

A geomining theme park in the Vetas-California mining district (Santander): An integrated approach for assessing the geotourism and geoeducation potential

Un parque temático de geominería en el distrito minero de Vetas-California (Santander): un enfoque integrado para evaluar el geoturismo y el potencial de la geoeducación

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ABSTRACT

The province of Soto Norte (Santander), Colombia, is known for its mining tradition in the municipalities of Vetas and California. Four centuries ago, mining exploitation was developed and environmental liabilities were generated, which put at risk this activity. Many defend the topographic and vegetal restoration of exhausted mining operations, burying them or sealing them. However, when these works have brought out mineral outcrops of worldwide interest or have allowed access to galleries excavated many centuries ago that have provided valuable archaeological remains that have served to learn a little more about our history. Therefore, Facing the general accepted idea that the restoration of a mining waste inevitably passes through its burial or sealing. Geotourism around the mining industry is an emerging sector that contributes not only to the diffusion of the interesting geological and mining heritage of the Vetas-California mining district (Santander), Colombia, but also to the development of local communities. Therefore, this mining district can be transformed in a geomining thematic park to protect the natural resources and to promote the growth of the local, regional and national economy.

Keywords: Economy, geotourism, mineral processing, rehabilitation, waste.

RESUMEN

La provincia de Soto Norte (Santander), Colombia, es conocida por su tradición minera en los municipios de Vetas y California. Hace cuatro siglos se desarrollaron explotaciones mineras y se generaron pasivos ambientales que pusieron en riesgo la actividad. Muchos defienden la restauración topográfica y vegetal de las explotaciones mineras agotadas, enterrándolas o sellándolas. Sin embargo, cuando estos trabajos han sacado a la luz afloramientos minerales de interés mundial o han permitido el acceso a galerías excavadas hace muchos siglos, han proporcionado valiosos restos arqueológicos que han servido para conocer un poco más nuestra historia. Por ello, frente a la idea generalmente aceptada de que la restauración de un residuo minero pasa inevitablemente por su enterramiento o sellado, el geoturismo en torno a la minería es un sector emergente que contribuye no sólo a la difusión del interesante patrimonio geológico y minero del distrito minero de Vetas-California (Santander), Colombia, sino también al desarrollo de las comunidades locales, razón por la cual este distrito minero puede transformarse en un parque temático geominerario para proteger los recursos naturales y promover el crecimiento de la economía local, regional y nacional.

Palabras claves: Economía, geoturismo, procesamiento de minerales, rehabilitación, residuo.

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I. INTRODUCTION

Mining tourism is a constantly growing branch of tourism, involving visits to both active and disused mining sites (e.g., Otgaar et al., 2010). Mining sites are important both for their geoscientific and industrial aspects and for their valuable cultural character (Różycki & Dryglas, 2017). Therefore, visiting of mining sites have a typical geotourism nature (e.g., Dowling & Newsome, 2006; Hose, 2012). Geotourism is defined as tourism that sustains or enhances the distinctive geographic character of a place, its environment, heritage, aesthetics, culture, and the well-being of its residents. In UNESCO Global Geoparks, geotourism develops on the basis of geological heritage and landscape in conjunction with the natural, cultural and intangible heritage aspects of a specific territory (UNESCO, 2020). Mineral resources and ancient or present activities that relate to them, have a great potential for the development of geotourism. However, geotourism of mining sites is challenging as they are often located in remote areas, are noisy, lack services and possibly cause pollution. In recent years, mining tourism is being introduced in the mines to overcome these problems and represents an opportunity for the development of mining regions (Różycki & Dryglas, 2017).

Undoubtedly, tourism around mining complexes is an emerging sector, which can promote development from rural areas. It can mitigate the environmental impact generated by the mining activity or the imminent closure of the mines, either due to the mining crisis in Colombia. However, we are faced with a scenario in which local communities with a mining vocation could experience a catastrophe, the end of a way of life that has represented the basis of the accepted economic and social order for generations. The Vetas-California mining district (VCMD) has numerous active and abandoned mines, as well as valuable natural heritage elements, providing great potential for the development of geotourism, which can provide visitors with the opportunity to observe the oldest geological formations in the Santander Massif, geomorphological landscapes, active and abandoned mines, traditions, myths and legends. Geotourism represents one of the fastest growing branches of tourism in the world, and is characterized by a dynamic character, which is sustained by the geological heritage and its integration with other elements of the natural and cultural heritage of a territory (e.g., Newsome & Dowling, 2010; Ólafsdóttir & Dowling, 2014). However, it is necessary to have planning and development specific plans agreed by all partners that meet the social and economic needs of local communities, while protecting and promoting the natural and cultural heritage of their territory. When a mine closes, a geological and mining heritage always remains as a remnant. If adequate protection measures are not taken, This heritage gradually would deteriorate in the same way that occurs with the degradation of the natural environment when mining operations started. Therefore, faced with the generally accepted idea that the restoration of a mining waste inevitably involves burial or sealing, an increasingly important group of people and institutions think that the preservation of evidence in outcrops, on the walls of a gallery or in an industrial facility. An alternative to mitigate the degradation of the geological and mining heritage that,

