lack of a national framework of public policy to guide it, and built its own evolution strategies, something that also applied to the Center's communication and outreach plan, that focused on making geothermal energy known to different audiences, because non other public institution in the country who were supposed to promote it were investing in this task (Otero, 2015). Far from being an inconvenience, this situation gave CEGA the freedom to create, experiment and establish the first set of independent products and activities, with a local perspective, related to geothermal in Chile, focused at a target audience that includes students (primary up to graduate), media, decision makers, interested citizens and local communities near geothermal projects. Among all these audiences, we value youth as a core audience because they are undertaking an educational formative process, and our outreach program generates content that can complement their formal learning on issues like energy, natural heritage, and environmental care. Also, young people has been our privileged public because the vast majority of members of our center are young citizens - undergraduate and graduate students – and we rely in these strong ties to get our message across a wider audience through their social media (Adams, 2011; Penney, 2018), being Facebook, Twitter, Youtube and Instagram, our main information channels, coupled with a media management strategy.

So, to open up the conversation about geothermal we created content with the aim to entertain, interest and generate understanding (Burns et al., 2003) about geothermal energy in different platforms (book, mural, talks and virtual reality exhibit), and distributed these content in a way it would encounter their audience mainly by surprise, in a pop-up fashion, in public places. This work is about what we made and how we distributed these materials to bring geothermal closer to everyday contexts in an appealing way to young audiences. Because CEGA aims to reach a wide audience, all products are developed under a creative commons license.

2. THE BOOK "THE LAND OF FIRE"

During CEGA's early days, the center received a copy of the book "Stories from the heated Earth" (Cataldi et al., 1999) – kindly donated by Hodgson, one of the editors - where several narrations about the relationship of ancient peoples with geothermal are portrayed. The book is an amazing piece of work, and quite an inspiration for CEGA's Outreach Unit. Precisely for that reason, CEGA felt in debt with the text, because the only reference to Chile's geothermal heritage was an allusion to *Rapa Nui* (also known as Easter Island in most of the western world) and the use of volcanic rocks for the sculpturing of *moais*. CEGA fell the call to gather more information about its local geothermal heritage, because as the editor's of the Stories from the Heated Earth state, there is a misleading general idea that the heat of the Earth is a new form of energy, an innovation from our modern culture rather than an

element that embraces and accompanies first nations and cultures since their origins. Those stories needed to be told, to be told again, to a next generation. This is how the idea of writing the book The Land of Fire (Otero, 2014) arose (Figure 1).

Figure 1: Book cover of The Land of Fire: land and nature marked by deep heat (original title in Spanish: "La Tierra de Fuego: gente y naturaleza marcada por el calor profundo").

As CEGA aimed the book for young readers, images were crucial for storytelling, thus the editorial decision was to give same space for photographs and illustrations than for than words in every page. To complete the task, CEGA gathered a team of 18 authors - geologists, anthropologists and journalists – and more than 20 prominent national artists and photographers to tell the story of how 15 geothermal zones (volcanoes, hot springs, geysers and more), in what today we know as the country of Chile, were formed. Stories were told from the perspective of the Earth Sciences – showing how nature fractured, boiled and moved to become the landscapes we know now - and they also were told from the perspective of the Social Sciences, narrating how people have related to these sites in a spiritual, economical or festive manner.

The project was carried out thanks to a competitive public funding ('Proyecto Explora CONICYT de Valoración y Divulgación de la Ciencia y la Tecnología'[1]) that allowed to write, design and print 1,000 copies of the book, all of which were donated to public libraries from across the country, the subway's library ('Bibliometro') and the Free Library ('Biblioteca Libre'), a nomad tiny library that fits in a van (Figure 2) and travels parks, beaches and music festivals to promote book exchanges among young people. Books were released with the aim that they would find a reader.

A digital version of the book is available at https://issuu.com/cega_uchile/docs/latierradefuego

Figure 2: During the book launching, the book cover was painted over the Free Library van that would later cross the central coast during summer vacations making book releases on beaches, parks and festivals like Lollapalooza.

[1] https://www.conicyt.cl/explora/category/concursos/

3. THE TEMPORARY MURAL "VOLCANOES OF CHILE"

Mural art is a powerful tool to popularize content in local communities: it brings information to everyday contexts, it embellishes the street, tells stories, and its creation implies the synthesis of concepts to facilitate their understanding. "Volcanoes of Chile" was the first Chilean scientific-educational inspired mural. It was a temporal mural, because the walls over which it was painted were covering a subway station construction site, and its exhibition lasted over a year. The Andean Geothermal Centre of Excellence led this project with the support of Metro de Santiago (Chile's local subway). It was a 300 m^2 art work that was the resulting product of several conversation sessions between three graffiti artists (all of whom were also involved in the illustrations of the book The Land of Fire), two geologists and a science communicator. The objective of the piece was to provoke the interest of pedestrians in what lies beneath our mountain rage, and to draw attention to our diverse geology, in a pictorial language that was appealing for the youth.

