Universidade de Évora - Escola de Artes

Mestrado Integrado em Arquitetura

Trabalho de Projeto

EARTHWORKS. An Architectural Essay for the Reclamation of the Post-industrial Landscape at S. Domingos, Portugal. 37o40'05.8"N 7o29'28.2"W

Jared Miguel Fantasia

Orientador(es) | João Gabriel Soares

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A dissertação foi objeto de apreciação e discussão pública pelo seguinte júri nomeado pelo Diretor da Escola de Artes:

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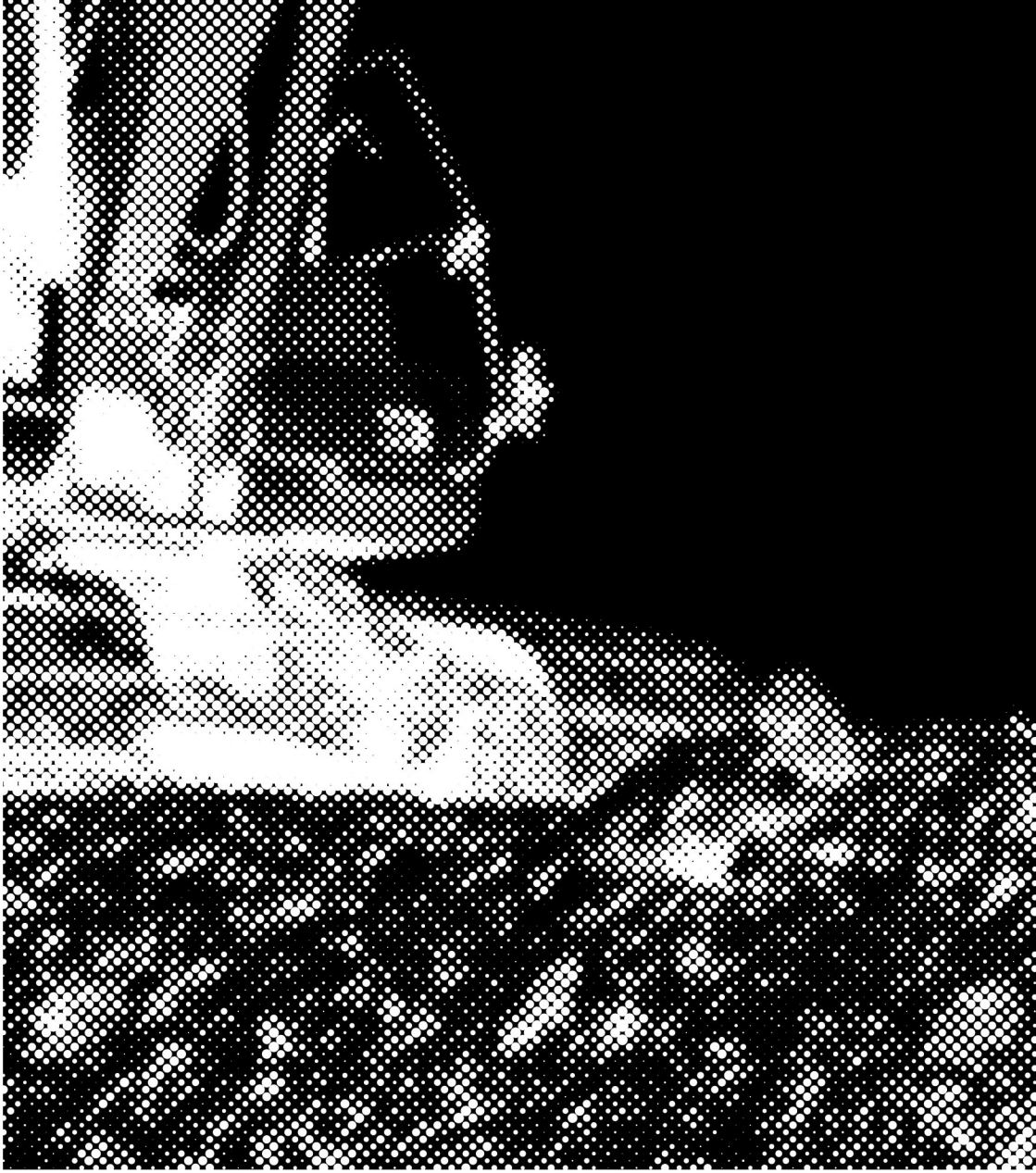

UNIVERSIDADE DE ÉVORA
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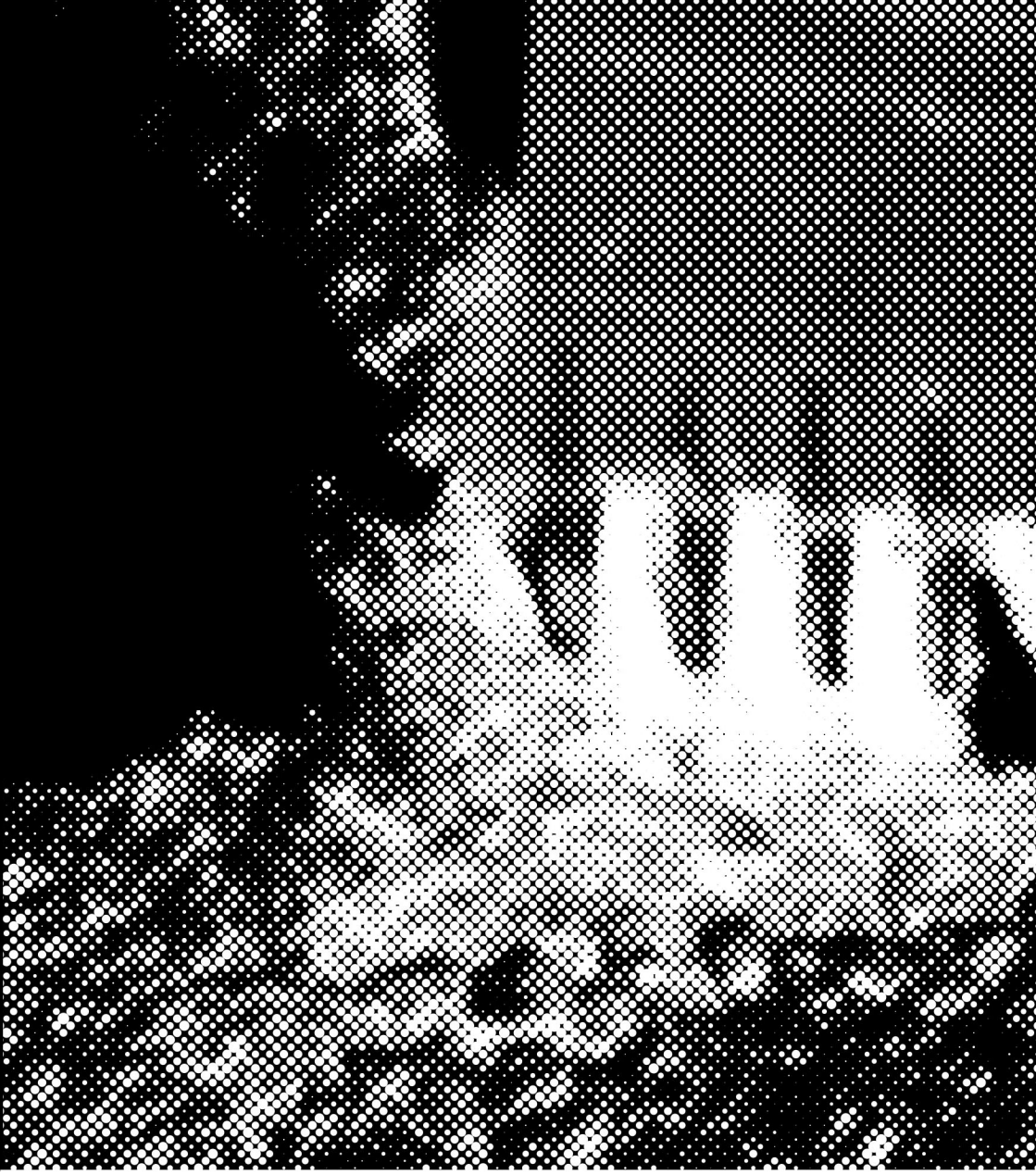
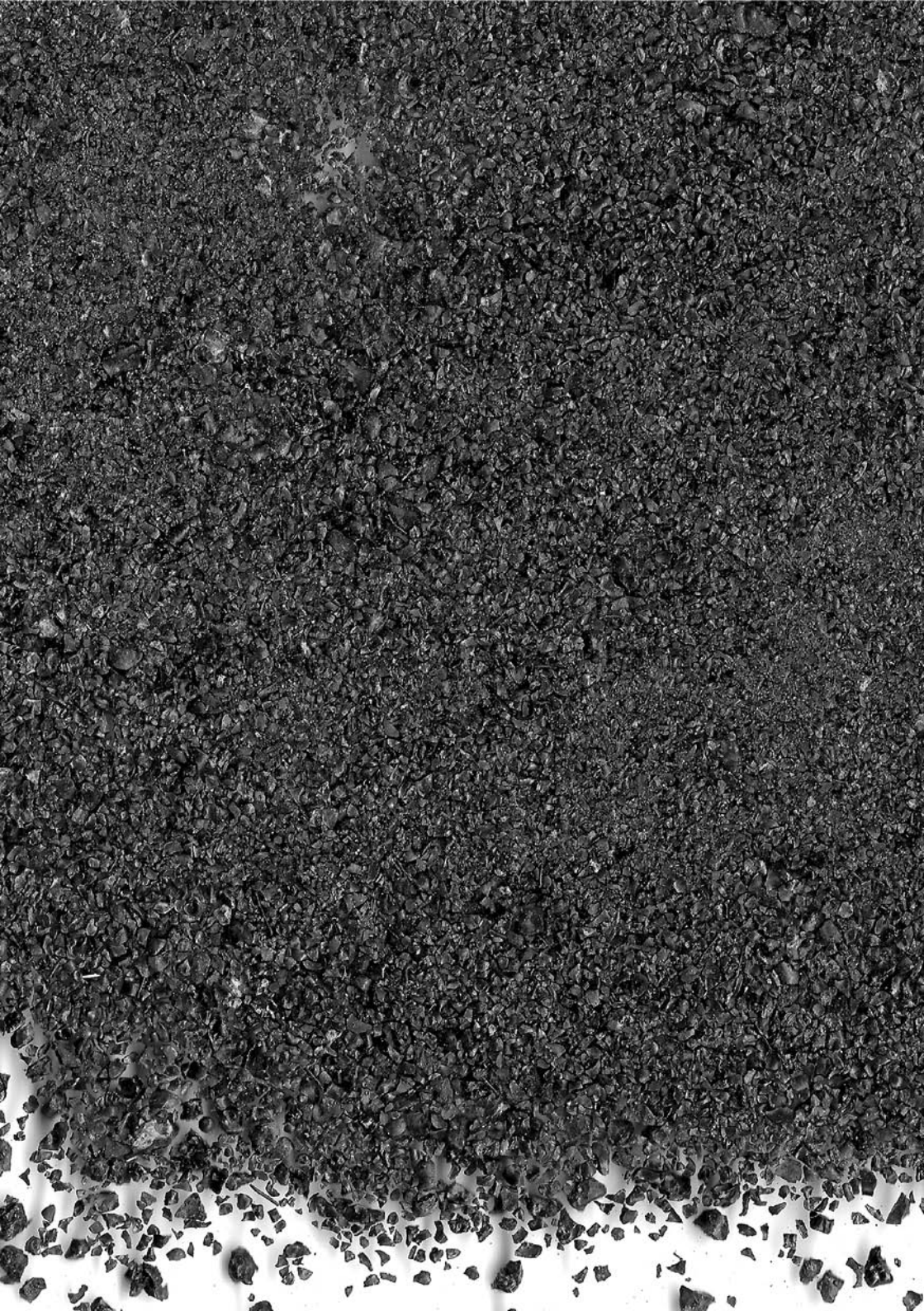
EARTHWORKS



Volume 01

An Architectural Essay for the Reclamation of the Post-industrial Landscape at S. Domingos, Portugal. 37°40'05.8"N 7°29'28.2"W



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Master's degree dissertation in Architecture | Jared Miguel Fantasia | 2019/2020
Supervisor: João Gabriel Candeias Dias Soares

Abstract | Resumo

EARTHWORKS. An Architectural Essay for the Reclamation of the Post-industrial Landscape at S. Domingos, Portugal. 37°40'05.8"N 7°29'28.2"W

Anthropocene man has sought to dominate nature by transforming her and by exploiting her finite resources. Pollution, waste and abandoned industrial sites have increased, alongside the exponential rise in population. Man, in the extraction processes of mining in particular, has created new sediments which no-one knows what to do with: spoil heaps, rubble and great quantities of toxic matter.

The 1960s and 1980s saw the beginnings of a global ecological consciousness and consequential acts of reclamation in the mining industry, which gave land artists not only a platform for their views relating to the post-industrial landscape, but a new "medium" to explore in their art. Whether it was an opportunity to acquire space and machinery to produce large-scale earthworks, or an intentional act of reclamation of the post-industrial landscape through art/ architecture, they saw the potential for post-industrial landscapes to become places to be engaged with through sublime contemplation and interaction.

The following thesis aims to create an understanding of artists who used post-industrial sites for the creation of earthworks and proposes an architectural project as a gesture of reclamation for the open pit at S. Domingos Mine, Portugal (37°40'05.8"N 7°29'28.2"W) and its surrounding post-industrial landscape as a means of reclamation through the discipline of Architecture.

Keywords: Earthworks; Post-industrial landscape; Reclamation; S. Domingos

EARTHWORKS. Um Ensaio Arquitectónico para a Reclamação da Paisagem Pós-industrial de S. Domingos, Portugal. 37º40'05.8"N 7º29'28.2"W

O homem do antropoceno procurou dominar a natureza através da transformação e exploração dos seus recursos finitos. A poluição, o lixo e os locais industriais abandonados aumentaram devido ao crescimento exponencial da população. Dos processos de extracção de minério, resultaram sedimentos inutilizados, como por exemplo, montes de escórias, entulho e grandes quantidades de matéria tóxica.

As décadas de 1960 e 1970 viram o início de uma consciência ecológica global e os actos consequentes de *reclamation* na indústria mineira deram a *land artists* desta época não só uma oportunidade para concretizar as suas ideias e perspectivas, mas também um novo *medium* para explorar a sua arte. Seja isto uma oportunidade de adquirir espaço e maquinaria para produzir *Earthworks* em grande escala como puramente obras de arte, ou seja um ato intencional de recuperação da paisagem pós-industrial através da arte/ arquitectura. Estes artistas viram o potencial da paisagem pós-industrial para se tornar num lugar de contemplação e interacção com o sublime.

A presente dissertação compreende um essaio escrito sobre alguns dos artistas que utilizaram sítios pós-industriais para a realização de *Earthworks* e uma proposta de projecto arquitectónico para a corta da mina de S. Domingos, Portugal (37 ° 40'05.8 " N 7 ° 29'28.2 "W), que visa a recuperação da paisagem pós-industrial através da disciplina da Arquitectura.

Palavras-chave: *Earthworks*; Paisagem pós-industrial; *Reclamation*; S. Domingos

Epigraph

002 *Earth works and excavation (ruins), Filmoteca de Catalunya, Barcelona.*

“The earth is our support, our base - the root that will, eventually, allow us to fly.

To speak of the earth requires us to think about water, The slow force that moulds, cracks and bores it. That transforms and sometimes also weakens it.

It also requires us to think about air, empty space, the wind that moves over the surface of the earth’s crust and which our buildings, extensions of that crust, channel or resist.

Speaking about the earth represents another form of encounter with the local. An encounter with the remains of wreckage: bones - the transformation of the organic into inorganic - , stones, old foundations, traces.

