Public Buildings of North Chile's Desert Architecture

Kazimierz Butelski

1 Cracow University of Technology, 24 Warszawska Str., Cracow, Poland
kbutelski@pk.edu.pl

Abstract. This article discusses public buildings located in northern Chile. The Atacama Desert provides many examples of relationships between architecture and the natural and cultural landscape. From Antofagasta to San Pedro di Atacama, we can encounter many examples of such buildings, such as museums, astronomical observatories and hotels, as well as buildings housing tourist-oriented services. We can also experience large-scale changes to the landscape associated with open-cast copper mining. One example of such a landscape is that of the Sierra Gorda mine jointly owned by Polish and Japanese companies. This paper explores the emergence of new architectural forms built in the desert and using desert materials.

1. Introduction

It is believed that the place with the least amount of water and humidity in the world is Atacama Desert, located in the northern part of Chile, near its border with Peru and Bolivia. The desert has an area of around 128,000 km² and is three times smaller than the Karakorum Desert. According to academic studies, some of its areas have never seen rainfall. Defining the borders of a desert is never easy. In the case of the Atacama Desert, we are aided by the Pacific Ocean and the Andes. The ocean is its natural border in the west, while the mountain chain of the Andes, on the border with Bolivia, is its natural eastern border. The southern and northern borders, due to a lack of similarly strong elements in terms of terrain morphology, have a more undefined character. However, it is assumed that, in the north, near the border with Peru, the Desert is outlined by the city of Arica, while in the south—the city of La Serena. The Atacama Desert is the site of the world's tallest volcano, called Ojos del Salado, with a height of 6893 metres above sea level. This volcano is also Chile's highest peak, and the small lake located nearby is also the world's highest water body [1].

Figure 1. A traditional building of the Atacama Desert region. Altitude 2500 near the border with Bolivia. Original photograph, 2019.
The desert's landscape and its uniformly beige colour remind us of video footage of the surface of Mars. This should not come as a surprise, as these areas have often been used as filming locations for science fiction movies. This sparsely populated area, which is difficult to live in due to a lack of water and high temperatures, does have high economic value. It is home to the world's largest deposits of sodium nitrate, boron, lithium and potassium salts, as well as metals such as copper, gold, silver and iron. Mining, solar energy generation, astronomy and tourism are the main sectors that define the built environment of the Atacama Desert. These branches of the economy lead to the construction of new public buildings which are the subject of this paper. The desert is composed primarily of large, empty areas, yet the need to provide services to industry and tourism gave rise to a few cities and numerous mining settlements. The local mining settlements are typically structures with a relatively short durability period. For many years, they were built out of materials provided by the desert itself, but this has changed, and contemporary buildings are predominantly made of metal. Mega-forms the size of tens of square kilometres are built in the Desert in association with mining and solar energy generation. They are supplemented by smaller buildings devoted to astronomy and tourism. This paper will discuss them while adhering to this proportion, keeping in mind that the architecture of this area's public buildings includes traditional religious buildings that have been built since the sixteenth century, i.e. the period when the Conquistadors arrived. These churches typically have a syncretic character and were built using local materials. Buildings of this scale were not built during pre-colonial times, as the Desert's local communities largely lived in harmony with nature, only using residential buildings for night-time lodging.

2. The city of Antofagasta—a village near a large salt lake

The region's central city is Antofagasta. It is also Chile's third-largest city, with around 400,000 residents. It is an important oceanic port and a mineral mining business and transport hub. This is one of the reasons behind its very high average GDP per capita, which is around USD 49,000. The city's form is stretched along 20 km along a north-south axis. From the east, it is confined by a mountain chain, while from the west—by the Pacific Ocean. The city was founded in 1868 by Boliviens and was named La Chima. Renamed to Antofagasta, it had been a Bolivian city until the War of the Pacific—Guerra del Pacífico (1879–83), which Chile won. Towards the end of the nineteenth century, Antofagasta became one of Chile's most important business and administrative centres. In the Quechua native language, it means "village near a large Salt Lake" [2]. Its urban development is varied and ranges from urban block-based colonial buildings near the market square to Modernist buildings along the port and the granular structure of favelas located near the mountain chain. The forms of development present here are varied and are predominantly eclectic, which is why it is difficult to identify a single dominant trend. The scale of the buildings is typically confined to two storeys, with multiple storeys encountered only in the central area, with none of the buildings competing with the mountains around the city for height. The city is dominated by development that, from a European point of view, could be considered temporary. This character could be associated with seismic and economic considerations, as such buildings can be quickly rebuilt if need be. In the port area, we can encounter buildings with the features of Modernist architecture, which follow the five points of modern architecture as defined by Le Corbusier, with a rasterised, distinct, unique beetroot red colour. The city is a gateway to the Atacama Desert. The construction of the Atacama Desert Museum in its peripheral area in 2009 highlighted and accentuated this fact. Thus, the Atacama Desert has been given its own museum, a rare occurrence for any desert.