in some cases can be viable and positive, is the creation of mining theme parks for the development of geotourism.

II. METHODS

An alternative to this approach, which has been adopted worldwide, is the use of industrial pasts as stepping stones to the future (Marota and Harfst, 2021). In the same way, it must be considered that, in regional development initiatives, such as the one proposed in this work, it is not only about the mining past but about the present, considering that in the VCMD there is mining active and abandoned, which presents a valuable potential as a resource for its research, which could become something more relevant for regional policy makers (Harfst et al., 2019). The resources that could be used include not only the facilities of mining operations but also mining wastes. However, within the potentials are also those elements that are part of the natural and cultural heritage of the region. Natural potentials include both geological and mining heritage (mining-generated landscapes and features related to them) as well as biodiversity, while cultural potentials include tangible heritage (architectural and technological infrastructures, production facilities and housings) and intangible heritage (traditions and non-material mining events, specific identities linked to a place and other aspects of industrial transformation) (Görmar et al., 2019) (Figure. 1).

2.1 Geological setting

The proposed geomining theme park can be located in the VCMD, which belongs to the Santander Massif, Eastern Cordillera of the Colombian Andes (Figure. 2). It presents lithologies associated to Precambrian metamorphic rocks to which the Bucaramanga gneiss belong, considered the oldest unit, igneous rocks of the Triassic-Jurassic granitic composition (e.g., Mantilla et al., 2012, 2013) are also found and an age magmatic pulse is evidenced Late Miocene due to the presence of porphyritic dikes and bodies, as well as tectono-hydrothermal gaps of Pliocene-Pleistocene age (Rodríguez, 2014). There is a strong structural control reflected by the presence of the different faults on the area of the deposit. Regionally, the main fault is the Bucaramanga fault, however, the structural control over the deposit is given by the local faults of San Juan, La Baja, Angosturas, Móngora, Paez and Romeral-Cucutilla and other minor failures associated with these, which They play an important role in the mineralization of box rock. In the central part of the Santander massif, there is a particular fault pattern with predominantly NE-SW trend faults such as the Surata Fault, with dextral movement (Amaya and Zuluaga, 2017), which coincides with the veins of the deposit, being parallel to subparallels.

III. RESULTS

3.1. Valuation of the geological and mining heritage

The VCMD constitutes a natural laboratory for the investigation of the geological and mining heritage, which deserves to be inventoried and valued, not only around active mining operations but also to the set of abandoned mining works (Figure. 3). The analysis of the state of the art

does not reveal previous studies focused on the geological and mining heritage in this territory that would allow us to highlight the historical evidence that reflects the mining activity carried out there. Here, it is intended to highlight the importance of this region in order to promote the enhancement and management of this heritage resource, in order to contribute to its conservation and socio-cultural integration with the environment.

Mining is carried out underground by mining tunnel. The tunnel is a technique in which the miners initially make a hole up to 15m deep, whose walls are reinforced as the exploitation front advances. Figure. 3a illustrates a mouth of an active tunnel, as well as the transport in wagons of the extradited material. There are several abandoned sinkholes (Figure. 3b) which represent an environmental threat. In Figure. 3c we can see an active

sinkhole whose walls have been reinforced. Pools of cyanide solutions constitute an operation work to recover gold and silver from ore minerals by chemical separation of sulfides (Figure. 3d). Mercury and cyanide mining have caused environmental impacts in streams that supply the Suratá River, as illustrated in Figure. 3e, where there is a gradual deterioration of the water quality of the La Baja stream. Another of the observed environmental liabilities is mining waste, which due to leaching processes can not only contaminate the soil but also the water. Product of mining exploitation, currently in the VCMD there are more than 20 storage piles outdoors of tailings from gold mining or in a state of abandonment, which constitutes thousands of tons of tailings from the gold mining with metallic contents and other pollutants. Figures 3g-3h show some of the mining operations that have been abandoned within the VCMD.