And an encounter with matter: red clay, yellow sand, grey pebbles In strata or masses.

Our work with earth consists in hollowing it out, boring into it, penetrating it. Guaranteeing the transfer of loads and fluids towards it, where they dissipate.

Vertical dimension: gravitational and spacial.

It also consists in moulding it, reorganizing the topography (introducing geometry), reinforcing it, cladding its surface.

Horizontal dimension: superficial and open.

The earth - the start and the end of architecture.”

(Mateo et al. 2014, 35)

Dedication

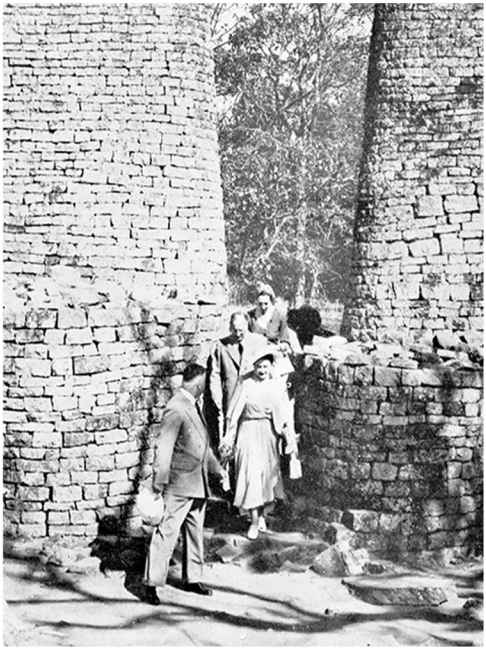
This volume is living memory of

Samuel Dickson Sandes III

(1899-1984)

A true adventurer, who just like his father and his father before him, passed down a cabinet of curiosities - an accumulative heritage - that inspired me and initiated this journey.

003 Composition of three photographs of Samuel Dickson Sandes III at the Great Zimbabwe Ruins during the 1950s. Left: With a group including Sir Mortimer Wheeler. Right: With Her Majesty Queen Elizabeth, the Queen Mother.



Acknowledgements

At the end of this journey, I would like to look back and thank those that have supported me directly and indirectly. To: my maternal grandparents, Peter and Allison, who moulded me as a child and initiated a spark that is responsible for making me who I am today; my mother who has supported me and pushed me on - through her strength, persistence and creative mind; my brother Craig, Svea and the Tweedys - my closest family - who have always believed in me; my orientatior who has been thoughtful, patient and kind; William Bennett for his time and correspondence relating to his work; my friends Tiago Pinto, Vanessa Franco, Raquel Ceriz, Filipe Correia, Carlos Fernandes, Fabio Mantuano, Ervis Lapi, Aldara Vazquez and Raphael Julien Saint Amand whose support, company and beautiful minds have been an inspiration.

Thank you for everything.

Volume 01

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Volume 02

APPENDIX

Framework

Introduction

The present master's thesis is a result of a continuum of work undergone during the academic year of 2012/2013 which was carried out in the subject of Project III - a second year design studio course at the Department of Architecture at the University of Évora, Portugal, and directed by the teachers and architects Sofia Salema[1] and José Adrião.[2] The aim of the design studio was, after an extensive territorial investigation, to propose an argument for the investigation of a design of an interpretation centre in the form of a museum for the mining area of S. Domingos, Portugal.[3] Rather than focusing on a classical or traditional view of what a museum is (edifices based on a programatic functionalistic approach - a route followed in the other design projects), this project questioned what a museum (or an interpretation of one) could be at this site. The result was a concept for a museum of the 21st century resulting in the reclamation of the open pit at S. Domingos Mine. This was inspired by the writings of Robert Smithson's *Some Void Thoughts on Museums* (Smithson 1996, 41-42) and, more specifically, *What is a Museum?* (Smithson 1996, 41-51).[4] The project was also influenced by artists' and architects' proposals for the rehabilitation reclamation of the Hiriya waste dump, near Tel Aviv, Israel and in particular, that of landscape architect Mira Engler.[5] Although the Hiriya site is not a post-industrial mining landscape, like that of S. Domingos, the Hiriya mound (60m high and created over a period of 46 years) proved interesting as it consisted of waste produced by man. Mira Engler's proposal for the site, *Reclaiming Metaphors out of the Dump, or Four Gestures for Hiriya* in the International group exhibition, *Hiriya in the Museum, Artists' and Architects' Proposals for Rehabilitation of the Site*, (Engler 2000) shows how a mountain composed of urban waste material can be reused, moulded, and transformed into a place of sublime beauty and activity. At the time of the development of the project, the design exhibition held by the Tel Aviv Museum of Art, was important to perceive how architecture could play a role in the reclamation of a waste dump, transforming an evaded place of environmental repugnance into one that is socially attractive, environmentally sound and, moreover something cultural as a museum. Mira Engler's proposal for the Hiriya waste mound was one source of influence in the development of the above-mentioned project, for post-industrial mining site of S. Domingos, at the time.[6] The S. Domingos mining pit, a negative void (a concept used in Smithson's writings - referred to above) would itself become the museum as it is a museum of void generated by the moving and stabilisation of mass waste deposits (located in the vast mining area of S. Domingos). Also it would allow the visitor to enter deep within the earth where remains of its immense pyrite deposit of megalithic proportions (used for thousands of years), could be experienced as if entering an excavation and allowing the visitor to become an 'archaeologist' that discovers and experiences the facts for them self in a 'living piece of archaeology'. The visitor in the void experiences the suggestion of prior positive mass and also the energy involved in its removal. This design project was selected by the Portuguese architect (2012 Alvar Aalto Medal-winner) Paulo David[7] and was published on June 30th, 2013 in the first edition of *Revista de Arquitectura e Urbanismo Académico Português* where images of the project can be seen from the design studio 2012/2013.[8]

My supervisor, Architect, Professor João Gabriel Candeias Dias Soares[9] has inspired me to perceive new areas of investigation and to understand the gesture of reclaimed earthworks, reflecting on the different values of such works, reclamation and the post-industrial landscape. He invited me, through the Department of Architecture of the University of Évora, to participate, along with a team of students, in the *5th International Workshop of Landscape and Architecture* (2019) held in Iglesias, Monteponi (Sardinia, Italy)[10] which was directed and coordinated by Giorgio Peghin.[11] The team was also coordinated by Professor João Gabriel Candeias Dias Soares - along with Italian architects and professors: Professor Marco Navarra[12] from the School of Architecture in Siracusa, and Professor Adriano Dessi[13] from the School of Architecture in Cagliari. At the time, the following master's thesis was not completely consolidated. However, during this workshop, I became more interested in the themes of: gestures through reclamation and the redemption of soil which had been contaminated by mining and processing plants. These ideas, which were reflected upon in a team project[14] and elaborated on during this workshop, went in the direction of the reclamation of the post-industrial landscape and so this was an interesting topic to pursue and become a central focal point for this thesis. The workshop project at Iglesias was designed for Masua and the nearby structure of Port Flavia. This hub, a former coastal mining area near the Sardinian town of Iglesias, formed part of several mining operations in the Sulcis area - a region of Sardinia which is rich in coal, sulphur , barium, zinc, lead, silver and other metals. Porto Flavia, on the cliff face, was once an offloading platform for mineral ore onto cargo ships that transported it to other ports in the Mediterranean Sea. The workshop project, proposed for Masua and Port Flavia, (contrary to the interventions of other different groups within the workshop - who explored other post-industrial themes and sites in the surrounding area) focused not on the design of a standard functionalist architectural building, but rather on the reclamation of this contaminated landscape through re-greening of what is today an extensive coastal body of contaminated land. A route was designed for one to experience this unique post-industrial landscape, which would in time be regenerated with local fauna a flora, reconnecting the coastal post-industrial area of Musua to the embedded awe-inspiring structure created on the cliff face of Porto Flavia. My supervisor and lecturing participant in the above mentioned workshop, allowed me to reflect on the beauty of man-made structures and the potential, that discarded post-industrial waste on mining sites has to transport us on a journey into the sublime. He also showed me that there is much to be learned from land art for the field of architecture due to the nature of the conceptualization of the project and the direct relationship that the artist has with the site, the landscape and the material - where they intervene. The meaning of our relationship with the landscape - especially that of the post-industrial landscape - and its reclamation through land art and moreover architecture, are important considerations to be explored in this thesis.

Man in the Anthropocene, with its ever-rising population and consumerist culture, has increasingly obtained raw materials with little, if any, regard for the impact that such acts have on Earth's geology and ecosystems. Once mineral sources are depleted, or their removal from the earth is no longer cost-effective, sites are abandoned leaving open wounds of massive proportion on the landscape - monuments created by man and his machinery. In recent decades however, an awareness of such environmental damage has come to the fore and, when attempting to solve the problem of what can be done with unsightly and toxic brownfields and open pits, it is becoming clear that a multidisciplinary approach is required. This change of awareness leaves opportunity for the creation of art and architectural works in the post-industrial landscape.

The American Earthworks movement, with its beginning in the 1960s and 1970s was influential, as not only did it change the way we look at art, and especially sculpture, it redefined it. By using earth (soil, rock, water) and, by processes of subtraction and addition, land is sculpted - often on a large scale and with the use of earthmoving equipment. Not only does the object of art and the site become one, but the work is a concept that can be replicated at different sites in time. Whether the selection of post-industrial sites and the act of reclamation was intentional or not, some land artists took advantage of the USA Surface Mining Control and Reclamation Act of 1977 (in varying degrees) to create earthworks and, in doing so, introduced the idea that man's wasteland can be given new life. However, in the 1980s in the field of architecture, the potential of earthworks to transform post-industrial sites was overlooked in acts of reclamation. Although today architects are interested in creating earthworks as reclamation in the post-industrial sites, this has not been the case in the Iberian Pyrite-Belt. Though the field of architecture, the following dissertation (comprising of research by design methodology) therefore aims to reflect on the work of artists such as Beverly Pepper; Dennis Oppenheim; Harvey Fite; Iain Baxter; Lawrence Hanson; Michael Heizer; Mary Miss; Newton and Helen Harrison; Richard Fleischer; Robert Morris; Robert Smithson; William Bennett. The field of architecture has much to gain or learn on the reflection of these works during this particular time due to the fact that these pioneering artists, in relation to the planning and realisation of their works, had a profound understanding of the site and the material but also the inherent process of construction in the conceptualization of their work.

The reclamation project in this thesis proposes the backfilling, covering and waterproofing of the open-pit at S. Domingos, Portugal (37°40'05.8"N 7°29'28.2"W). This is a pragmatic solution to the toxic water seepage at this site but the project also embraces the post-industrial identity of the site and that of its surrounding landscape. The earthwork acts as a 'song line' or a 'performance' that evokes the experience of the post-industrial landscape as a place for sublime contemplation and of memory in an epoch marked by instability and change and, as concept for the reclamation of open-pits world-wide.

004 Illustration showing hydraulic excavator conducting earthworks. Earthmoving equipment was essential to many Land Artists from the 1960s onwards; Earth became the artist's canvas and earthmoving machines their paintbrushes. © Jared Miguel Fantasia.

State of the art

With the ever increasing extraction of natural resources (necessary to maintain the needs that humans have created for themselves and which are linked to their global economies) industrial wastelands occur and solutions have to be found for the future - in addition to solutions to the legacy of post-industrial sites abandoned in an unregulated past.

The state of the art within this thesis is composed of a multifaceted reflection on topics such as: man's sacred relationship to the landscape; sculpture as part of the landscape; the changing nature of sculpture; reclamation and sustainability; post-industrial landscapes as places of heritage; earthworks as reclamation. Being within the realm of an architectural reflection on the post-industrial landscape, it considers more specifically how earthworks can be employed in the field of architecture to embrace and to enhance post-industrial waste lands for what they are i.e. monuments created by man in a perspective of a the technological sublime.

Given the complexity of disused mining sites, they cannot be looked at in isolation and so workshops are essential to bring together the necessary range of ideas required for solutions - considering for example, "architecture, engineering, infrastructures, techniques, the local context and socio-economic models"[15] such as in the annual *International Workshop of Landscape and Architecture* held in Iglesias, Monteponi (Sardinia, Italy).The latter is one of many such forums seeking solutions for the "redevelopment, regeneration and environmental rehabilitation"[16] of mining and abandoned industrial sites in the problematic mining landscapes of the Mediterranean region and Europe and has resulted in works such as, *L'Architettura delle Miniere: Paesaggio, Suolo, Sottosuolo, Terra* (Peghin 2019) and *Re-Mine: Architettura e Modificazione Nei Territori Minerari de Industrializzati* (Peghin 2019) - both works being related to the committee of the Centro Studi Mediterraneo del Paesaggio.

This thesis gives pertinence to a further dimension of thought to this annual International Workshop of Landscape and Architecture, by adding a previously unconsidered area of reclamation: the idea of the creation of an earthwork from the vast amounts of industrial waste on post-industrial sites where such waste is a medium to be moulded and transformed and thus having architectural potential. The creation of Earthworks on post-industrial sites is not new, but the pioneering, grand-scale earthworks (akin to works of architecture) created by American artists on post-industrial sites in the 1970s have been largely overlooked in such architectural forums. We have only to consider the writing and works of Robert Smithson and Robert Morris and the grand sculpture of Michael Heizer, in post-industrial landscapes - regardless of reclamation being intentional or not.

Art and architecture historian, Philip Ursprung (2009, 3) notes a change in perception with regard to culture and the landscape that began in the 1960s and one which can be seen in the earthwork of Robert Smithson, "who saw earth not only as physical matter that he could use for his pieces like *Spiral Jetty* but also a metaphor for historic and psychological processes, such as when he compared the earthworks to 'a sedimentation of the mind.'" Ursprung also notes that this "shift" is also evident "in the videos and films of urban performances by Gordon Matta-Clark, who worked with fragments of houses and was interested in what he called 'living archaeology': the means to transform leftovers into something new." Archaeologist, Sir Mortimer Wheeler[17] had already, in the 1950's, begun to see necessary changes to the way we perceive our culture's past; rather than the landscape of ruins being the subject of objective academic study, he advocated that they should rather be experienced. He advoicated that "archaeology is a science that must be lived, must be 'seasoned with humanity.' Dead archaeology is the driest dust that blows" (Wheeler 1954, Preface V). Ursprung upholds the architect, Zumthor's architectural approaches to landscapes with ruins of our cultural past. When considering Zumthor's shelter over an ancient Roman archaeological site in Chur, Graubünden Switzerland (1986) as a model, Ursprung proposes that "the present-day intervention neither simulates nor interprets the absent past. It does not fixate the meaning of the archaeological traces, rather it allows the visitors to emotionally and intellectually reconstruct the lost entity in their imagination and feel like archaeologists who are discovering the historic fabric under various layers of the past. In Zumthor's hands, history is not a commodity to be consumed, nor an image to be looked at from a distance, like a diorama, but an open process that can be individually experienced" (Ursprung 2009, 3). While the fields of archaeology and anthropology are very rich and would have much to contribute to this thesis, they are not my fields of study and for this reason these lines of investigation have not been pursued - for example, by including an anthropological survey, which would be very interesting.

The artist, Robert Smithson, in the production of his non-site pieces, transformed raw material by taking it out of nature, organising it and creating a piece of art. Similarly, discarded material has been reclaimed and elevated to create works of art and architecture such as artist Matta Clark's *Garbage Wall*, (1970) and Greek architect Dimitris Pikionis' *Pikonis Pathway* (1954-1957). Architect, Jaques Herzog argues that architecture, like art, has the power to transform removed material and give it meaning and "character" in a new context (Ursprung 2015, 54-55). The façade of Herzog & de Meuron's *Stone House*, Tavole, Liguria (1994) can be seen as a wall that Gerhard Mack (Swiss art and architecture critic) suggests, "acts like a painting vis-à-vis the landscape" (Gerhard Mack in Ursprung 2014, 51). In Herzog & de Meuron's *Dominus Winery* (1977), banal rock gabions have been elevated in the creation of architecture.