3. The museum of the desert - Museo del Desierto de Atacama

The museum was designed on the desert's southern edge, on the periphery of Antofagasta, in 2009. The design made use of the shape of the terrain and the remaining elements of the nineteenth century Huanchaca silver factory. The factory was shut down in 1902 and given the status of an architectural heritage site in 1974. This factory processed the raw materials supplied by local and Bolivian mines. The new section of the museum is sited at a drop in the plateau in front of the ruins of the old factory.
and the open space of the Pacific. Each of the two levels of the plateau is accentuated by reinforced concrete elements scattered at ground level. This difference in terrain elevation was a pretext for the conceptual design of the building, sited at the edge of the two levels. Thanks to rhythmically spaced ramps, we can scale this height and walk across the reinforced concrete roof of the building. This roof forms an observation platform, which faces westwards towards the pacific and eastwards towards the factory ruins. The museum building's layout is oriented with its longer axis along the east-west direction. The spaces between the ramps form patios and let natural light into the museum's exhibition spaces and the main entrance to the building. This entrance is accentuated via a reinforced concrete slab that acts as a bridge suspended above a space that glimmers with various materials, filled with rocks that represent the wealth of the Atacama Desert's mineral resources. The reinforced-concrete building cuts into the mass that is the desert's matter with its rhythmic forms. The building is heavily integrated with the terrain, almost acting as if it was a part of it. This desert mass, with a distinct, beige colour, is ever-present as far as the border with Bolivia, which is located at around 300 km from this geographically widest area of Chile. The colour changes as far as near the Andes, where lakes appear. They are a sign that one has arrived at the eastern edge of the desert. The entire cultural park complex outside of the museum, with the remains of the factory and two plateaus, it is supplemented by an amphitheatre that is partially underground and acts as a counterpoint. This amphitheatre, which features a covered stage, is built out of reinforced concrete and can accommodate an audience of 200. The building is in the north-western part of the cultural park.

**Figure 2.** Museo del Desierto de Atacama, Antofagasta, Chile 2009, authors: Ramon Coz Rosenfeld, Marco Palidura Alvarez, Eugenia Soto Cellino, Ignatio Volante Negueruela. Original photograph, 2019

4. **Buildings for minerals—mining**

Going deeper into the Atacama Desert's territory, from seaside Antofagasta towards the city of Calama, located 200 km to the east, we encounter immense changes in the landscape throughout the entire journey. These alterations are primarily caused by the open-cast mining of copper. Piles of excavated earth several dozen metres tall stretch for kilometres on end, while the excavations themselves, with a depth of as much as one kilometre, create new forms and a new landscape. They are de-facto large-scale structures with forms that change constantly along with the extraction of minerals to the surface. Mines and the mining industry operate here on the basis of mining licences issued by the Chilean government. Profit from these operations are one of the main pillars of the Chilean state budget. Escondida mine alone produces 2.5% of Chile's GDP. The scale of this copper mine, which is the largest in the world, can be pictured when one accounts that it produces around 8% of the world's copper supply. Another mine, Chuquicamata, is the world's deepest open-cast mine, with a 4,000 by 2,500 metres mining area that is 900 metres deep. One of the largest of Chile's mines, although outside of its top ten, is Sierra Gorda. This mine is the property of KGHM, a Polish company that is a leading copper producer, and Japanese shareholders. The copper mined here is transported by rail and via trucks to the port in Antofagasta, located several dozen kilometres away, to be shipped to metallurgy plants in China. The final product is sold to clients all over the world. We are thus

---

1 Sumitomo Metal Mining Co. and Sumitomo Corporation
dealing with a regular global corporation, which invests Polish and Japanese capital into exterritorial production hoping that profits will be directed to the countries where said capital originates. Chilean copper mines, contrary to Polish ones, are largely open-cast mines and the earnings of their workers are very high. Chilean miners are a privileged group of workers with high incomes and the mining itself is performed using cutting-edge technology. The miners are equipped with, among other things, backpacks with photovoltaic cells (Mozilla solar) and use them to power small electronic devices like cell phones or tablets.