Figure 1
Potentials and opportunities of the VCMD

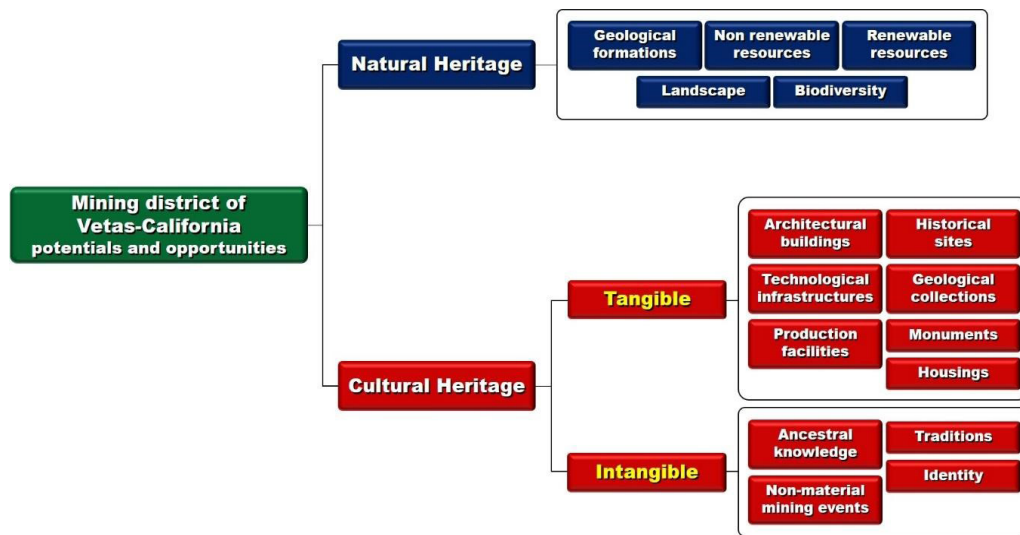


Figure 2
Geological setting and location of the VCMD. Adapted and modified from Bissig et al. (2014)

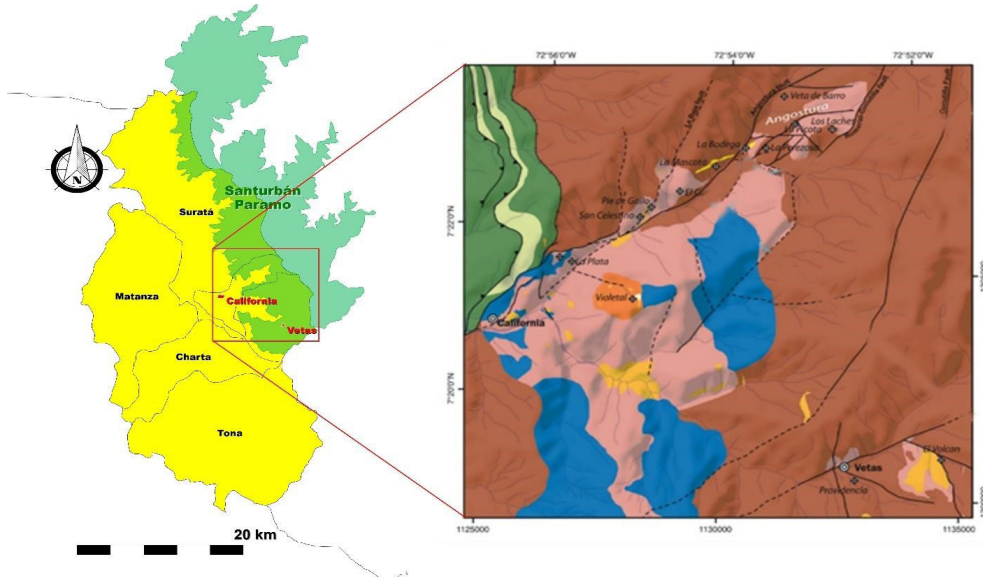


Figure 3
Current mining activities in California Santander



Nota: (a) Mining entrance of an active sinkhole and transport of material by wagon. (b) Abandoned sinkhole. (c) Data collection inside a mining tunnel. (d) Pools of cyanide solutions in the chemical separation of sulphides. (e) Contamination of the La Baja stream. (f) Mining waste. (g) Abandoned mining operation. (h) Californian mill or rammer inoperative and abandoned

The VCMD is made up of several natural and cultural sites of interest, with 27 sites of geological interest (Figure. 4) describing the geological history of the region. The identified mining and geological heritage has been the starting point for the design of the geomining theme park.