Urban post-industrial sites, with prime real estate value and being close to infrastructures, have more potential to be transformed or re-purposed (given also the increasing shortage of land for development in cities) (Loures & Burley 2012; 224) in comparison to post-industrial sites in rural areas with little infrastructure and a very low population density and so the latter are largely ignored by governments with the solution often being to close them up (EDM 2001,15). Acts of reclamation have therefore increasingly been focused on urban landscape and also at greening space for public use. However, where mining has taken place, the procedures are so invasive and extensive that land reclamation is costly and extremely challenging - if not almost impossible to achieve fully. The future of mining sites also opens up a number of ideological differences between professionals and interested parties in consideration of their future (EDM 2001, 21-25).

Solutions to reclamation of post-industrial landscape (from engineers, ecologists, historians, politicians, architects and even artists) tend to be individual within their field rather than integrated with other areas of expertise. For engineers and geologists, the priorities of reclamation of the mining site lie in stabilisation of earth and the need to halt the extensive infiltration and contamination of the water table with its toxic chemicals posing risks to the local population and visitors. For ecologists the solution may be one of restoration of the site to pre-mining times – which can be considered 'unrealistic' as landscape is naturally ever-changing – or it may be simply creating any form of green space because this is preferable (plants also playing a role in the clean-up of contaminants). Industrial sites are places of cultural heritage; being man-made they are a multiple layered testimony of man's past identity which must be preserved and so the idea of site restoration must be given significance in reclamation projects. The contribution of the architect is connected to changing function of space and aesthetics; the old, unappealing and unwanted site is transformed into a new landscape (eradicating all evidence of its use in the past) or where spaces are restructured and restored for new purposes, yet retaining some of the original cultural identity of the place. Art works may be produced within the framework of the site, for example to give contemplation of its history; to serve as monuments of its past.

However, multidisciplinary approaches to such sites also need to consider that they are places of living archaeology, as considered by Zumthor, Matta-Clark and Sir Mortimer Wheeler, and therefore artists and architects have an important part to play in multidisciplinary approaches to their reclamation - especially with regard to monumental tailings. Works such as Michael Heizer's *Effigy Tumuli, (*1983-1985), constructed from strip mine waste, facilitates the experience of the scale of such waste but *Effigy Tumuli* is also an art work which attempts to give recognition to the prehistoric culture of the place from its pre-mining era. The creation of Earthworks through the collaboration of art and architecture breathe new life into dead earth as it becomes a landscape of sublime technological beauty and meaning, making it truly sustainable.

This thesis considers the potential of Earthworks in post-industrial reclamation to re-sculpt such sites, to give them new purpose and to create new perceptions of what mining waste could be - in the same way that Robert Smithson's and Robert Morris' works were innovatory in the field of reclamation in the1970s. In addition, this thesis shows the potential for post-industrial sites (especially post-industrial mining sites in the Iberian Peninsula - like S. Domingos Mine) to be reclaimed though art in the field of architecture and, to be considered in architectural workshops, like that held in Iglesias, Sardinia (being an ideal platform not only to bring new ideas to the table but to generate discussion regarding the transformation of such unique landscapes).

005 Image from the poster of the Fifth International Workshop of Landscape and Architecture entitled, 'Paesaggi Minerari' held at Monteponi (Iglesias).

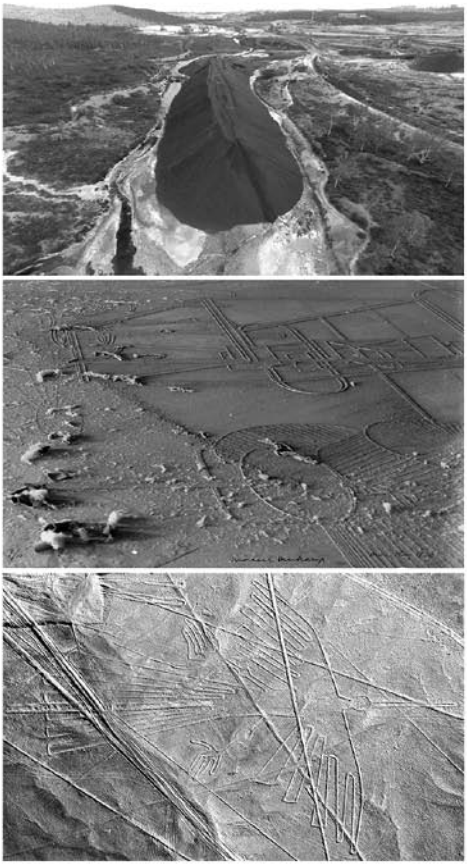
006 Composition of 4 images from top to bottom: 1. Stonemasons working on the Saint Dimitrios Loumbardiaris courtyard by Dimitris Pikionis. 1954–58; 2. Smithson, Robert. *Non-site*.1968. 3. Matta-Clark, Gordon. *Garbage Wall*. 1970; 4. Detail of a gabion from *Dominus Winery* designed by architects, Herzog & de Meuron.

Hypothesis & aim of work

Since the onset of the Anthropocene, technological advancement, exponential population growth and rising consumerism, has pushed Earth to its limits. In the procurement of resources, man has largely been exempt from his social responsibility as he has acted upon his environment with impunity.[18] This has been particularly evident in the mining sector where opencast mining, especially, has left gigantic scars on the landscape; once thriving mining pits, now depleted of natural resources, lie abandoned along with their tailings and moreover remain the source of contamination of entire water tables. The reality of the situation is that we *are* now accountable for the environmental destruction of a previous industrial revolution - which has left blights that can no longer be overlooked - in addition to our responsibility to make provision for reclamation of present and future industrial sites.

S. Domingos Mine, Portugal presents a problematic mining site in terms of its scale and the magnitude of its waste and toxic contamination. This thesis generates the question: Can worthless contamination be used as a medium for the production of large-scale earthworks which help renew the function of neglected and abandoned post-industrial landscapes? Moreover, it proposes that architecture, inspired by earthworks (considering the pioneering ideas of land art such as that of Robert Smithson, Michael Heizer, Robert Morris and others) has a role to play in the renewal of such post-industrial landscapes – not only in terms of aesthetics but also in man's connection and attitude towards such landscapes. Photographer, Man Ray in his work *Dust Breeding (Duchamp's Large Glass with Dust Motes*. Printed 1967. New York: The Metropolitan Museum of Art) captures, on a glass sheet, Duchamp's sculpted accumulation of years of dust (a worthless medium) forming an imaginary landscape. This transports the viewer and awes them in a similar ways as a view of the *Nazca Lines* in Peru would do. Can the same be done with the vast slag heaps in post-industrial landscapes?

The aim of this thesis, and the reclamation project within it, is to act as a 'song line' or dreaming track such as that found in Indigenous Australian culture[19] where, within the animist belief system, paths across the land (or sometimes the sky) and mark the route followed by localised "creator-beings", during dreaming, thus connecting people to their land. While the theoretical part of this thesis is the path, the architectural project is the art, the 'song' - the performance that connects the reader to the post-industrial mining site of S. Domingos and many others similar to it around the world.



007 Composition of 3 images: Top. Mining terrils in the post industrial mining site of S. Domingos; Middle. Ray, Man. *Dust Breeding (Duchamp's Large Glass with Dust Motes)*. 1920; Bottom. Printed ca. 1967. Delso, Diego. *Aerial view of the "Condor"* 2015. One of the geoglyphs of the Nazca Lines, which are located in the Nazca Desert in southern Peru, 2015.

Research questions

How are art, earthworks and architecture linked and what is their relevance to the post-industrial site?

Radical changes regarding the forms of art came about in the 20th century as objects could be seen as art and moreover, the idea behind the work became more important than the piece itself. For example, conceptual artist Sol Lewitt[20] in his essay, *Paragraphs on Conceptual Art*, states: "When an artist uses a conceptual form of art, it means that all the planning and decisions are made beforehand and the execution is a perfunctory affair. The idea becomes the machine that makes the art." (Lewitt 1967) It would then appear that art and architecture have common ground. Artist and architect, Alessandro Poli[21] (from the architectural firm *Superstudio* founded in Florence, Italy in 1966) states - when referring to his work, *Il Piper* of 1964 - that, "because architecture was no longer simply something practical, it was also artwork, an element of Land Art." Architecture therefore no longer belonged exclusively to the realm of 'the built' to be reflected on. Poli's, *Il Piper* was both a park and a structure; it was an urban place where people could seek enjoyment. The place therefore became a model and architecture for Poli, therefore it was no longer a matter of something being practical as it was also artwork - an element of Land Art. The work consisted of two big used Ferris wheels from a closed down amusement park. He stated, "You could park your car inside and, seated in your vehicle, you would observe, you would watch, and you would enter into a new silence, a new reality. The wheels remind us of the work *Bicycle Wheel* (1913) by Marcel Duchamp who was a great artist of his time, and who saw the wheel as a work of art."[22]

In *Operating conceptually in art - Operating conceptually in architecture* by architect, Jose Capela (2012, 76) considers the Renaissance humanist, Leon Battista Alberti's work model of how conceptual artists should relate to the execution of their own works (as described by Mario Carpo) to be identical to the model proposed by Sol Lewitt. Architectural historian and critic, Mario Carpo, in *The Alphabet and the Algorithm*, states that "at various times and in different contexts Alberti insists on this ideal point of no return, where all design revisions should stop, and construction begin speedily and without hesitation (and, he adds, without any variation or change during the course of the works, regardless of who is in charge of the site). Alberti famously advised architects against directing the actual construction: in his view, building should be left to the workers and to their supervisors" (Carpo 2011 quoted in Capela 2012, 76). Capela therefore considers Alberti's framework to be "the framework for the status of the architect as an artist and of architecture as art." He adds that, "According to this model the entity, that has been instituted as the 'project', has two fundamental characteristics:

• it acts as the intermediary between the author(s) of the work and those who execute it. The architect's work ends with a project, based on which the builders then execute the work.

• it is autonomous as a work. As a product of the architect's activity, the project can be judged in its own right.

Its qualities and flaws, even those related to the capacity of the architectural forms to support daily life (their suitability for being inhabited) or the building's performance throughout the work's existence – which only time will tell – everything that actually depends on the project can be evaluated within the project itself. Those elements are already there.

This is also the case in a work of conceptual art: the idea is self-sufficient as the record of the artist's intentions and it is the starting point for a performance that is supposed to be literal. Conceptual art approaches the operating model of the 'project' (Capela 2012, 76).

Why should post-industrial reclamation therefore consider Earthworks as architecture and vice versa?

This thesis postulates an idea that, in the reclamation of post-industrial mining sites, architecture has a significant role to play through the creation of Earthworks by:

• creating reclamation possibilities for sites – especially where this is difficult to achieve due to the extent of its invasiveness in the landscape;

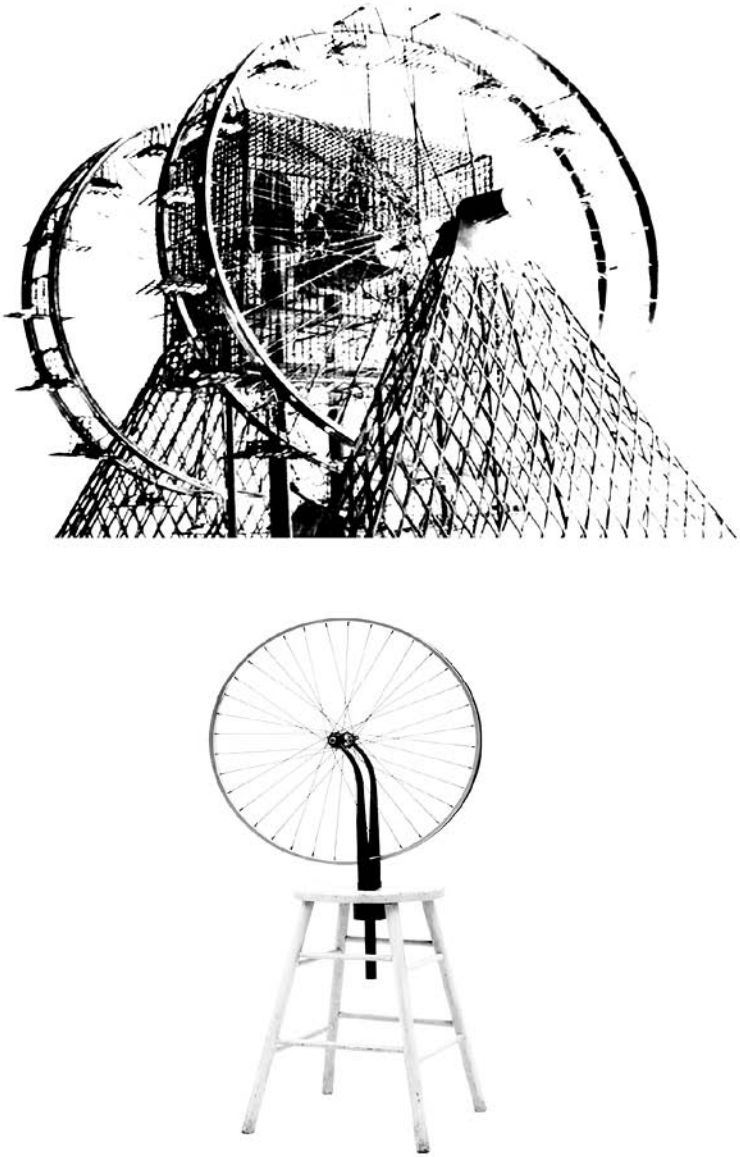
• playing a mediatory and organisational role where all interested parties are brought together and the ideals and expertise from a variety of fields can be co-ordinated and integrated.

• physically 'transporting' the visitor into the post-industrial landscape and allowing them to experience the spirit of the place, to appreciate its industrial past (which is part of man's culture) and, to facilitate a change in their aesthetics and value in relation to such landscapes;

• revealing what *is*, thus promoting man's need to take cognisance of the significance and morality of his acts in relation to the Earth (Martin 2001, 173-174).

• creating what the Land Artist, Robert Smithson described as 'democracy' between the industrialist (on whom we depend for our physical needs) and the environmentalist (a custodian of the earth) through land art. With regard to Robert Smithson's project proposal for Bingham Mine (*Bingham Copper Mining Pit – Utah, Reclamation Project*,

1973), Timothy Martin proposes that “the task of the land artist is to create a garden - a place where democracy can look back upon itself, can catch sight of the material of the site in a way that induces a sense of prenarrative, solid time. Things, in this garden, are markers of time, and even people are subject to entropy, to the disintegration of biological life downward into the earth upon which they gaze. From the deepest hole in the world one sees a territory where democracy is democracy precisely because it is the political philosophy that includes and enjoys its own material inconsistencies and paradoxes” (Martin 2001, 174).



008 Comparison of two images: Top. Poli, Alessandro. Photograph of *View of a model for Piper.* 1966; Bottom. Duchamp, Marcel. *Bicycle Wheel.* New York, 1951 (third version, after lost original of 1913).

Methodology & Structure

The methodology adopted in the following dissertation is one of "research by design" culminating in a projectural synthesis.