During the first weeks of the project, the scientists involved wanted to fit as much information as possible in the mural, the science communicator wanted to keep it simple, and the artists where still trying to understand what 'subduction' meant and if 'pyroclastics' could be represented in fluor colors or not. The final work, which was a mixture of giant infographics and hyper realistic recreations, was the result of a negotiation process where mutual curiosity and respect about each expert expertise was clue to a successful large-scale pop science street art experiment. The mural was promoted among science teachers from neighboring schools, sending them a postcard of the mural, inviting them to take a walk around it with their high school students. The content depicted in the mural included layers of the Earth, subduction process, types of volcanoes and historical eruptions in Chile, how geysers are formed, ceremonial relations of pre-hispanic peoples with volcanoes, and geothermal energy. Nearly 6,900 pedestrians walked nearby the mural corner every day, and the initiative had a good reception in the media, with almost 20 articles published in newspapers and websites, along with mentions to it in radio and TV programs. After the mural was disarmed (it was covering a Subway construction site), and thanks to the fact they were tag free – something quite uncommon for most murals in Santiago- the walls were donated to an institution that used them for building workshops for school children involved in science assessment activities.

Figure 3: One of the 4 walls of the mural "Volcanoes of Chile" depicting the subduction process, El Tatio geyser field and famous Llullaillaco mummies found on a ceremonial site on top of the volcano that bears that same name.

3. TALKING ABOUT THE GEOLOGY ON SCREEN

There are plenty of movies whose central theme is linked to geology, dealing with earthquakes, tsunamis, volcanoes and more. Additionally, there are plenty of audiovisual productions with stunning landscapes which are a delight for nature lover viewers. Movies, also, are better than lectures or texts at engaging young people (McNeal et al., 2014) with Earth Sciences issues. At the same time, mainstream products, like films, may carry misconceptions about the science involved, either in purpose, in benefit of the fictional script narrative or because people in their adulthood still have robust misconceptions about geology (Francek, 2013). Thus, talking about the geology in mainstream movies and TV shows seemed an attractive idea for talks in science fairs and festivals were CEGA was invited to participate in massive talks for high school students. The National Science and Technology Fair runs every year during a weekend and gathers around 50,000 people in Santiago, and the Engineering and Science Festival is a bi-annual event that gathers over 15,000 people.

For these events, CEGA developed the talks "The Geology of Game of Thrones" & "Damn fiction: Geology in movies". On the first one, the speakers explain how some of the landscapes used as scenarios in the famous HBO TV series[2] where formed, reporting the real geological history of the locations, with an emphasis on geothermal and volcanic features, like a hot springs cave and the formation of 'dragon glass' as it is called in the TV show, which is obsidian rock; and also, the hosts point out where in Chile similar places and rocks can be found in the Andean mountain range, all of which is a hook to end up talking about the heat under our feet, which makes possible many of these beautiful landscapes and features. "The Geology of GOT" attracted so much attention, that it

[2] For more information about the TV series visit oficial web site https://www.hbo.com/game-of-thrones

obtained media coverage in a national circulation newspaper (Figure 4). After its premiere in 2017 the talk has been scheduled at universities and science fairs.


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EL DÍA

La formación geológica de Dragonstone también se da en el Cajón del Maipo

Atención fanáticos: los paisajes de GOT tienen su símil en Chile

Dos geólogas fanáticas de la serie dictaron el taller "La geología de Game of thrones", en la XI Fiesta de la Ciencia y la Tecnología, organizada por el programa Explora Conicyt, que se celebró este sábado en el Parque Metropolitano.

Figure 4: *Las Últimas Noticias* newspaper features an article about CEGA's talk "The Geology of Game of Thrones" 8th October 2017.

For the talk "Damn fiction: Geology in movies", the speakers reviewed different movies related to Earth's sciences, like The Core, 2012, The Wave, Dante's Peak, among others, which mostly dealt with a violent side of nature. The narrative of the presentation considered emphasizing that showing dramatic geological events favored a cinematographic storytelling, however, there is a positive side about geological hazards too: Chile coexists with earthquakes and volcanic eruptions because of its position in a plate boundary, but this also brings positive consequences such as mineral wealth and an enormous geothermal potential. During its premiere, the talk was visualized by 3,800 people on line, becoming the second most watched talk of the festival.