3.1.1. Natural sites

The VCMD forms part of the Santurbán Paramo (Figure. 5a), which represents a natural setting of great importance for Santandereans, which deserves special attention to promote and disseminate their environmental and ecological awareness, and sustainable development. Thanks to the climate and geographical position, it has a rich geo and biodiversity in fauna and flora with different environments and landscapes. The natural wealth of the Santurbán Paramo de is reflected in the marvelous landscape in which the lagoon complex stands out, surrounded by the oldest metamorphic rocks of the Santander Massif (Figura. 5b). The lagoons have different characteristics and incomparable beauty and have an invaluable ecosystem value. It also stands out for its ecological importance, since several water sources are born there that supply numerous populations in its surroundings. Much of this natural landscape has a paramo ecosystem and a smaller portion of Andean forest. It presents a high mountain relief and a characteristic climate of constant fog. Within the fauna, the spectacled bear and the condor of the Andes stand out. The flora is described as mainly open, dominated by grasses, herbs, shrubs and frailejones (*Espeletopsis Santanderensis*, Figure, 5c), this being one of the paramos with the greatest richness of frailejones worldwide. Figure. 5d illustrates a large

block of a migmatitic gneiss on the La Baja stream. This metamorphic rock is characterized by quartz, plagioclase and biotite, the latter altered to sericite and chlorite. Figure. 5e shows a brecciated structure and texture, with abundant xenoliths of the host rock (granodiorite), which is composed of quartz, plagioclase (sericite), potassium feldspar (kaolinite), biotite (chlorite), hornblende. Figure. 5f illustrates a granodiorite outcrop showing copper sulfate mineralization, developing crusts on a rock mass. Observe detail of the mineralization in Figure, 5g. These mineralizations are of great scientific interest to understand the complex metallogeny of the VCMD mineral deposits.

3.1.2. Geological sites

In the VCMD, Pre-Devonian rocks with a high degree of metamorphism outcrop, which show a migmatitic character, which are cut by intrusive rocks of Triassic-Jurassic to Miocene age, whose composition corresponds to granodiorites, quartzmonzonites, and quartzdiorites. The younger porphyritic facies were emplaced within the pre-existing rocks as dikes and small stocks. Mineralized quartz veins, usually gray in color and with a brecciated texture, are located in igneous and metamorphic rocks. The intensity of the hydrothermal alteration observed in these rocks apparently does not depend on the composition but mainly on the degree of fracturing that the rocks have suffered. Mineralization consists of gold and silver, associated mainly with pyrite, quartz, and minor amounts of sphalerite, tetrahedrite, galena, and chalcopyrite. In some cases, various veins contain trace minerals with the presence of uranium.

3.1.3. Geological sites

The VCMD, located in the central part of the Santander Massif, includes the area of mining activity located between these municipalities in the department of Santander, from which gold has been extracted from hydrothermal deposits since Hispanic times. This is the only area of the Eastern Cordillera where quartz veins mineralized with gold, silver, and sulfides are mainly exploited, developing zones of hydrothermal alteration in

the host igneous rocks, which compositionally correspond to granodiorites, quartzmonzonites, and quartzdiorites from the Triassic-Jurassic to Miocene. This mining district constitutes a natural laboratory not only for teaching geosciences but also for research. Landscapes have changed due to the mining operations that are evident in this region, which is manifested in abandoned mining as part of ancestral mining practices that are part of the history of the territory.