Jørgen Hauberg (architect) identifies that the creation of a work of architecture lies in processes prior to enactment. In addition to research using scientific methodology or that of the humanities, a more qualitative and expressive research component (such as in the practice of art) is possible in architecture, as the architect reasons and understands through their engagement with "form and space: drawings, models and completed works". Furthermore, he proposes that art, in the form of earthworks, and architecture share common ground as craftsmanship and architecture both require knowledge of "materiality and context of the place" as a prerequisite for building to take place. In the creation of artworks, man has begun with aesthetics and, using "mind, eye and hand," transformed medium using science and technology so as to produce something of utility, durability and beauty (by which Vitruvius characterised as the purpose of architecture) (Hauberg 2018, 48). Architecture requires "sketches, models, material experiments and completed architectural works" and, "material sketching" bridges representation and reality and initiates "intellectual reflection and development of the profession" (Hauberg 2018, 49). Architectural gestures also involve the "capacity to produce *disegni*" where the hand depicts the thought processes of the mind and so the finished work is imbued with the thoughts of its creator (Andrews 2015,137). Just as we can talk about *disegni* we can talk about model-making or any form of artistic expression related to the architectural process.

Architectural theorists, Mette Thomsen and Martin Tamke (quoted in Hauberg 2018, 50) define the architectural design process as "reflective practice" as the architect puts forward questions and, creates solutions; it is a process "in which critical assessment, comparability and evaluation takes place through the continual weaving between problem and solution in an iterative movement between inquiry and proposal." In the design process, drawing becomes the language of communication, replacing words and creating cognitive dialogue between "hand and brain".

Research for art and design is a process resulting in an artefact which represents those processes which went into its creation. Research by design is "research through design, using the expression especially for the Dutch practice at The Faculty of Architecture in Delft (V.A.,2000)" and also at the Department of Architecture at the University of Évora. Design and research are interconnected because, through engaging in design, we create "new knowledge about the world" (Hauberg 2018, 51).

According to Hauberg (Hauberg 2018, 51- 53), Research by Design opens the possibility interrelating architectural practice and, research process and methods as they have the following in common:

• "Basic perceptions" where "philosophical, ethical and theoretical perceptions, norms and values regarding the surrounding world, the role of architecture and the object itself (architecture)" which are debated and posed for rudimentary research.

• "Investigation" through basic processes of "analysis, criticism, selection, problem formulation…"

• "Programme" being a research strategy consisting of a "concrete spatial proposal" for the development of work which is "the experimental and partially independent of the analysis"

• "Subsequent rationalisation" consisting of "argumentation, theoretical explanation of the proposal and subsequent testing in practice, if applicable,"

• "Communication" of material through "a text, a drawing, a model or an example that explains the correlation between the components of the methodology in a manner that is consistent, reasoned, made probable and cannot be contradicted."

Hauberg therefore proposes that a "holistic approach to design as well as research" can be achieved where research can originate from design if works are not viewed in isolation. This can be achieved through a strategy of "back-casting" in which the final spatial "picture" is viewed first, and where methodology changes "between the descriptive (purely describing), the ideographic (the unique and exceptional), the nomothetic (the argued, rule setting) and the proposal, which in the end is based on the ethic argument" (Hauberg 2018, 53).

With consideration of Hauberg's approach towards research by design in the field of architecture, this dissertation is structured in five separate parts and is subsequently laid out in the following manner:

I - Framework consisting of:

• Introduction
• State of the art
• Hypothesis & aim of work

• Research questions
• Methodology and structure

In this chapter the outlines of the theoretical structure underlying the following thesis and theories, that are most relevant to the following research, are discussed and evaluated. The main goals here are to: define key concepts; evaluate and combine relevant theories and models; explain the assumptions and expectations that guide the project.

II - Basic Perceptions and investigation of themes surrounding topics such as:

• the Anthropocene - an industrial age;
• the post-industrial landscape; reclamation and sustainability;
• post-industrial landscapes as places of heritage;
• Earthworks as reclamation as situations of reference from the 1970s to early 1980s. These are considered to be pertinent to the subject because they are pioneering responses to the reclamation of the post-industrial mining landscape and more specifically that of open-cast mining.

These themes or ideas pervading the work are outlined and debated, as a starting point - or input which is later developed in the architectural reclamation design project in part III.

III - An Introduction and analysis of the S. Domingos mining area and its open pit. This consists of:

• a brief history of the S.Domingos Mine through time, territory and place;
• cartographic analysis and compilation of documentation (from online sources and those produced during the investigation period);
• a photographic survey consisting of photos taken in the mining area of S. Domingos during visits to the site in 2018, a collection of sediments (waste) from the site which later on became medium artistic gestures captured through the art of scanography. (It was necessary to return to the site as no pictures were taken or samples collected during the development of the initial project in 2012.);
• Process - an accumulation of waste. A collection of waste material from the production of the project through time and that served as documentation to be reflected on;

• subsequent rationalisation and communication of ideas from Part II through an architectural reclamation project at the open pit of S. Domingos, Portugal (37°40'05.8"N 7°29'28.2"W) as well as an explanation of the project's inherent process of construction.

Here an overall perspective is given of the site situating the project through time and space, as well as its evolution - the conceptual thought processes that gave rise to its nature.

IV - Final Considerations

This concluding text of the body of work consolidates the processes of parts I, II and III. The designed reclamation project proposed for S. Domingos Mine, raises the possibility of the performance of art as earthwork to inspire architecture and give it a role in the reclamation of post-industrial mining sites through the use of mining waste and thereby creating landscapes of healing which retain man's cultural past. The proposed architectural project being a concept, can be replicated on other post-industrial mining sites in the Iberian Peninsula and beyond.

V - Appendix consisting of:

• Attachments
• Endnotes
• Index of images
• References

This volume provides additional information on this dissertation that can be consulted during the reading of this thesis.

009 Left: Photo. *Play-acting with sketching: using a photo print as a background to draw on.* From: Keller, A. I. (2005). *For Inspiration Only; Designer interaction with informal collections of visual material.* Ph.D. dissertation, Delft University of Technology, Delft, Netherlands. Right: Text accompanying the photograph (left) on *Thursday Night Live!* Het Nieuwe Instituut. Panel discussion on "Research through Design". (Het Nieuwe Instituut is a museum for: architecture, design and digital culture; national collection for Dutch architecture and urban planning agency for architecture; design and digital culture research and development.)

Research through Design is the designerly contribution to the creating of new knowledge. Knowledge that can be used by others. And brought about by designerly interventions such as speculating about the future, making prototypes, and engaging with complexity and ambiguity without necessarily trying to 'box them in'.

Earthworks

Man's sacred relationship to the landscape

"People's relationship to the landscape is one of the most significant expressions of culture, in many respects equal in importance to the relationship to the sacred," (Beardsley, J., 2006, p.8).

Artists have always sought inspiration from nature to produce works. "Landscape art may be considered as a modern art form, but it is one that echoes our earliest creative impulses. It's an art but can't be bought or sold, doesn't exist in galleries and has to be found before it can be seen. It makes us think in a new way about beauty and wonder of the natural world and the ways we mark our fleeting place within it."[23]

Man has evolved from the Earth and is inextricably bound to it for his needs. Humans are not part of nature and shaped by nature's forces, but are apart from nature because they can act on nature and shape it and use its resources as they please. It is inherent in man therefore to alter landscape in the way that he perceives it and through his artefacts and construction, transform nature into his culture. Architectural theorist, Norberg-Schulz, in *Genius Loci: Towards a Phenomenology of Architecture*, (1980, 50-51) sees nature as a stimulus for man. Man does not aim to replicate nature but rather he is prompted by it. He creates what he has "visualize[d]". He then "complement[s]" it by adding what he needs. "Symbolization" then takes place because the meaning of his creation becomes internally and culturally symbolic and also a microcosm of his world. When man remains or "settles" in a place, he gives meaning to his environment in relation to his being and so the place of man's creation is defined by, "an *imago mundi* or microcosmos which concretizes his world" (Norberg-Schulz 1980,17).

Social anthropologist, Tim Ingold (2000) links landscape to archaeology. Landscape is understood by those who live in it and who engage with it and who travel along the paths which connect places. Ingold refers to landscape as a "taskscape" because incorporated into it, is the performance and rhythms of biological organisms living within it (who make sound; touch; move to rhythms and cycles of nature). He states, "In dwelling in the world, we do not act upon it, or do things to it; rather we move along with it. Our actions do not transform the world, they are part and parcel of the world transforming itself. And that's just another way of saying that they belong to time" (Ingold 2000,164). He points out that a landscape painting, in Western thought, is an artefact – a final product which is "complete" in itself. However, in Yolngo culture (Australia) the "emphasis on painting is in the performance. Far from being the preparation of objects for the future contemplation, it is an act of contemplation itself (Ingold 2000,161). Ingold holds French philosopher Merleau-Ponty's perspective of landscape as being "not so much the object as 'the homeland of our thoughts'"(Merleau-Ponty 1962, 24 quoted in Ingold 2000,171).

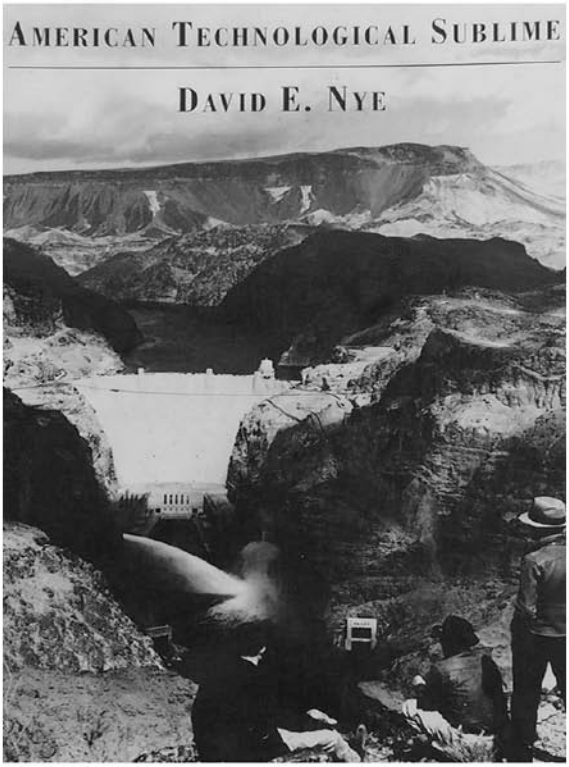
In Part 2, *Landscapes of the Soul*, of the documentary film *Nomad: In the Footsteps of Bruce Chatwin,* German-film director and screenwriter, Werner Herzog proposes that landscapes do not change over time and that they are imbued with mysticism and power. They have the power to move people much like Silbury Hill (the largest Neolithic structure in the world located near Avebury, UK) where people have formed an attraction and claim to feel magnetic forces. The area was a pivot for the travel writer, Bruce Chatwin who grew up there and where he always had a feeling of belonging – being a place of the soul. However, Herzog points out that our attraction is not always to landscapes of beauty, but to that of "strangeness" and the latter formed a quest for Chatwin – in a way like Herzog's fictional landscape of a valley of 10 000 windmills which causes a soldier to become insane - and for which Chatwin coined the term, "deranged landscape".[24]

German Romantic landscape painter, Caspar David Friedrich's oil painting, *Wanderer above the Sea of Fog* (c.1818. Hamburg: Kunsthalle), is a powerful landscape in the spirit of European Romanticism which gives the idea of man venturing out into nature and in doing so, discovering his inner being. The iconic painting also reveals the landscape of the sublime – the 'out of the ordinary'; man, aloft, is a spectator in awe of nature's performance, viewing and contemplating its beauty and grandeur. However, in terms of philosophers Edmund Burke's[25] and Kant's[26] ideas of the sublime and the beautiful, we feel the solitude of man, the infinite, immense and powerful forces of nature (and man's vulnerability to them) as well as them being a metaphor for his psychological being – the turmoil in his darker soul. Perhaps man, who is at the center and occupies much of the painting in silhouette, can be symbolic of a future darker force of man's increasing dominance over the earth if we consider the future and the idea of the technological sublime attributed to the 20th and 21st centuries.

The "Technological Sublime" is a term introduced, David Nye[27]where awe of nature is replaced with the awe of the power of the man-made, the industrial and technological. Photography replaces the paint brush and saturates man with images of his ingenuity and capacity for greatness for example, images of his control of nature in the building of a dam wall. Moreover, man is now on a darker path of no return as his dependency on the technological increases and replaces nature.

010 Two still images (left and right) from the 1968 film *Signs of Life* by Werner Herzog within the second chapter entitled, *Landscapes of the Soul* in the documentary *Nomad: In the Footsteps of Bruce Chatwin* by Werner Herzog. Werner Herzog states that, "but apart from the idyllic landscapes that gave a feeling of home, of belonging, Bruce Chatwin was searching for strangeness. He always liked my first feature film, for this. In it, a protagonist, a German World War II soldier on a reconnaissance mission, suddenly becomes insane when he stumbles across this valley of 10,000 windmills. Bruce, in our conversations, mentioned this scene often. He coined the term "deranged landscape" for it." Through this we can consider the power of awe that the landscape has - even to the capacity to drive someone insane.

011 Comparison between the natural sublime and the technological sublime (left). Friedrich, Caspar David. *Wanderer above the Sea of Fog.* c.1818 (right). Image from the cover of the book, *American Technological Sublime* by David E. Nye, depicting three individuals marveling at the construction of the Hoover Dam.


AMERICAN TECHNOLOGICAL SUBLIME
DAVID E. NYE

Sculpture as part of the landscape / The changing nature of sculpture

American art theorist and critic, Rosalind Kraus' used a klein group[28] which is a binary field, as an attempt in 1979 to define the post-modern field of sculpture as "the expanded field" (Kraus 1979, 38) as works appeared to no longer fit what had traditionally been defined as sculpture. Sculpture had become "narrow corridors with TV monitors at the ends; large photographs documenting country hikes; mirrors placed at strange angles in ordinary rooms; temporary lines cut into the floor of the desert. Nothing, it would seem, could possibly give to such a motley of effort the right to lay claim to whatever one might mean by the category of sculpture. Unless, that is, the category can be made to become almost indefinitely malleable" (Kraus 1979, 32).

Sculpture had been traditionally tied to a place, and had served a certain symbolic function in that place and in that site as Kraus noted, "The logic of sculpture, it would seem, is inseparable from the monument" (Kraus 1979, 33). However, by the early 1960s modernist sculpture began to have no place where it belonged – it was self-referential, i.e. its meaning and function could change in any given space making it "nomadic" (Kraus 1979, 34). "It had entered a categorical no-man's land: it was what was on or in the front of a building that was not the building, or what was in the landscape that was not the landscape." For example, artist Robert Morris', *Untitled (Mirrored Boxes)* exhibited in the Green Gallery in 1964, showed that "sculpture had entered the full condition of its inverse logic and had become pure negativity: the combination of exclusions" – it could no longer be defined as sculpture in the traditional sense because it is in the landscape but not part of it and is in the architecture but is not part of it not part of it (Kraus 1979, 35).

Kraus dismissed the idea that Land Art from the 1960s was a re-emergence, or evolutionary continuum of man's ancient engagement with nature in his art. Like land artist Robert Smithson (who wrote about his ideas in relation to his work) Kraus dismissed "historicism". For Kraus, the idea of earth art and being a continuation or evolution of traditional sculpture, was outdated and exaggerated. As she said, "Through this pulling and stretching [...] overtly performed in the name of vanguard aesthetics - the ideology of the new - its covert message is that of historicism. The new is made comfortable by being made familiar, since it is seen as having gradually evolved from the forms of the past. Historicism works on the new and different to diminish newness and mitigate difference" (Kraus 1985 quoted in Beardsley 2006, 59). John Beardsley[29] however, acknowledges this argument but also points out that a view of art's "rupture" from what had come before, should also be seen in the perspective of time and in the context of the socio-political turmoil of the 1960s (Beardsley 2006, 59).