4. A VIRTUAL JOURNEY TO THE CENTER OF A VOLCANO

Considering the growing ability of location-based entertainment with virtual reality to attract young users (Mihale-Wilson et al., 2018), CEGA's last outreach project explored this platform for geothermal promotion, creating a short term interactive exhibition called "Journey to the Center of the Volcano". The objective of the exhibition was to promote learning about the shape of the volcanoes, their dangers and benefits for the Chilean population, highlighting that Chilean volcanic nature leads to a great geothermal potential. Geothermal energy is hidden underground, and its inner invisibility is one of the characteristics that difficult geothermal promotion (Gross, 2013), thus one of the objectives of the virtual reality experience was to unravel the hidden heat of the Earth through a fantastic voyage to the heart of a volcano, and invite the audience to wonder how much energy they thought it could be generated from the heat of the Earth (Figure 5).

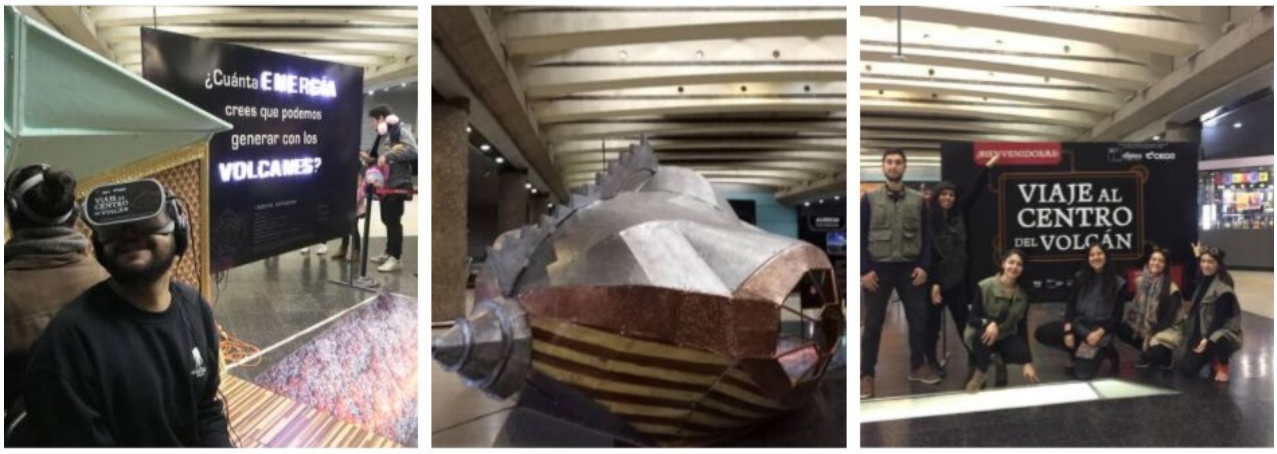

Figure 5: From left to right: Virtual reality experience inside the Ship with a panel at the background that asks How much energy do you think we can generate with volcanoes?; exterior of the Verne's inspired Ship; part of the team of geologists that guided the exhibition.

The exhibition was mounted for two weeks during school winter holidays (July 2019), inside a subway station, and it was free of charge, receiving over 200 people every day. The exhibit visuals were inspired in the work of the science-fiction pioneer novelist Jules Verne, and it included a real size ship for a crew of 4 persons who could travel inside a volcano through virtual reality helmets, entering by the crater, reaching the magma chamber, to finally escape an eruption through a volcanic tunnel. The exhibition also included a corridor of 12 information panels, with augmented reality images, animated models and stereoscopic viewers, along with the company of a team of young geologists who toured the exhibition sharing their experiences on volcanic and geothermal research. The objective of the display was to show the dangers and benefits of volcanoes in Chile. Thus, the geothermal energy potential was highlighted as one of the positives of having over 2,000 volcanoes along the Chilean Andean mountain range.

Most of the materials related to this exhibition (RV experience, exhibition booklet and podcasts) will be available at the project web page www.viajealcentrodelvolan.cl by December 2019. "Journey to the center of the volcano" was developed thanks to a competitive public funding ('Proyecto Explora CONICYT de Valoración y Divulgación de la Ciencia y la Tecnología), the economic support of CEGA and the collaboration of Metro de Santiago.

5. CONCLUSION

During its almost 10 years of operations, the Andean Geothermal Center of Excellence – CEGA– Outreach Unit has been able to experiment with different science communication materials aimed at a young audience. Because in Chile there were no promotional geothermal materials before the creation of CEGA, the center was free to create its own and totally new style for the standards of diffusion of renewable energies in the country, which are generally designed in a more formal and technical language.

Most of CEGA's outreach materials were created using the themes of volcanoes as a gateway to talk about geothermal energy, under the premise that if we have so many volcanoes in the Andean mountain range, how much energy must there be under our feet? This idea guided the development of CEGA's products, which were created with a pop aesthetic in mind, using main stream cultural references, art and state of the art technologies to engage our public.

The distribution strategy of CEGA's outreach materials sought to expose them on public spaces of high traffic, like parks, festivals, busy commercial corners and subway stations, and promoting them through the center's social networks. One of the indicators that our products were successful is the positive reception in the media, and the number of visitors that the activities have achieved.

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