Figure 4
Geographic map and sites of interest at the VCMD

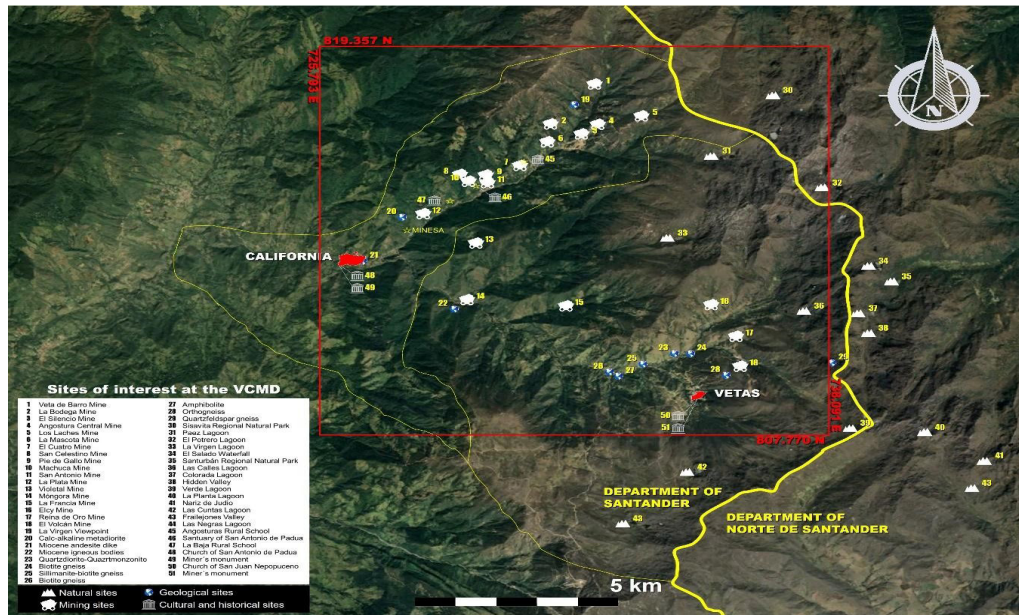
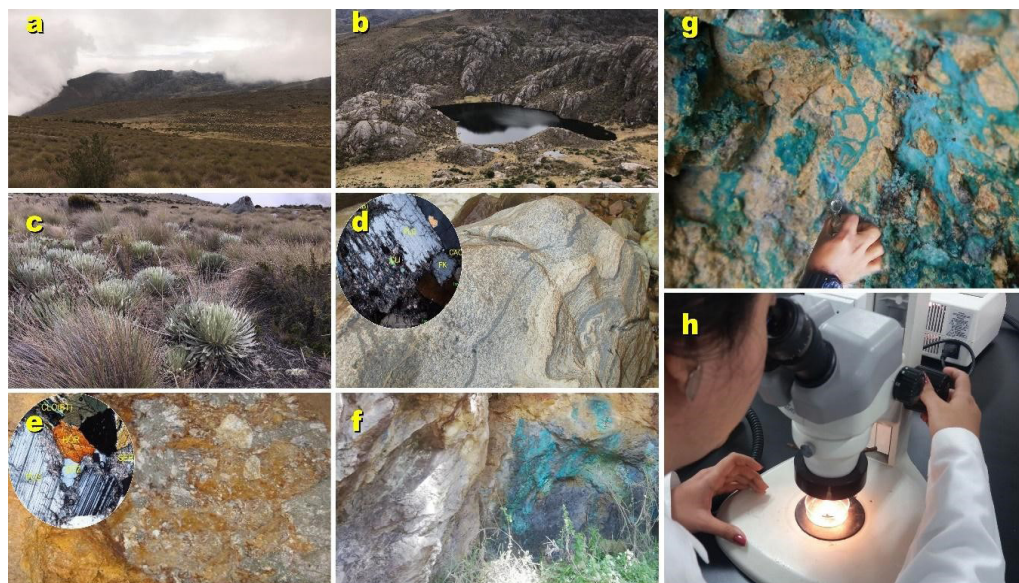