The movement of post 1960s art into the environment beyond the gallery allowed art to involve itself with the political and socio-cultural concerns of the time. This had ramifications for architecture which became more aware

of what man wanted from his environment (Raposo 2017, 71). Also, 20th century land artists, for example Michael Heizer and Robert Smithson, sculpted their work in an architectural manner. We see this in the precision of the mapping, design and methodical construction of forms (the use of positive and negative mass on architectural scale). It can also be seen for example in works of artists such as Robert Morris, Eduardo Chillida, James Turrell and Carl André (elaborated on below):

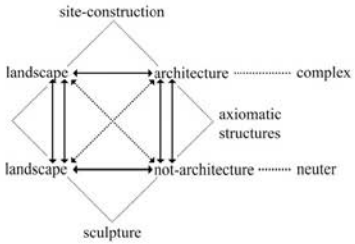
-Robert Morris's Para-architectural projects — observations, exercise courts, aqueducts, courts, concourse, etc.,(1971) namely in the drawing titled, *Observatory Markers, Equinox Sunrise–Sunset*, 1971. In the reproduction of the twenty large ink on paper drawings for this work - an imaginary architectural complex (as seen in the 1971 Tate Gallery exhibition catalogue), we can note the level of constructive detail prepared for planning for the execution of the piece through section axonometrically but also through the gesture of dragging canted steel plates, resulting in the formation of a trench. The forming of the trench is the work because the work consists of the action or gesture of dragging. (Morris notes this clearly in the drawing with the label, "Trench founded by dragging plates". In the 2009 exhibition at the Tate Modern gallery (without the original drawings) the redesigned pieces for this installation were called *Bodyspacemotionthings*.[30]

-Basque sculptor Eduardo Chillida, in his work realised in 1995 for Montaña de Tindaya on the island of Fuerteventura (Canary Islands), uses the void as object in his cube of monumental scale dug high up into the mountain and accessed by a passage within. The light defines the space and transforms it, entering through openings from above, which creates different nuances in time as the day passes. It is apparent that due to its monumental scale, man who enters the space feels his relative insignificance in its immensity. The environment evokes emotions of empathy in the individual and therefore tolerance (hence the title of *Mountain of Tolerance* given by Chillida to the work). German philosopher, Martin Heidegger, explained with reference to Chillida's sculpture at an earlier period that space is not empty and "not nothing" and that voids are places rather than containers to be filled by bodies (Mitchell, 2010,76). Space is relational and gives man place. In Chillida's negative mass or void therefore, man has a sense of place and belonging to his world rather than alienation from it.

-American artist, James Turrell's *Roden Crater*, begun in 1997 and located in the remote area of the desert near Flagstaff, Arizona, USA is a considered a work of land art but can also be considered to be an architecturally designed complex consisting of different engineered sections, planned and constructed within the eye of an extinct volcano. In the central Crater Eye, Turrell has created an elliptical observatory from where the skies above are perceived through an opening using the naked human eye. The viewing of the celestial light, unimpeded by other references (as the *Crater Eye* facilitates) are experienced, rather than viewed, for the spectator is imbued with

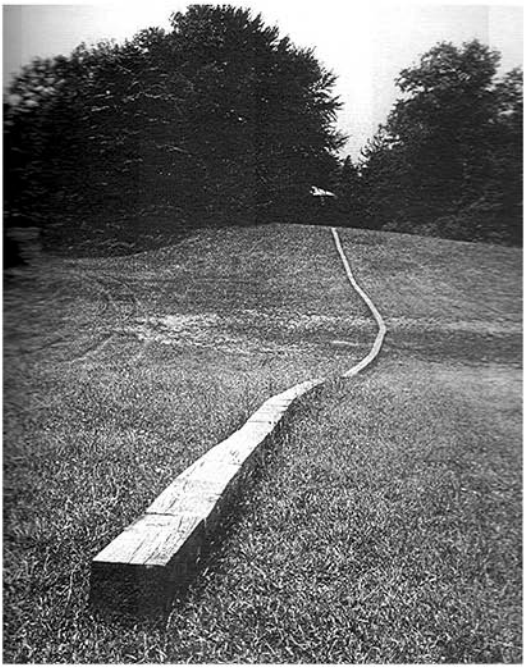
references (as the *Crater Eye* facilitates) are experienced, rather than viewed, for the spectator is imbued with mood which is ever-changing with the light in time and in changing weather. Light therefore becomes form and architectural space.[31]

In American minimalist artist, Carl André's *Modular arrangements of unaltered building and industrial materials such as brick stacks, metal squares, slabs, and timber blocks* - as seen in his retrospective exhibition, *Sculpture as Place*, 1958 -2010 [32] - it is apparent that art was no longer an isolated sculpture in the galley. Rather art had become site-specific - an element of space in the same way that space is created in architecture with the viewer in the space; sculpture became place (Raposo 2017, 152). (We see this for example in his work, *Secante* in 1977 - a sequential line of timber blocks following lines of topography). From art, architects - inspired by its elements - found forms of existence and concepts about space that engaged man's experience of space rather than him merely perceiving it (Raposo 2017, 154)

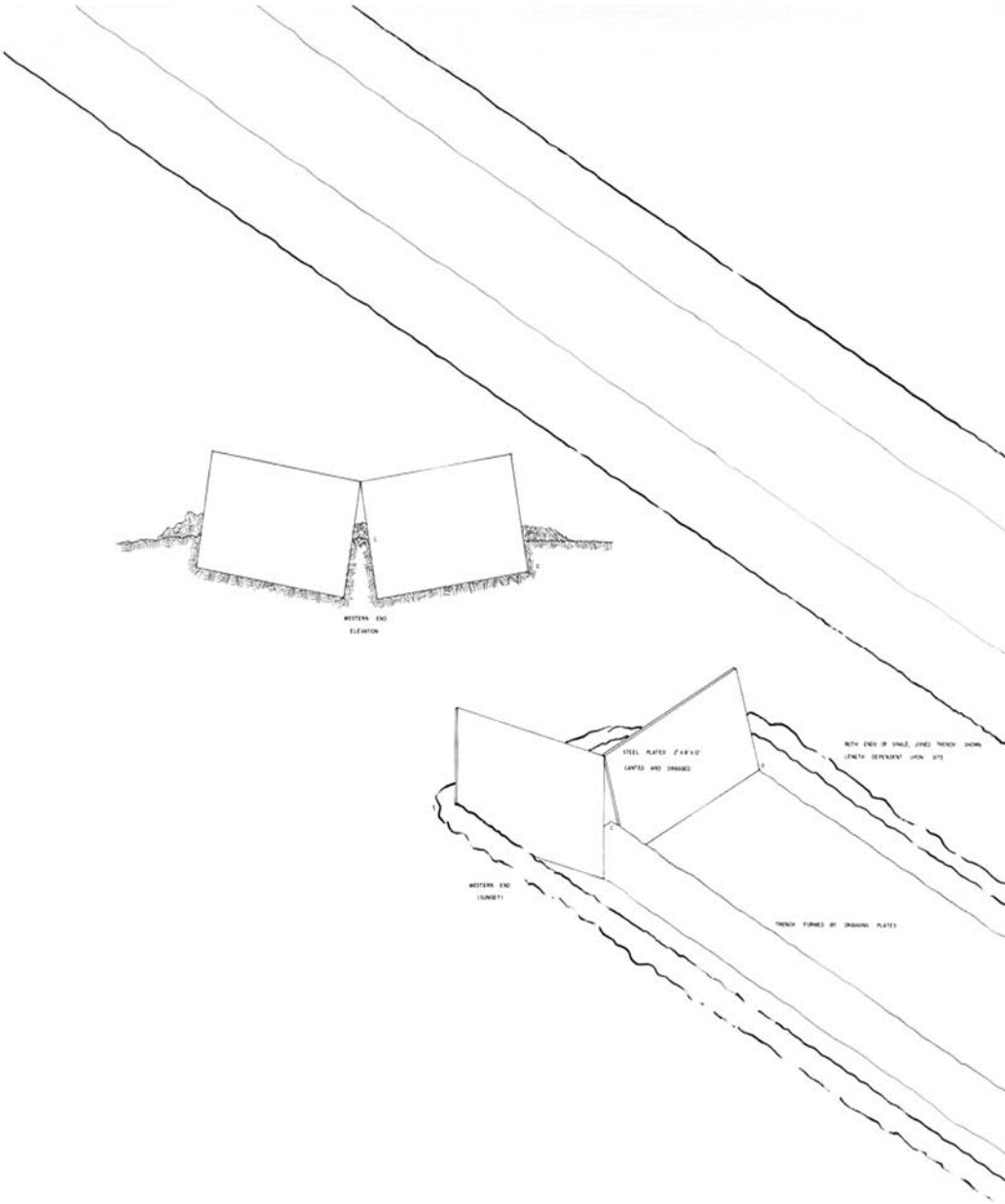


012 Krauss, Rosalind. *Klein group for the "Expanded field"*. 1979. Using logical expansion, Krauss transforms a set of binaries (opposites) into a quaternary field which "both mirrors the original position, and at the same time opens it" (Kraus,1979, 37). "The dimensions of this structure may be analyzed as follows: 1) there are two relationships of pure contradiction which are termed axes (and further differentiated into the complex axis and the neuter axis) and are designated by the solid arrows (see diagram); 2) there are two relationships of contradiction, expressed as involution, which are called schemas and are designated by the broken arrows; and 3) there are two relationship of implication which are called deixes and are designated by the broken arrows" (Kraus,1979, 37).

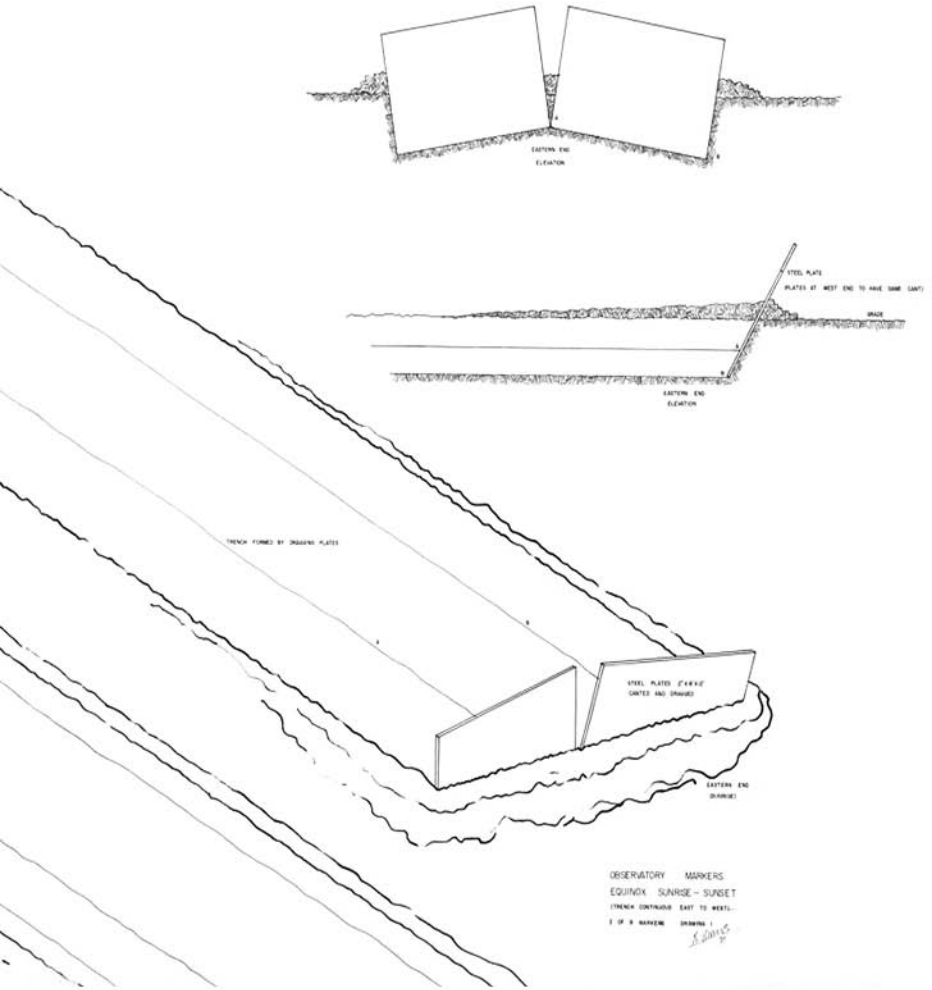
013 Morris, Robert. *Untitled (Mirrored Boxes).*1965. Reconstructed 1971.



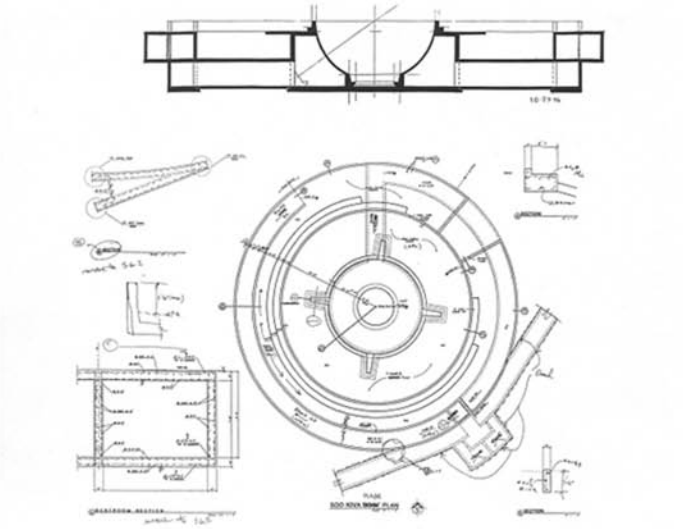
014 Andre, Carl. *Secante*. 1977



015 Morris, Robert. *Observatory Markers, Equinox Sunrise–Sunset*. 1971. This drawing is taken from the 1971 Tate Gallery catalogue which comprises of reproductions of some twenty very large, ink-on-paper drawings that illustrate a fantasy architectural complex and, which are titled, *The Para-architectural projects —observations, exercise courts, aqueducts, courts, concourse, etc.*


EASTERN END
ELEVATION
STEEL PLATE
GRADE
EASTERN END
ELEVATION
TRENCH FORMED BY DRAGGING PLATES
EASTERN END
OBSERVATORY MARKERS
EQUINOX SUNRISE – SUNSET

016 Chillida, Eduardo. *Tindaya, Fuerteventura.* 1985.



017 James Turrell's elevation and plan view for the eye of the *Roden Crater*, 1997.

The Land Art movement

The term, 'Land Art' is a variable, complex and even overused term, used to cover a wide range of artistic interventions, works, ideas, and attitudes towards nature and the land (Kastner 1998, 12). Land Art, Earth Art, Earthworks and Environmental Art are terms that are often used interchangeably.

American artists who began creating Earthworks or Land Art in the late 1960s - artists such as Robert Smithson, Michael Heizer and Walter De Maria amongst others - are labelled as "radical" and "pioneering" and "troublemakers" who radically challenged tradition and caused the art world to question: what constitutes art; how art is valued; the role of the artist; the necessity of museums, galleries and urban spaces to display art for contemplation.[33] Michael Heizer reflected the desire in the American art world for the USA to be at the forefront of Art (as opposed to the Europe historically being the centre of influence). He stated, "Art had to be radical" and also, "It had to be American." He was the first of the Land Artists to take art out of its gallery environment by engaging in works in vast uninhabited areas such as the western deserts of the USA (Beardsley 2006,13). "For [Smithson] and artists like Heizer, the turn to the Earth as material, site, and subject of art spoke to longue-durée histories and geological eternities that upended confident, modernist relations to art and materials, amounting to a critique of the art world of their time but more importantly of wider modern discourses of progress, rationality, and technological control" (Kett 2015, 135).