Figure 3. Piles of excavated earth from open-cast copper mines along the road between Antofagasta and Calama. Original photograph, 2019

Just as industrial structures are monumental in scale, the residential architecture built to house its workers is very small. This scale, apart from its material determinants, is also rooted in culture. It shows us the way of life of its residents who like to live in great open spaces and building closed shelters for living in has a very limited scale that corresponds to the needs of the community that has produced it. The industrial-scale exploration of the Atacama Desert has a decades-long tradition. It has left its traces in the form of deserted, deteriorating mining towns, so-called Salitreras, dated to the saltpetre boom of the first half of the twentieth century. The Salitreras were built from materials provided by the desert itself—earth and stones. This cheap construction technology, featuring monomaterial walls, was based on applying layer after layer of earth mixed with water inside a formwork and ramming them, with the resulting walls having a width of around 50 cm. These buildings, typically only a single storey high, have ceiling spans that do not exceed 4 metres. This solution comes with multiple advantages. The first is economic, as we use the material available at the construction site, the second is social, as the ease of construction meant that seasonally available on-site workers without special qualifications could be used. The third is environmental, as these walls breathe which allows maintaining an indoor living environment suitable for habitation despite significant daytime and night-time temperature differences. Fourth, after being abandoned, they slowly decay, returning the area to its natural state, becoming a part of the desert. This solution is aligned with the latest tendencies in sustainable and energy-efficient building, resulting in limiting energy consumption across the building's entire life cycle. Earth construction techniques have been known since the period before the Spanish conquest and have never been fully replaced by more modern technologies. Some authors [3] point to there being three main reasons for this state of affairs: the continued existence of a local community with well-established cultural knowledge of this construction technology, the considerable distances to urban centres which leads to difficulties in access to other materials and technologies, the good thermal insulation properties of the walls, which is suitable in a climate with high differences between daytime and night-time temperatures. As a result, architecture that utilises raw earth as a material continues to be present and popular in northern Chile, on the Altiplano Plateau and in the valleys of Norte Chico, which include the Atacama Desert.
5. Buildings for the sun—Solar Energy
In recent years, the Atacama Desert has become the site of South America's largest solar power plant—Planta Solar Cerro Dominador. It uses steam to produce electrical energy. The steam is produced in a tower that is the focus of solar mirrors. The area occupied by solar collectors is around 750 ha. The output of the plant is 210 MW and it cost around a billion dollars to build. This structure, impressive in terms of both composition and form, with a concentric plan, is visible from space, demonstrating the economic potential of this desert region. Another type of solar power plant that operates on the Atacama Desert is Planta fotovoltaica San Pedro de Atacama III, which operates using photovoltaic cells. This plant has an output of 30 MW and cost around 105 million dollars to build. Due to the manner in which it generates energy, its spatial layout has the character of an orthogonal grid with panels evenly distributed across a very large area. Further east of the plant, towards the city of San Pedro di Atacama, mining activity gives way to the desert's natural state, untouched by human activity. This change has opened a path to the development of tourism and the construction of new types of public buildings. Apart from these large-scale projects, solar energy is also used on a smaller scale. Examples of this include the powering of road infrastructure elements and miniature energy sources fitted to backpacks to power communication devices. Photovoltaic cells placed along the Antofagasta–Calama road demonstrate the phenomenon of applying solar power for the purposes of road transport.

![Figure 4. Planta Solar Cerro Dominador, Google maps 2020](image)