Figure 5
Landscapes and geotourism attractions in California Santander



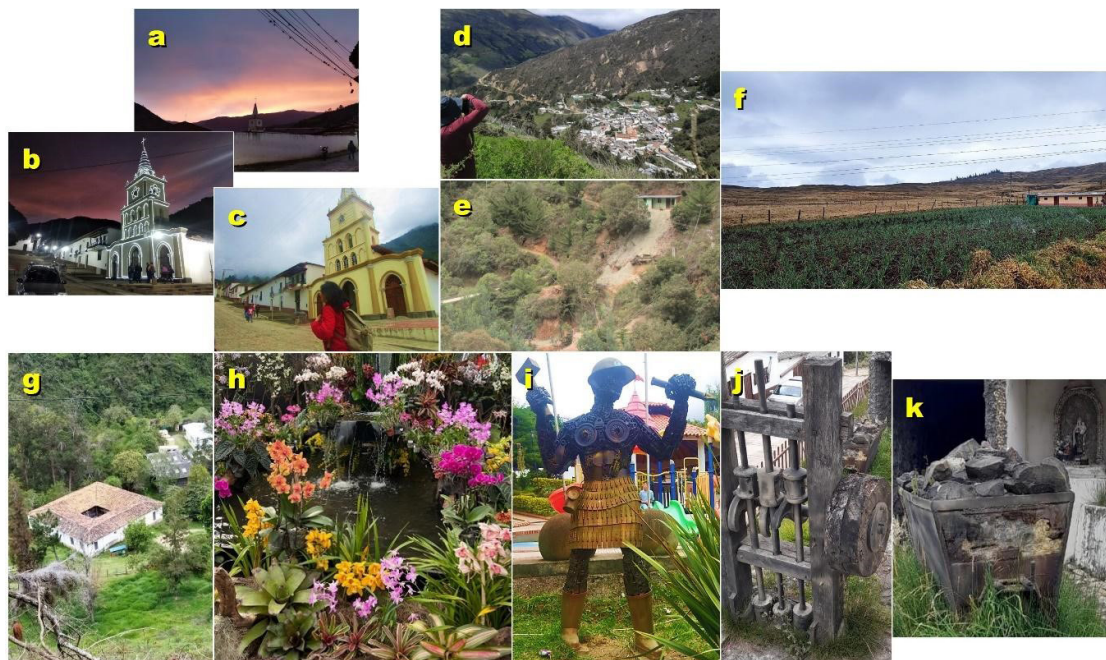
Nota: a) Characteristic landscape of the Santurban Paramo. (b) Las Cuntas Lagoon (3.787 msnm). (c) Valley of pajonales and frailejones. (d) Large block of a migmatitic gneiss on the La Baja stream. (e) Brecciated structure and texture, with abundant xenoliths of the host rock (granodiorite). (f) Outcrop showing a copper sulfate mineralization. (g) Detail of the mineralization. (h) Studying a copper sulfate mineralization under a stereomicroscope

3.1.4. Geological sites

The municipalities that are part of this mining district present sites of cultural and historical interest such as the Church of San Antonio de Padua, the colonial architecture that some houses still preserve, libraries and historical archives, monuments, the pilgrimage to the Sanctuary of San Antonio de Padua, patron saint of the town and who is venerated in the main church and in the chapel that was built near the urban perimeter (vereda La Baja), the folk dance group, the Nueva Generación band, family-type string musical groups, children's and adult ballad singers as exponents of poetry and groups in charge of representations, comedies or costumbrist farces, which represents the living expression of the historical memory of the territory. Figs. 6a-6b illustrate the sunrise and sunset in the municipality of California, which is located in the foothills of the Eastern Cordillera of the Colombian Andean Mountain System. California captivates any visitor who comes to its territory, despite the fact that its streets are inclined. In Figure. 6c we can see the street on the side of the main square in California where the Church of San Antonio de Padua stands out. Since colonial times, the history of the VCMD has been linked to the mines. The urban centers of the municipalities of Vetás and California are surrounded by beautiful green landscapes (Figure. 6d), which contrasts with the mining landscape (Figure. 6e). In the lower parts it is common to observe onion and potato crops (Figure. 6f) that even reach the banks of rivers with crystalline waters, cows and sheep grazing and trampling the paramunal lands. In rural areas, it is possible to observe houses surrounded by a wonderful landscape (Figure. 6g) and adorned with multicolored flowers (Figure. 6h). Over time, this region traced its history with mining exploitation,

then multinational companies arrived, some left and others changed their names, but their only purpose was to extract gold in the region (Álvarez, 2017). The priest and botanist José Celestino Mutis, was the one who undertook the first investigations on fauna and flora in the region but also on mining, describing a region rich in gold and silver and other metals (Dueñas, 2008). During the last century the inhabitants of this mining district have carried out the extraction of gold in an artisanal way and as their efforts bore fruit and a mineralized vein became visible, they proceeded to baptize it with the name of the owner, creating mines such as San Celestino, La Mascota, La Bodega or Angostura (Escobar, 2015). This region has an ancestral history in which the mining vocation stands out, which must be projected in a sustainable way based on the valuation of the geological and mining heritage and recovery of the memory of ancestral mining practices. The historical legacy of the mining activity developed in this mining district, has numerous traces of this activity, such as transportation systems for mineral resources and workers, abandoned buildings and plants, extraction systems, wells, trenches and galleries, and mining tailings, as well as specimens of hydrothermal breccias and sulphides. Throughout the center of the main square of the California municipality is the miner's monument (Figure. 6i), a life-size statue in the shape of a man adorned with gold inlays that represents the importance that mining has had and continues to have not only in the economy of this municipality and its surroundings, but in the memory and tradition of each of the families that inhabit it. Two tools that are part of the old mining operations are preserved in Vetás, such as the Californian mill rammers (Figure. 6j) and mining wagon (Figure. 6k).