The 1960s and 1970s were decades of social rebellion and technical innovation. In the USA there was a quest for freedom for example, with increased drug experimentation, desire for sexual liberation from norms, rising feminism, the Black Power Movement and Civil Rights protests. It was a time of political assassinations and a fight against communism (threatening to destroy capitalism) which was fought in a protracted bloody war in Vietnam and in the Cold War with near nuclear holocaust on the USA's doorstep. This was a time of progress with materialism and consumerism and mass media defining culture more than ever before. Rapid technological advancement, with the beginnings of artificial intelligence, facilitated NASAs ventures into space and to the moon. Television brought not only advertising, protest and the horrors of Vietnam War into the living room, but also pictures of planet Earth from outer space which allowed man to perceive his planet rather differently. A minority of people began to voice their concerns about pollution and environmental destruction.

American art historian and art critic Barbara Rose (2002, 1106) notes that the relationship of art and gallery was beginning to change in America the mid 1960s. Post-minimalist "art nomads" who were attracted to international exhibitions in Europe and opportunities to work abroad, were influenced by new styles and began to re-examine the traditional idea of permanence of art and also its personal and social significance in the current socio political

climate of the time in the USA. Rose (2002, 1107) notes that "by the mid-Sixties, current events had contradicted any form of optimistic idealism and Utopian notions of order to the extent that 'reality' had to be located elsewhere - outside the museum-gallery institutional framework that neutralized any critical dimension"

Art was no longer about the creation of a gallery and museum object with traditional aesthetic. Heizer pointed this out when interviewed in 1977, "I'm not interested in the kind of work that's being done in the delicate world of the studio or seen in the quiet atmosphere of museums [...] What I'm after is investigation and exploration. It's not about leaving remnants or making something that's beautiful!"[34] In addition, Heizer did not view art as a moveable object to be acquired or traded as he claimed, "there are no values attached to something like [land art] because it is not portable and not a malleable barter-exchange object."[35] Smithson adopted a more philosophical approach to his work, documenting his ideas in his writings.[36] He aimed to differentiate the relationship between a 'site' in the landscape and that which happens in an art gallery – 'a non-site'.[37] For a gallery exhibition, in a series he called *Non-Sites* (1968), Smithson placed rocks from specific places into containers on the gallery floor next to maps and photographs on the wall denoting where the material had come from. This established "what Smithson termed a dialectic between site - the outdoor source of the earth materials – and 'nonsite' – the sculpture in its dissociated setting, functioning as a signifier of the absent site." (Beardsley 2006, 19). The material was therefore 'signified' in its reprocessed, contained state by the 'signifier'. Heizer and Smithson's views therefore indicated the redundancy of the museum or gallery - in the traditional form of a building - to give their art meaning. Also, Land Art began to blur boundaries of art and architecture because 'site' no longer gave meaning to the object by framing it; "it was no longer the background or support for a discrete art work. 'Site' expanded as a place of open limits and constant change. The land became an art object that was as insistent as the bins of rocks in the gallery" (Ryan 2007, 3). However, the creation of large-scale earth art beyond the walls of the gallery presented challenges and due to the huge costs of excavation and construction in remote areas, patronage of work was needed. Virginia Dwan (art dealer and gallery owner) financially supported some work of land artists e.g. Heizer (Beardsley 2006, 16).

Art no longer had to be made by the artists themselves because the idea became more important: American conceptual artist, Lawrence Weiner, when discussing his work *A 36" x 36" Removal to the Lathing* (1969) at the *When Attitudes Become Form* 1969 exhibition in Bern, Switzerland, pointed out that in art, the work itself is "very unimportant compared to the idea" and that if the work is replicated in multiple locations, the work is exactly the same [...] what it is, is a unique idea [...] you can't insure the work and you can't lose it; you can't damage it."[38]

"The earth and materials like stone, soil, sand, and clay constituted not only evocative grounds for the elaboration

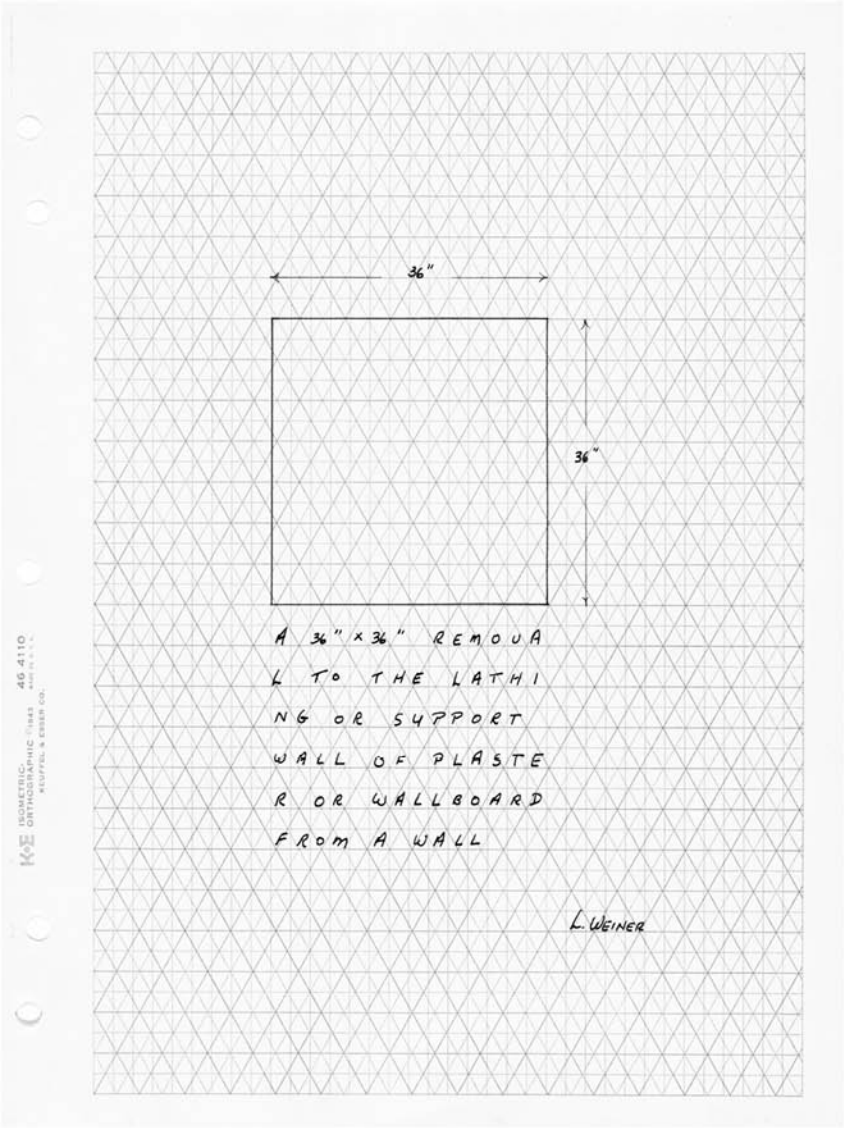
of objects but also natural and metaphysical forces that evaded the controlled grasp of the modern imagination" (Kett 2015, 135). "The concepts of change and decay were conceived in most works, e.g. the effects of changing nature of time and celestial bodies as well as that of erosion. Smithson favoured the idea of "entropy" (Beardsley 2006, 22) with the natural breaking down and disorganisation of matter in his works (which is also reflective of the eroding definition of what had constituted sculpture).

Photography and film also became a medium, recording the process of work and its changing states - and even becoming the work after it had disappeared. Land Art varied in scale, method and material; from smaller installations to monumental outdoor works. Land now became the artist's "canvas" and the "caterpillar" (large earthmoving equipment), their brush.[39] Earth was taken away or added to sites or foreign objects to the field, e.g. mirrors, concrete, wood, steel etc. were introduced. Works could be ephemeral or enduring. Heizer, when referring to the immense scale of his site work, is quoted as saying, "Man [sic] will never create art really large in relation to the world—only in the relation to himself and his size. The most formidable objects that man has touched are the earth and the moon. The greatest scale he understands is the distance between them, and this is nothing compared to what he suspects to exist."[40]

The experience of Land Art is a physical and sensory one. Land artist, Vito Acconci, attributes the Land Art movement to "being like a new kind of religion". Even in trying to locate Land Art (as these works were not even located on a map that time) in the vast, inhospitable and possibly dangerous wilderness, was akin to a kind of "pilgrimage". The location of these works (e.g. Walter De Maria's *The Lighting Field* 1974-1977), is considered to be important in transmitting a particular "spirit of the work".[41] Germano Celant states that idea of these remote works was for the viewer to be in the piece e.g. inside for example, Heizer's *Double Negative* (1969-70), "you are taken by the wall" and "the piece has to control you and not you control the piece otherwise it becomes an object and they refused that."[42] Virgina Dwan (when experiencing Michael Heizer's *Double Negative* and Robert Smithson's *Spiral Jetty (*1970) - at the time of their creation - reveals that "for the first time one has to be a part of and go into the art object" and when we "walk out on *The Lighting Field*, of Walter De Maria, we become a part of the piece as we view it". She notes the effect of walking into Heizer's *Double Negative*, experiencing elation at its beauty, "aloneness" and "a sense of oneness" when contemplating its beauty inside; the walls of the rock face comprising of layers of history - of eons of time.[43] Greg Lindquist writing about his experience of the Heizer's *Double Negative* site in the article, Descending into the Abyss of *Double Negative* indicates that the long journey in remote and extreme conditions and the weather experience at the site plays a part in the experience of the work (as it had had for him when viewing Smithson's *Spiral Jetty*). "The deep silence of the desert invited a hyper-awareness of the

landscape's nuanced light and rugged physicality. Heizer's dual ravines became enclosures of sensory depriva tion[...] standing within the work, the void and its unsheltered geological strata become exposed as actants in a system of natural processes that merge with human interaction."[44] Within Michael Heizer's *Double Negative*, one is taken on a journey through geological time. Michael Heizer, through the power of machine, has cut through the end of a *mesa* allowing one to experience the eons of its formation in its strata in the same way as highways have been sliced through hills revealing the composition and formation of Earth.

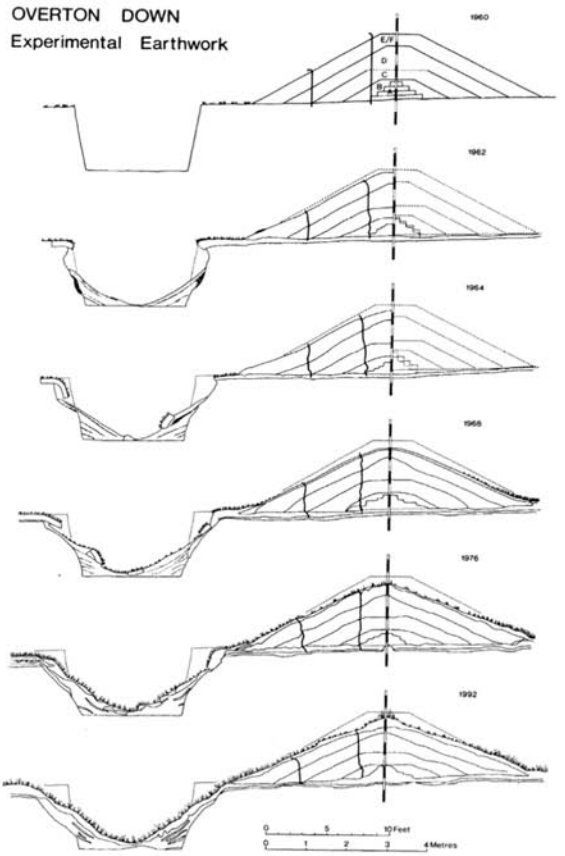
018 Two images (left and right) from the1969 exhibition, entitled "Earth Art", held in the Andrew Dickson White Museum at Cornell University in Ithaca, New York and curated by Willoughby Sharp.



019 (Left) Weiner, Lawrence. *A 36" X 36" Removal to the Lathing or Support Wall or Plaster or Wallboard from a Wall*. 1968. (Right) Lawrence Weiner constructing the work in the exhibition *When Attitudes Become Form*. Kunsthalle. Bern, Switzerland.1969.

Kerr Houston notes that "In a 1966 essay entitled 'Entropy and the New Monuments,' the artist Robert Smithson argued that a number of contemporary works of sculpture and architecture embodied a dullness and an absence of energy; blank forms and listlessness struck him as recurrent features. Such works thus recalled, to the erudite Smithson, the Second Law of Thermodynamics, which he read as implying that the entire universe is undergoing an inevitable loss of energy and a corresponding drift towards homogeneity. (Or, as Smithson put it, 'in the ultimate future the whole universe will burn out and be transformed into an all-encompassing sameness'). Thus, the gelid surfaces of Minimalism and banal strip malls of America were harbingers of the degradation of the universe: premonitions, in Smithson's view, of an inexorable 'energy-drain.'" "Entropy and the Old Monuments." [45]

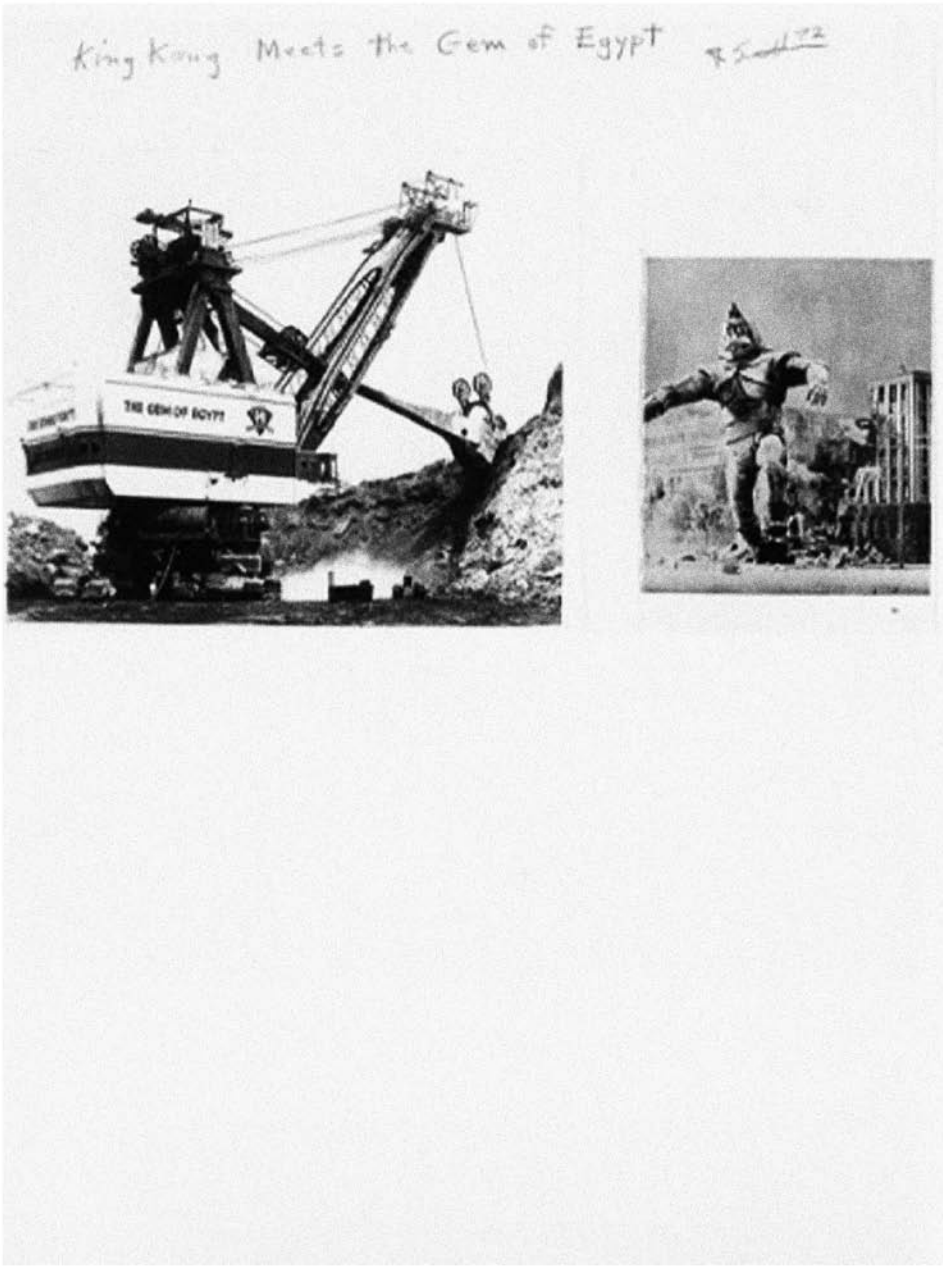
020 Image used by Robert Smithson (showing Bladen, Ronald. Untitled. 1965. In "Primary Structures" exhibition. Fischbach Gallery) in "The New Monuments and Entropy." in Artforum (Summer 1966 edition)