6. Buildings for the stars—Astronomy
After sunset, when night falls across the desert, one can experience another of Atacama's treasures—a view of the sky undisturbed by civilisation. This possibility has led to the siting of one of the world's largest sky observation telescopes in the desert. The ESO—the European Southern Observatory, located at an elevation of 2365 metres above sea level, is located to the south of Antofagasta. A mountaintop plateau was used as a platform for observation equipment, while a hotel for scientists, engineers and guests visiting the Cerro Paranal Observatory was placed at its foot. The design of the hotel, by Auer Weber, is from 1998. It is another case of a building that is organically combined with the terrain, akin to the desert museum in Antofagasta. The hotel was designed as an element of a pass between two slopes and its roof can be walked on. The hotel literally fills in a fragment of the pass between the road and a line marked by its hotel rooms, which are a sort of a dam for its overflowing form. As a result, its facade is oriented towards the surrounding desert and rocky mountain landscape. 120 rooms placed on four storeys form a facade composition based on a repeating pattern with a
colour and form that references South American raw earth architectural tradition. The main facade is oriented at around 45 degrees to the southwest. From the other side of the flat "overflowing" form of the building is a road that leads to the observatory. The only element that truly stands out from the hotel's large flat roof is a dome with a diameter of 35 metres that covers an internal garden with a pool. Other elements that can be seen on this artificial plateau are long ramps that lead underground, to the building's entrance. The concept of the building assumes a single-bay layout of the four-storey, granular structure of hotel rooms, contrasted with large open spaces that support the hotel located on the other side. Ramps act as the main element of the building's internal circulation. The thickness of the facade and appropriately placed openings in the roof prevent an excess of the strong desert sunlight into the building's interior. This urban composition resembles the siting of the Spa House in Żegiestów by Adolf Szyszko-Bohusz. In this design, its author utilised an equally powerful compositional procedure by cutting a valley with a perpendicularly placed building, thereby creating two spaces: a natural and a cultural one, with the building acting as a border. Similarly, in the ESO Paranal Hotel, the building demarcates the line between the natural and the cultural landscape.

![Image of Paranal observatory and ESO Hotel](image)

**Figure 5.** Paranal observatory and ESO Hotel in the lower right corner. Original photograph.

Drawings of the site plan and the main floor below, source: [5]

7. **Buildings for tourism**

The city of San Pedro de Atacama is the desert's tourist service centre. It is located around 300 km to the east of Antofagasta. There is a range of tourist attractions focusing on desert exploration around the city, which is located on a plateau elevated 2408 metres above sea level. These include: desert and
mountain landscapes with volcanic peaks, hot springs, geysers, rock formations, dunes, as well as wildlife preserves dedicated to the conservation of flamingos and vicuna. The city is not large and is inhabited by around 5000 residents. Many of its streets are unpaved and its buildings are mostly traditional, single-storey structures made out of raw earth. The reason for the city's construction was the fact that an oasis was located there, on an otherwise arid and barren plateau. The city's central section is mostly focused on gastronomic functions, tourist service offices, souvenir stores and low-standard hotels. Its public buildings include a church, a meteorite museum, the Museo R.P. Gustavo Le Paige and a bus station. The city's two interesting examples of hotels with contemporary designs are located on its outskirts. Furthermore, at a distance of 30 km from the city, at an elevation of around 3450 metres above sea level, there is a recreational complex with hot springs called The El Tatio geysers, which are another attraction that features open hot water pools, located even further and higher, at an elevation of 4320 metres above sea level.

7.1. Hotel Tierra Atacama

It was designed in 2008 by Rodrigo Searle y Matías González and is sited on the city's outskirts. The hotel has a very large, 5-hectare parcel, from which there is an excellent view of the surrounding desert landscape. The large area of this parcel effectively isolates the hotel building from being affected by the neighbouring rural development, forming an enclosed, isolated enclave. The entrance to the building is neither obvious nor axial. The design of the entrance forces guests to zigzag amidst numerous walls made of raw earth with varying texture and placed at various angles relative to each other and. The reward that awaits patient guests at the end is a wonderful view of the majestic Licancabur volcano. We are constantly accompanied by this view while at the hotel, as it can be seen from all of its spaces and from its internal garden. This complicated, multi-directional entrance is a reference to the place-based genius loci, as the area used to be a cattle ranch, hence an analogous manner of partitioning space. The hotel has a uniform scale of height, horizontally blending into the layout of the masses of the entire complex. Only the roof above the hotel's service centre has a light, uniform incline that opens the building from its entrance in the direction of the abovementioned volcano. The functional structure of the building shows a clear division into two zones, whose imaginary border is at the building's entrance. The open-spaced zone to the left of the entrance houses the hotel's ancillary spaces, such as restaurants, a bar, a lobby, a spa and other service zones. The zone to the right of the entrance features two sequences of hotel rooms divided by an internal, open, garden-like patio. This patio is also a type of open and uncovered hotel hall, as it is from here that we enter each of the rooms grouped into two-element sets. These sets have two typologies, with the sequence of rooms closer to the entrance situated on an earthen embankment, which allows each of the rooms to have a view of the volcano, seen above the lower, parallel sequence of rooms. The spatial solutions of the rooms are an interpretation of traditional buildings as each has a private patio that is fenced off by walls. The patios in front of the rooms from the side of the main entrance have an enclosed character, while those from the garden side are partially open to the landscape. A part of the hotel's form was built using a modern material—Cor-ten rusted steel—in combination with and in contrast to the walls, traditionally made of earth.