Figure 6
View of economic and environmental activities in California Santander



Nota: Cultural and historical sites in the VCMD: (a)-(b) sunrise and sunset in the municipality of California; (c) typical street in California, showing the Church of San Antonio de Padua; (d) panoramic view of Vetás surrounded by green landscapes; (e) mining landscape; (f) onion and potato crops; (g) house in rural area surrounded by a wonderful landscape; (h) multicolored flowers; (i) miner's monument; (j) Californian mill rammers; (k) mining wagon

3.2. Geotourism in mining regions as a development opportunity

The region has based its economy on the artisanal mining affected by the crisis of the mining industry, which has generated high rates of unemployment, very high informality, and serious income generation situation, among others. In this way, the municipal administrations of the VCMD must implement strategies for agricultural development, entrepreneurship and job creation. However, local communities could also adapt to the needs that the region's tourist offer requires, taking advantage of the many tourists who are arriving there thanks to its natural and cultural wealth. Therefore, local communities, in addition to mining activity, could be involved in geotourism by providing accommodation, typical food and hospitality to tourists (Figure. 7).

In this region there is a dense network of trails that will allow you to discover the valuable natural heritage by bicycle or on horseback, making it the ideal place to practice sustainable and responsible tourism. Tourists will have the opportunity to come into contact with the peculiarities that characterize the nature of this region.

Nowadays the great diversity of landscapes, the beautiful lagoons that this great municipality has and the attraction of mining make people come with great admiration to enjoy the richness that the VCMD has and especially the great quality of the people who day by day he strives to provide a warm welcome to tourists who come to this beautiful municipality. Thanks to the numerous geosites, among which the outcrops of the numerous lagoons stand out, the culture and history of mining and the Páramo de Santurbán have great potential for the development of geotourism thanks to their aesthetic, scientific or tourist values. The valuation of geosites of interest for geotourism development should be carried out based on their accessibility, state of conservation, scientific value and educational value.

In the present work we highlight the valuable mining heritage that is associated with extractive activities, which includes material and immaterial remains inherited from abandoned mining that dates back to the mid-6th century or active and that make up the social process of reconstruction of the lived past and experienced by local communities (collective memory). Obviously, there are several aspects of heritage interest associated with mining activity, which include the geological, social, economic, historical and cultural (material and immaterial) values, and those related to aesthetics of industrial architecture, emotional related to the work of the miners and technology associated with the extractive process (e.g., Álvarez, 2009).

3.3. Geoducation for a more sustainable mining

Geoducation promotes the transfer of knowledge about the role of geosciences, which is presented as an excellent opportunity for the teaching-learning of geosciences and related sciences and different topics of interest such as natural hazards, environment and climate change in a language adapted to the public. Evidently, the conflict situations that have arisen in regions with mining activity show that there is a lack of understanding of

these issues between communities, decision makers and the private sector. Therefore, not only teaching but also the dissemination of geological and mining heritage, sustainable development and the environment, acquire great value and Become an act of responsibility for the local communities. Mining without education generates a negative alteration of the natural state of the environment, which is a determining factor in the deterioration of The life quality of living beings. However, it is not only mining that contributes to the environmental impact, the lack of awareness of those who inhabit a territory is a factor that also contributes to this problem.

The VCMD has a valuable geological and mining heritage, and constitutes a fundamental resource for the development of geo-education activities in order to transmit its knowledge to society and contribute to its conservation for future generations. Geo-education strategies could include the use of geo-suitcases, rock samples, didactic material (books, cards, posters or infographics on different topics), recreational activities or games. The use of these strategies contributes to the interaction with the students and the transfer of knowledge on different topics related to the ancestral culture with a mining vocation in this territory, such as the importance of minerals in daily life, the formation of mineral deposits, the mining and sustainable development, the development of recreational activities on geological and mining heritage or the role of geologists in society. On the other hand, geoducation activities may include excursions, research projects, school workshops, guided tours, scientific and cultural events, courses, training, social services, exchange stays with state, national and international universities, festivals and knowledge fairs.

3.4. Geomining theme park

One of the alternatives for the conservation of the geological and mining heritage of the territory is its transformation into a geomining theme park where it can be shown to the interested public. A geomining theme park represents a place where the geological and mining heritage is protected, conditioning it so that they can be visited by the interested public, with a recreational, didactic or research objective. Natural-scale reproductions of mining works, in their geological environment, or associated facilities in which mining or natural processes are shown, can also be considered as such. Therefore, purely geological museums would not be included, without connection to exploitation work (Orche-García, 2003). The theme parks thus defined become tourist attractions capable of generating employment and income, modifying the social degradation that could have been caused by closing the old mining operations, and also, restrictedly, if the geological and mining conditions allow it, in centers of mineralogical, petrographic, mineralogenic, medical research, etc.