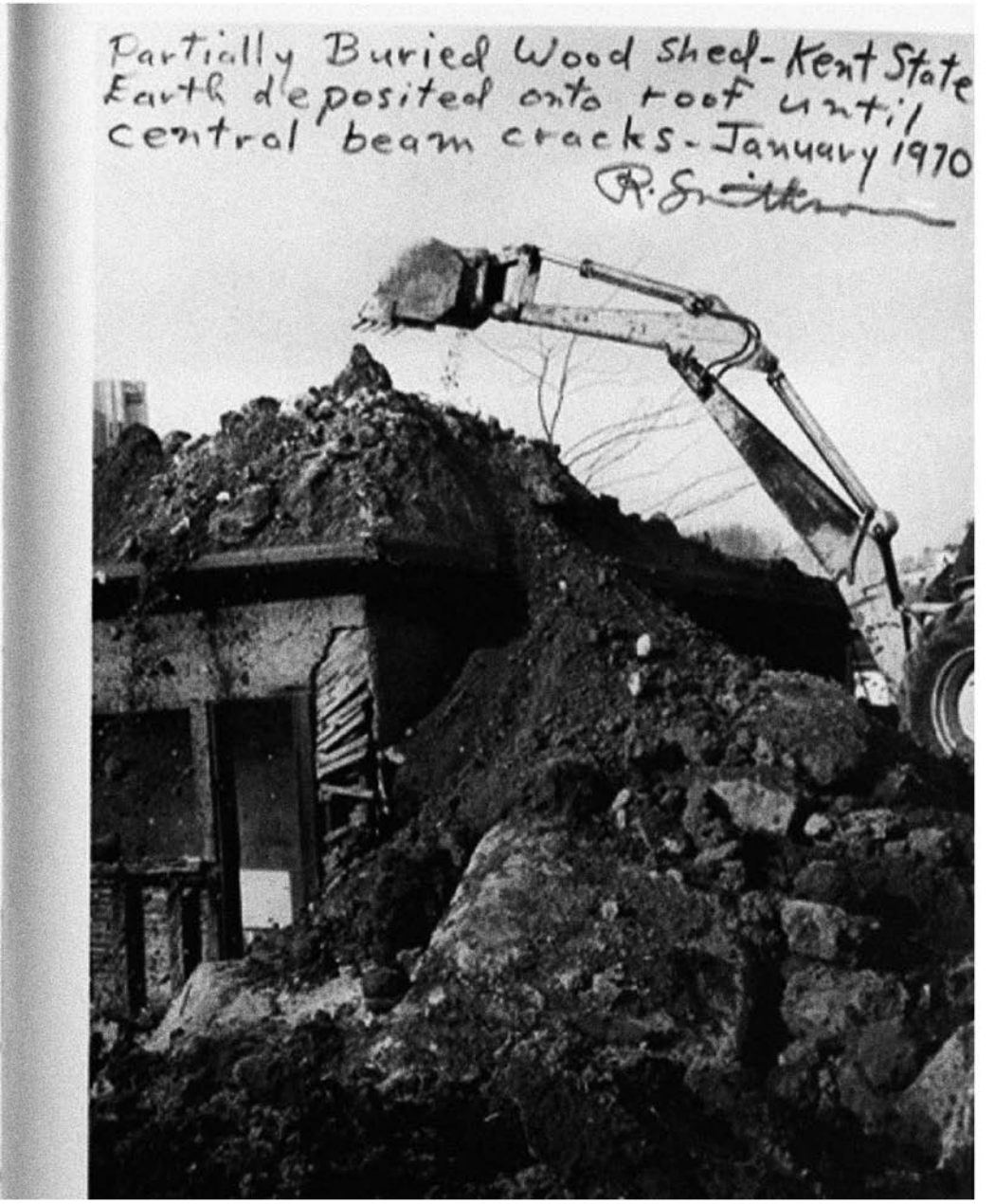
This experimental archaeological work (designed to continue for 128 years) was built to examine the process of entropy over time on different materials used in the creation of mounds. Not only was the artist Robert Smithson interested in the process of entropy (a term which he coined in art in relation to his earthworks) but this was being examined at the time in the field of archaeology with regard to the degredation of prehistoric works. Santiago de Molina in *Arqueologia del Futuro* (2014) considers that "for archeology and architecture, there really is no ruin as such, but only an open cycle that rounds off edges, opens cracks and knocks down everything. There is a real continuity between both disciplines. So much so that architecture is a substantial part of a true 'archeology of the future'. The spirit of the true 'open work' is manifested in each building. In all states of form, architecture is always a valuable transmitter of messages. The continuity between work and ruin is due to the accursed time, to the blessed time, great architect, maker of forms and maker of their meanings." [46]

021 The section of the Overton Down Experimental Earthwork showing its changing profile between 1960 and 1992.

022 Comparison of photographs: Cover of the "Atom" government newsletter, November 1969 and the Nevada Test Site, Yucca Flat Government photograph, c 1980s (left) with the first photograph of Earth from the Moon taken by Lunar Orbiter 1 in 1966, reprocessed by the LOIRP for comparison (right). Man now had the capacity to transform the shape of Earth's crust through domination of his technology. Previously, as can be seen in craters caused by asteroids on the moon, the changing of the surface if the Earth had only been due to the forces of nature. Now man's technology has given him the capacity to sculpt and transform land mass for example through atomic explosions and industrial activities such as his large open-cast mining pits which have formed craters on the surface of the Earth.



023 *King Kong meets the Gem of Egypt* (left) and *Partially Buried Wood Shed* (right) from *Entropy and the New Monuments* by Robert Smithson (1966).


Partially Buried Wood Shed - Kent State
Earth deposited onto roof until
central beam cracks - January 1970
R. Smithson

024 *Bulldozers, not paintbrushes... Charles Ross building Star Axis*. Photograph: Elizabeth Ginsberg

take on the task of representing the future, of preceding and summoning up sensations to come, a people to come,worlds or universes to come

you have extended our capacity to sense and live in relation to geologic time

025 *In Search of Geologic Time* with captions taken from Deleuze's, *Chaos, Territory, Art* and the *Framing of the Earth* by Elizabeth Grosz.

026 *B, Sequence of tilted strata at 1-70 road cut through the hogback, Jefferson County, Cold.*, 1972. Photograph by W.R.Hansen.

027 Gorgoni, Gianfranco. *Michael Heizer standing on Double Negative, North Las Vegas, Nevada.* 1970.

Reclaiming the post-industrial landscape

The Anthropocene - an industrial age

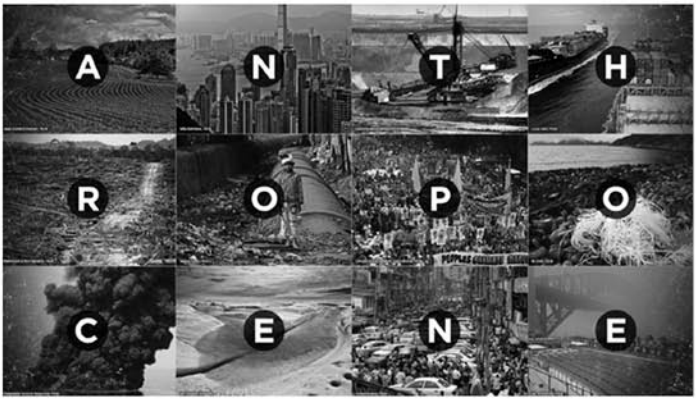
The Anthropocene epoch is an unofficial unit of geologic time, used to describe the most recent period in Earth's history when human activity started to have a significant impact on the planet's climate and ecosystems.[47] Significantly, man's evolving technological development or Industrial Revolution that had its beginnings in England and Europe in the 18th century played a part. Marked by a change in the activities of man – especially in his relationship to the land and the way he lives - the nature of economy has shifted from one dominated by agricultural activity to that of mining, manufacturing, transportation and other technologies. It has been characterised by rapidly increasing scale of population, urbanisation, changing social class systems and the way that man's environment is structured.[48] Krinke (2001, 126) observes that, "as the world moved from agriculture to industry, a mechanist view of the universe began to supplant the idea of an organic nature. A desire for 'progress' and faith in technology implied that the earth was a place to extract resources and its 'complementary' idea: that the earth could absorb anything humankind asked of it". A culture of capitalism with man's growing culture of culture of need, obsolescence, easy expendability and replacement has fostered increasing extraction of non-renewable resources and manufacturing. Consumerist culture has expanded - especially after WWII and increasingly from the 1960s (Whitely 1987, 3). Man has impacted the biological, physical and chemical processes of the earth's surface to an extent that previous natural forces took eons to accomplish. Waste earlier considered to be located in our environment, has already started to become the environment due to its extent.

On the one hand, on a global and national level, we can see that the benefits of mining and industry have helped societies evolve technologically and economically but resources and viability of mining enterprises is limited. The most influential out of man's five economic sectors, is the primary sector (agriculture, logging and the extraction of raw materials from the Earth) and the secondary sector (manufacturing and processing of these raw materials) which devastatingly scar the land and contaminate the environment. Moreover, these activities have limited lifespans - especially when they relate to the abuse of non-renewable resources, bringing about the existence of post-industrial sites where the original activity no longer takes place. Locally, closure of mines and factories result in "polluted sites, communities shrunk by emigration, infrastructure absent or degraded through lack of investment, economic contraction, and a lack of capacity to switch to other activities" (EDM 2011, 13).

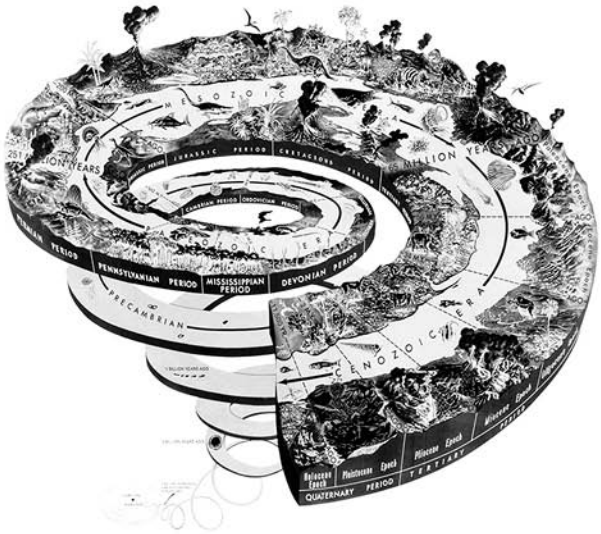
Through his intervention and actions man is producing his own sediments of waste which will stand testimony to his presence upon the planet when he no longer exists. The Mining Minerals, and Sustainable Development Project (MMSD) estimated in 2019 that there were 3500 active mining facilities worldwide.[49]

Alongside gigantic open pits and mining shafts, where minerals have been extracted, large dumps of waste rock or artificial hills of waste matter (often with little or no mineral value) have been produced, layer on layer and dominate the landscape (e.g. as the man-made hills - created by the gold mining industry towered over a city in South Africa). Major risks to the environment are consequences of the dumping of mining waste: contaminants leaching into the direct environment (soil, groundwater, surface water, air) and affecting humans, fauna and flora; the stability of tailings dams.[50]

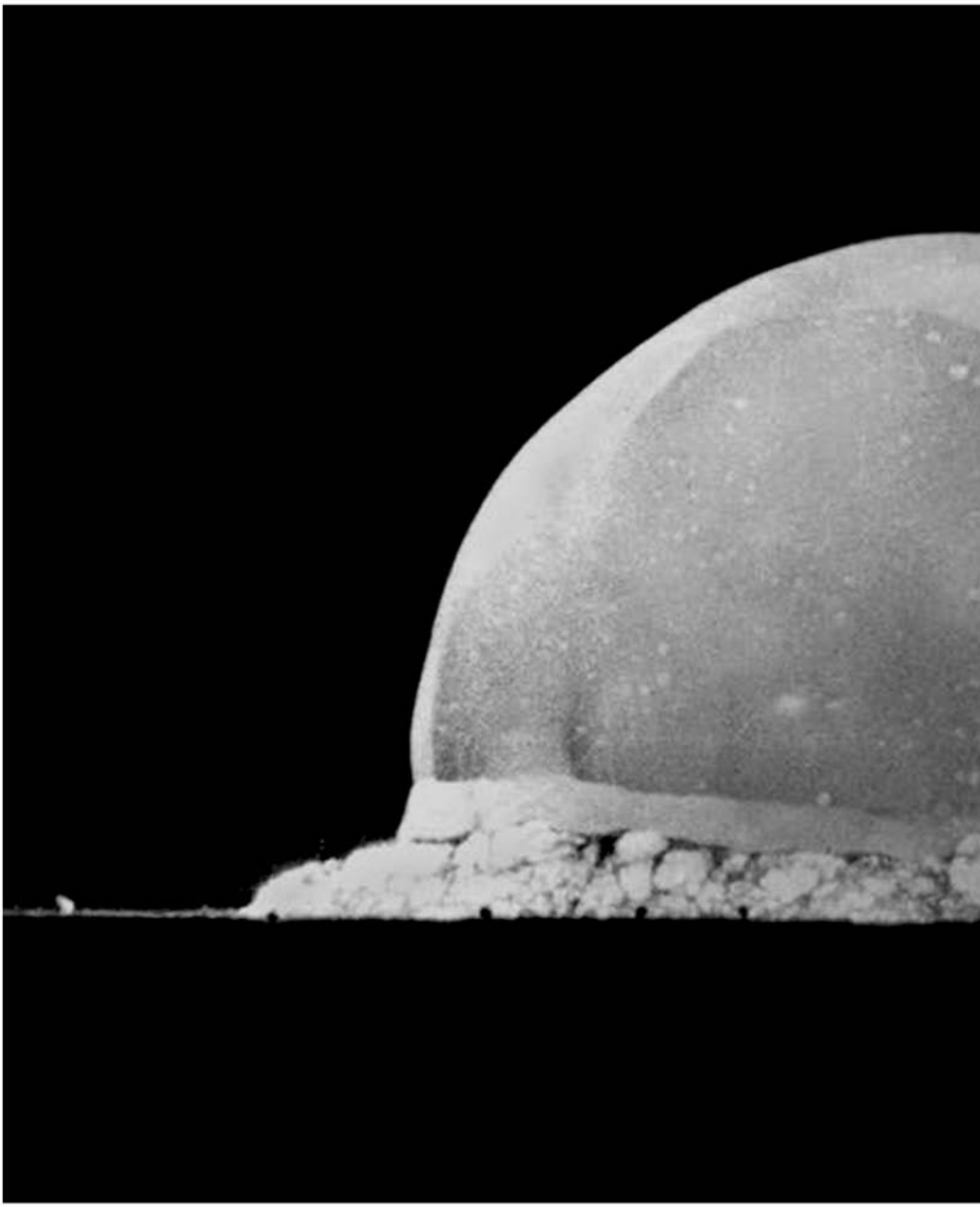
Man's 'new' ownership of the Earth - rather than stewardship - has had such a negative impact on the environment that it continues to cause lasting consequence. Tayebi-Khorami et al., (2019) point out that "there is a need for comprehensive long-term strategies for transforming the mining industry to move toward zero environmental footprint " and that to "create new economic value, minimise its social and environmental impacts and diminish liability from mining waste". it would need "cross-disciplinary skills, across the social, environmental, technical, legal, regulatory, and economic domains to produce innovative solutions.