One noteworthy element of the building's public section is the structural design of the division of the columns that support the roof into sets of several slender members, which give the interior an appearance of being a single space, while giving the structure, covered with a large shed roof, an appearance of lightness. The external section of the building that adjoins its main body from the side of garden, composed of a sequence of spaces partitioned off by stone walls, is another distinct feature of the building. These spaces can be used for various activities, such as lounging, swimming or hosting grill parties in smaller groups—each attraction offering a view of the Licancabur volcano. In terms of detail, the material used for flooring around the swimming pool, which references old railroad ties, is quite eye-catching. It adds to the effect of the contrasting pairings of coarse and smooth materials that is distinct for the building's design. In this case, these pairings are wood and water,
while in others they are metal and earthen wall, or stone and glass. The building features noticeable references to local construction tradition and the use of its eco-friendly characteristics. At the same time, this design can be seen to pursue solutions that are innovative for hotels and spas, which have never been prevalent in the region's traditional architecture. What is perhaps the most important is that while it does so, it does not lose the fundamental life principle distinct of this area—the close relationship between man and nature, expressed via constantly being in contact with it and reducing the artificial, enclosed environment created by man to a minimum.

Figure 6. Hotel Tierra Atacama main entrance. Authors: Architects Rodrigo Searle y Matías González [6]. Original photograph, 2019

7.2. Hotel Explora Atacama
It was designed by Germán del Sol in 1999, on a large plot the size of 17 ha, which features several species of trees and plants that are distinct for the region. Similarly, as the previously discussed hotel, it was built outside the city, in a place formerly used for herding cattle. Because of this, the author of design decided to leave and interpret traces of this form of use in the form of roads, pastures and farms. The heart of the complex is an internal, irregularly shaped square. The square was designed on a platform elevated around 1 m above terrain level. This principle of elevation above the ground applies to all elements of the plan, particularly the walking paths located all around the site, which take on the form of timber platforms. The square is outlined by single-storey, linearly grouped complexes of hotel rooms on three of its sides, with a two-storey service building enclosing the fourth. The ground floor of this part of the hotel houses storage spaces and garages, while the main reception area is located at level +4 m. There are a total of 26 modules in groups of two to six complexes, offering 52 two-person rooms. Additionally, there are eleven modules on the ground floor and four on the first floor of the service building, amounting to another 30 rooms. In total, the hotel offers 82 two-
person rooms for 164 guests. Level +4 houses all accompanying functions in a single-space interior covered by a timber roof: the hotel lobby, the reception desk, meeting halls, bars, restaurants and kitchens. This level, akin to an observation point, has an impressive view of the surrounding area that extends to the horizon formed by the peaks of the Andes. The author opted for this solution based on a study of the site and the many photographs he made while doing so. One of these photographs, with an especially artistic and abstract character, depicting the main element of the landscape—the Licancabur volcano—did so in particular. This photograph speaks volumes of Germán del Sol's method of work, as an architect who relies on observation that leads to an "architecture without purity" [7]. This concept of design references the manifesto by poet Pablo Nerudo on "poetry without purity", based on a precise observation of traces of human behaviours in the pursuit of the essence of humanism, which is often imperfect. The architect often does the same, observing and revealing place-based traces and analysing their cultural background. This principle is demonstrated in many of his designs, wherein space is formed by imperfections and impurities. Following these observations, the main courtyard of the complex is formed by dried mud instead of a perfect marble stone floor. Timber paths in the form of platforms, shaded by an overhanging roof, were built for the hotel's guests along the rooms. The analyses conducted by the author of the design led him to search for new solutions and inventions to solve existing design problems. In the desert, one of the most serious design problems is excessive overheating. Thus, the design featured a concept of a roof that was spread over the massings of individual rooms but did not touch them. This roof provides shade and air flow over the massings housing the rooms, which naturally cools them. This idea is of particular significance in a desert climate and the notion of a double roof is one of the design's smart solutions. It is well-known that wherever cattle is herded, the water source from which the cattle drinks plays a significant role. This place-based tradition was referenced through a sequence of open pools. These pools depart from the original meaning of the water hole via white, abstract cuboid forms of pavilions that house changing rooms and shelters from the desert sun. The intimacy provided by the use of proper forms of plants that build niches that hide visitors from onlookers is likewise remarkable. Pampas grasses were used for this purpose, as they grow to a height of two to three metres and can thus easily hide a person.