The objective of a geomining theme park is twofold. On the one hand, recovering a degraded space that contains a valuable heritage, which, on the other, is offered to the public for their knowledge and enjoyment, or to the scientific community for study. The use of certain mines for therapeutic purposes can also be an interesting alternative: this possibility is a reality experienced by thousands of people in various underground mining parks. In conclusion,

it can be said that the functions that a geomining theme park can fulfill are very varied, the main activities that can be programmed are the following: (1) recreational, cultural and pedagogical, (2) scientific and (3) therapeutic activities

3.4.1. Geomining theme park working with local communities

The involvement of local communities in geoconservation has been widely developed in countries where social awareness of geological heritage is a priority issue (e.g., Miles, 2013). According to Popa (2015), in rural areas the understanding of the importance of geological heritage and its relationship with other types of heritage values is not as

developed, which can lead to the generation of conflicts, depending on the particularities of the territory and of those who inhabit it. However, it is essential not only the existence of a management body but also The participation of local communities as decision makers, with a bottom-up approach. Currently, there are different methods focused on working with local communities to link territorial projects and their respective regions (e.g., Eweje, 2006; Abbas et al., 2017; Rosado and Ramirez, 2017; Barron et al., 2017; Guerrón et al., 2019), which is very important to enable empowering marginalized rural communities, in trying to provide them with the knowledge to improve their living conditions (Park, 1992).

Figure 7
Potential activities for development of geotourism



IV. DISCUSSION

The present study concerns with the VCMD, which forms part of the Soto Norte province, which represents the gateway to the Santurbán Paramo. Despite having been stigmatized for its mining activities, the local communities have been proposing initiatives focused on contributing to

the sustainable development of this region. This mining district has been dedicated for more than four centuries to artisanal mining, this being its main economic activity. The mining exploitation in this region began with the gold exploitations carried out by the indigenous groups: Guanes, Chitareros, Laches and Yariguíes. The conquest of the Spanish contributed to the industrial development

in artisanal mining that is still reflected in the use of some tools today. Over time, different multinationals have been interested in the mineral extraction that exists in this region, without large-scale mining having been possible to date.

The mining tradition that is lived in this region is also supported by the devotion that the inhabitants have to San Antonio de Padúa, whom the miners have as their patron. The approach to economic development and the reduction of social gaps can go hand in hand with the enhancement, rescue and conservation of the geological and mining heritage. The proposed geomining theme park is located approximately 2 h from Bucaramanga, traveling between beautiful mountains and its imposing rivers, we find 6 municipalities that are framed between the mining tradition and other economic activities such as agriculture and livestock, these are California, Suratá, Vetás, Charta, Matanza and Tona.

The mining industry can and, in some instances, has played an important direct role in supporting tourism development in remote areas. This study identified that despite limited involvement there was a substantial enthusiasm regarding the potential for tourism development in the VCMD. Mining industry can provide significant infrastructure for the development of geotourism and several benefits for the local communities. Despite the difficulties associated with taking a more direct approach to facilitating economic development and more particularly geotourism development, it is desirable for, and may even be morally incumbent upon, the mining companies to do this in order to maximise economic development in the region. The process may be slow and involve political sensitivities but the company may be best placed to assist in overcoming the identified limitations of lack of interest and difficulties in attracting reliable workers as it is most likely to have the resources and ability to provide appropriate expertise to ensure success in the longer term.

V. CONCLUSIONS

The mining industry could play, in some instances, an important role in supporting tourism development in remote areas. There was a substantial enthusiasm regarding the potential for tourism development in the VCMD. Mining industry can provide significant infrastructure for the development of geotourism and several benefits for the local communities. Despite the difficulties associated with taking a more direct approach to facilitating economic development and more particularly geotourism development, it is desirable for, and may even be morally incumbent upon, the mining companies to do this in order to maximise economic development in the region. The process may be slow and involve political sensitivities but the company may be best placed to assist in overcoming the identified limitations of lack of interest and difficulties in attracting reliable workers as it is most likely to have the resources and ability to provide appropriate expertise to ensure success in the longer term. Security aspects and economic aspects were not considered in this article, which will be addressed in a future publication.

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Conflict of interests

The authors declares no conflicts of interest.