Figure 7. Internal courtyard of Hotel Explora Atacama, San Pedro de Atacama, Chile 1999. Architect: Germán del Sol. Original photograph, 2019

7.3. The Purtima Hot Springs
These grasses have also been featured in a design that acts as a satellite for this hotel—the Purtima Hot Springs. This design has also been authored by Germán del Sol. The Purtima Hot Springs are a part of the Explora hotel that is located 30 km away from its main complex, and are called "Termas de Prutima". They are located along a road that leads to the world's highest geysers—El Tatio, which are located at an elevation of 4320 metres above sea level. The hot springs are located in a canyon at an
elevation of 3450 metres above sea level. The canyon is entered from a plateau that features a parking lot. Here we can use one of eight natural geothermal pools with hot water. They are approached similarly as in the Explora Hotel, via platform paths elevated above ground level, made from timber painted red. Thanks to this, the area of the hot springs, with its wealth of natural forms, flora and fauna, can be seen in its natural form. The red line of the path, which has a varying width, is accompanied by white, abstract cuboid pavilions that house changing rooms and gastronomic establishments. Several buildings made using traditional earth and stone technology have also been restored and adapted to the needs of the preserve's protection services. The entire area is covered by pampas grass, which builds cozy and intimate niches around the paths, hot springs and pavilions. The simple means of expression used by the architect create a remarkable space that provides access to natural and landscape assets.

Figure 8. The Purtima Hot Springs 3450 metres above sea level. Original photograph, 2019

8. Conclusion
The examples of public buildings located in the Atacama Desert that were discussed and analysed in this paper, ranging from those near the Pacific coast at an elevation of zero metres above sea level to those at an elevation of around 3500 metres above sea level, demonstrate that the desert has significant potential for the creation of contemporary architecture. This hypothesis was not seen as obvious at the start of the study. Furthermore, this architecture has numerous innovative features that turn the inconveniences of living conditions into its advantages. One such advantage is the creative development of traditional construction forms and technologies, which have been practised in the region for centuries. Another advantage is the emergence of new forms that result from the appearance of new functions, such as solar power plants. The creation of monumental forms during mining operations carried out across substantial areas of the desert remains a potential that is still not utilised to its fullest capacity. Finally, the concept of "architecture without purity" represented in the designs of Germán del Sol, an architecture that is just as imperfect as we are, appears to be a promising challenge in making space more acceptable and humanist in a world that strives towards perfection and standardisation. The greatest value of this approach, as presented in the analysed examples, is leaving man in his natural environment, instead of alienating him through perfection.

References
[1] CIA. The World Fact Book. 1 06 2018.
[2] K. Probierz, “Pustynia Atakama i najgłębsza odkrywka świata.” Wrześień-Październik 2008.
  http://www.nbi.com.pl/assets/NBI-pdf/2008/5_20_2008/pdf/6_probierz_chuquicamata.pdf
  (data: March 24, 2020).
[3] V. Hours, F. Mauduit, "Earth Architecture: Tradition and Innovation of an Ancestral Material in the North of Chile.” In Architectural Guide Chile, 51-55. Berlin: DOM Publishers, 2016
[4] Editor. “La Tercera.” 1 07 2011. https://www.latercera.com/noticia/ingresan-a-evaluacion-ambiental-planta-fotovoltaica-san-pedro-de-atacama-iii-por-us105-millones/ (data: 03 18, 2020)
[5] Archello. “Archello.com.” 25 03 2020. https://archello.com/project/eso-hotel-on-cerro-paranal-chile (data: 03 25, 2020)
[6] Admin, "Hotel Tierra Atacama." March 8, 2008. https://eartharchitecture.org/?p=425 (accessed March 1, 2020).
[7] I. Fracalossi, “Entrevista a German del Sol. Ver a traves.” ARQ+1, nr Numero especial 2013 (2013): 12-15.