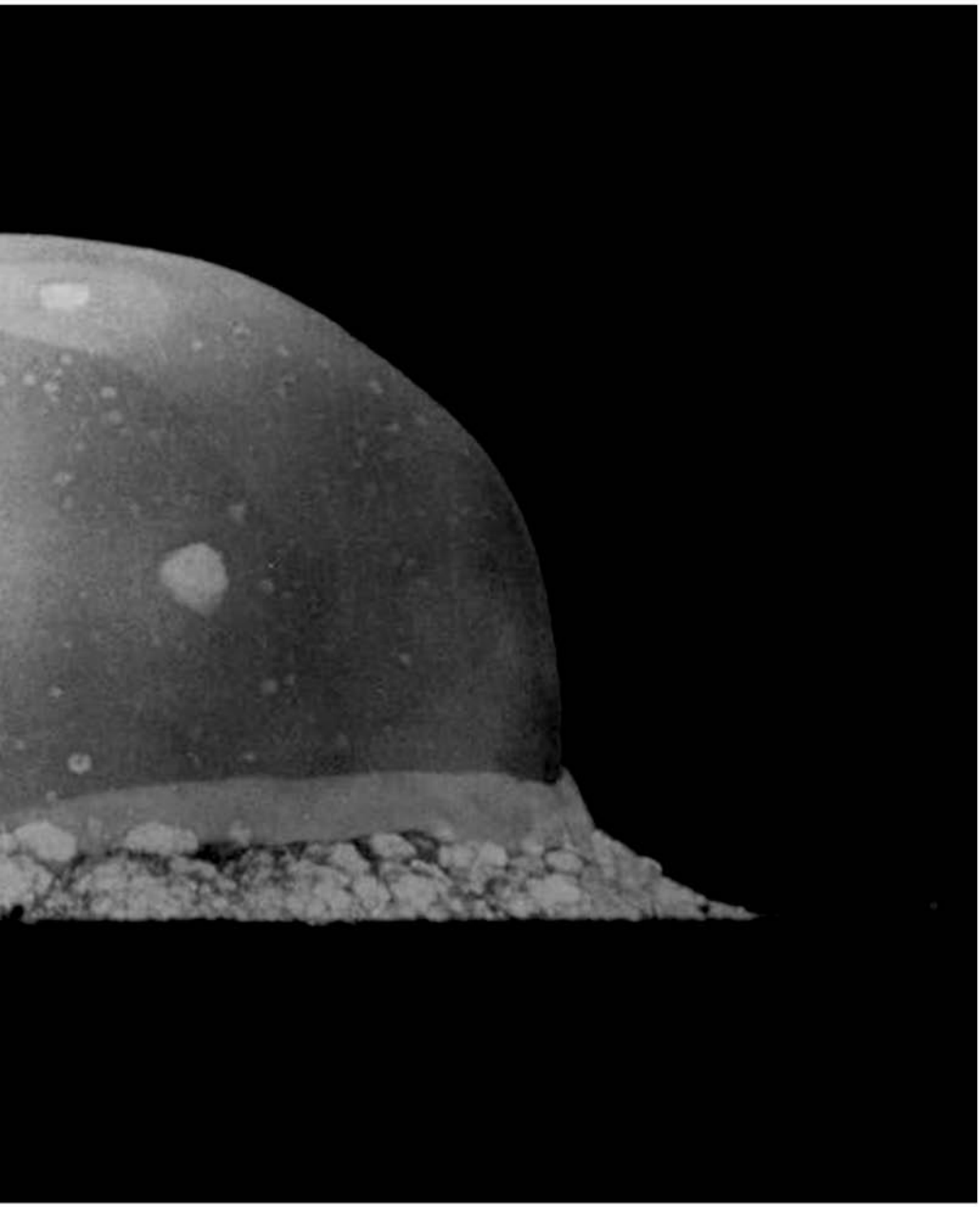
028 Images showing various landscapes of human activity in the Anthropocene. The *Encyclopedia of Earth* states that "the Anthropocene defines Earth's most recent geologic time period as being human-influenced, or anthropogenic, based on overwhelming global evidence that atmospheric, geologic, hydrologic, biospheric and other earth system processes are now altered by humans. The word combines the root 'anthropo', meaning 'human' with the root '-cene', the standard suffix for 'epoch' in geologic time. The Anthropocene is distinguished as a new period either after or within the Holocene, the current epoch, which began approximately 10,000 years ago (about 8000 BC) with the end of the last glacial period."

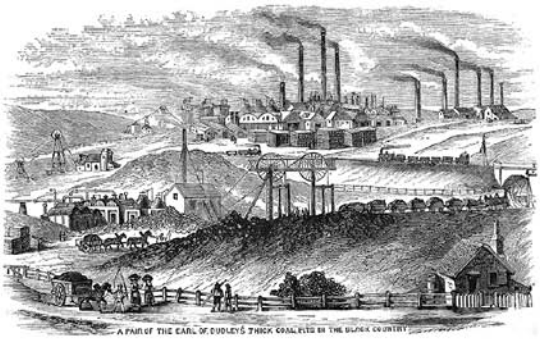


029 Excerpt of an illustration in a poster for the U.S. Geological Survey on the geological times periods prior to the existence of man. Image produced by Joseph Graham, William Newman, and John Stacy (2008).



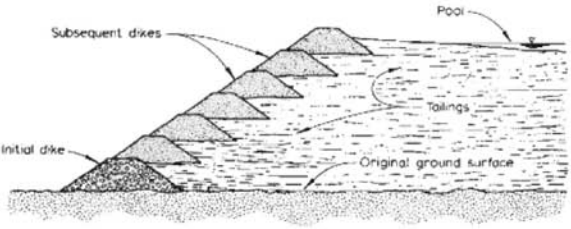
030 *16 milliseconds after the beginning of the Anthropocene: The Trinity nuclear test.*



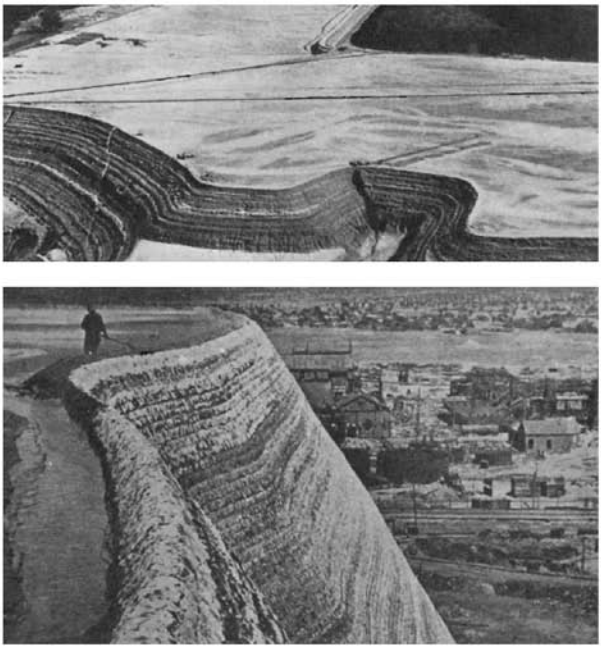


031 "A pair of the earl of Dudley's Thick Coal Pits in the black country" by Samuel Griffiths, editor of the *The London Iron Trade Exchange*. The illustration shows the emergence of towering waste heaps alongside mining shafts in the early industrial mining landscape.

032 *Mining dump Missouri*. Vintage line drawing. The drawing shows the extent of the dumping of debris in the nineteenth century and the increasing scale of the waste heaps over time. The waste has no other function and becomes the landscape over time.



033 Sequence of images depicting design and construction of Tailings Dams in South Africa. Left: Typical cross-section depicting the various elements comprising of dykes and tailings dam. Right Top: Areal view of the tailing dam showing the construction of a new terrain comprising of stratification of sedimentary layers of tailings and laying of subsequent reinforcing dikes. Right bottom: Picture from on top of the tailing dam showing detail of the texture of the result of layering of the subsequent structural dykes and tailings in layers over time. The image also shows the monumentality of the tailing dam as it hovers over the town below as an artificial mountain made by man.



The post-industrial landscape

Mining began in the Iberian Peninsula about 2,000 years ago. Globally, it has a much longer history than manufacturing and for over 3,000 years it has left an altered landscape - especially so with the onset of the industrial epoch. With increasing requirements, the extent of mining increased - from small scale operations to large open-pit operations used to extract enormous tonnage of coal, iron, manganese, copper and to a lesser extent lead, zinc, gold and nickel. As a result, scarring of the earth and vast amounts of the waste rock or overburden and spoil heaps remain - in addition to large-scale contamination of the surrounding environments. Governments have put into place regulations for the reclamation of mining sites after closure, placing the onus for this on mining companies. However governments often face legal complications that may arise from such closures (for example after company bankruptcies and change of ownership) and still bear the burden of existence of centuries-old closed mines whose activities predate any laws protecting the environment.

With regard to the sustainable development of mining operations, it is argued that to be sustainable, the socio-economic benefits of the mining process must be greater than any costs. “This package of costs and benefits, losses and gains in capital is, in the broadest sense, mining’s legacy” (EDM 2011,13). Endeavours to address mining legacy have therefore created divisions between the mining industry and society, as reclamation is viewed by mining companies as a financial cost which erodes profit. On the one hand, mining legacy can be considered to be beneficial - globally, because society has benefited and developed from the technology raw materials facilitate and nationally, because mining has provided revenue which has boosted economies, infrastructures and related industrial development. But mining has had a negative impact on societies where it has been able to control governments. Also, mine closure affects local communities which are left a legacy of: economic loss; loss of infrastructure; job loss and inability of workers to re-skill; emigration resulting in smaller communities; degraded and contaminated land (EDM 2011, 13).

Negative outcomes of mining can be attributed to: mining activities based on human ingenuity and therefore ignorance of the adverse environmental consequences; population growth placing increased pressure on the availability of land and water resources; “reactive” rather than “proactive” mining legislation and weakness in applying it; governments needing to promote foreign investment - despite attempts to protect the environment - and running nationalised ventures as cost effectively as possible; low standards of behaviour in private enterprise because environmental considerations are unprofitable; unstable communities of immigrating and emigrating workers leaving communities without entrepreneurs to recover after mine closures; mines remaining open when mineral prices are advantageous and closing when they are not; governments failing to invest revenues from mining activities in developing infrastructure in local areas during profitable times leaving local communities unable to withstand

mine closure (EDM 2011, 14-15). Philosopher, Jonathan Maskit (2007, 323) points out that "While industrial sites draw people, creating communities around themselves, those sites, once abandoned, quickly spawn a cancerous disintegration of those communities, leaving a sort of secondary zone of abandonment around the site.

Industry however remains part of man's history and culture and so the post-industrial site should be considered worthy of preservation when seeking solutions for such sites. Landscape architect and agronomic engineer, Luís Loures (2008) points out that urban expansion after World War II has pushed into industrial zones and that post-industrial sites have been transformed for residential and other purposes, forgetting the importance of 'cultural heritage' including that of the industrial. Loures (2008, 693) believes that "certain industrial landscapes have an intrinsic value, that should be protected and highlighted in a similar manner as other cultural elements, and considered as part of our heritage " as these are also sites of "memory" where "such uniqueness of a place" the "'genius loci'" should be "protected to bring the past into the present". Values of the past are important for the future and so post-industrial landscapes should be seen as an "ongoing process of architectural design" and "including all the additional elements and structure associated with industrial activity". This could also be said with regard to disused mining sites.

034 Prigann, Herman. Photograph of former coal mine. Ruhr Valley, Germany.

035 Aerial view of Botayama (slag heap) towering over Iizuka City below in 1950s.

Reclamation and sustainability

Since Earth Day on April 22, 1960, an awareness of the plight of Earth has prevailed and there has been a growing need for reclamation of what has been damaged by man. The USA Surface Mining Control and Reclamation Act of 1977 was the first to put into law the need for funding for the reclamation of mining sites after closure but the nature of reclamation was not clearly identified. The supporting document to Article 20 of the European Union Mining Waste Directive, MWD (Directive 2006/21/EC on the management of waste from the extractive industries) in accordance of Article 21, requires the drawing up of lists of closed and abandoned waste facilities and rehabilitation which "shall allow for the establishment of the most appropriate risk assessment procedures and remedial actions having regard to the variation of geological, hydrological and climatological characteristics across Europe" In this document, the terms restoration, rehabilitation, remediation, reclamation and regeneration are used interchangeably. It is acknowledged that when procedures have been so invasive only a partial return is possible. Remediation focuses on the environmental clean-up of contaminated land and water. Reclamation is defined as "the process of converting derelict land to usable land and may include engineering as well as ecological solutions". Rehabilitation means the treatment of the land affected by a waste facility in such a way as to restore the land to a satisfactory state, with particular regard to soil quality, wild life, natural habitats, freshwater systems, landscape and appropriate beneficial uses. Regeneration opens the possibility a "broad socio-economic (and environmental) perspective" which encompasses the mine area and that of the environment and communities beyond. Restoration involves an attempt to restore the ecology of the area but it is assumed that the engagement of field of architecture in any reclamation project would lie would only in the archaeological restoration of pre-existing structures.[51]

It has become increasingly important that all human engagement with land be sustainable and this applies to architects who design much of the landscape. In 1969, Scottish landscape architect, Ian McHarg pioneered the idea of ecological planning in his book, *Design With Nature*. However, Sim van der Ryn (American architect) and Stuart Cowan (mathematician and environmental analyst) in *Ecological Design* (1996) still argue for the necessity of sustainability in architecture and its integration with ecologically orientated fields. Van der Ryn and Cowan point out two approaches to sustainability: ecological and technological. Ecological sustainability recognises: the limits of Earth's resources; that "self-reliant and organised" communities are the foundations of change and; "traditional cultural knowledge and place" in harmony with nature are valuable resources. Technological sustainability on the other hand, offers solutions to existing problems but does not change the original approach as ecological sustainability does (Van der Ryn and Cowan 1996, 20). The 1987 United Nations Brundtland Commission definition of sustainability is an example of the latter. It defines sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs"[52] However this remains a very broad and therefore challenging definition for architects.

The complexity of solutions for reclamation of post-industrial landscape would indicate that a multidisciplinary and interdisciplinary approach is essential where the input of a range of professionals is engaged to assess the absolute potential of any brownfield site with a combined goal and with a sythnthesis of information. Landscape architects, Luís Loures and Thomas Panagopoulos believe that the landscape "characters" namely, "the heritage, the environmental and the socio-cultural character," should determine the strategies employed in reclamation rather than considering only the environmental (Loures and Panagopoulos 2007, 791) for sustainable reclamation of a site also includes man's presence there.

Landscape architect, Elizabeth Meyer (2008, 7) takes the idea of sustainability further. She explains, that in landscape design "sustainability stands on three pillars, […] : ecology, social equity and economy, and the ecological operates in relationship to social justice and capitalist profit, but not aesthetics." Aesthetics is not a superfluous consideration when it comes to designing landscape and that it is equally important in the consideration of the components of sustainability. Designed landscapes require more than the use of sustainable technologies. Landscape cannot be considered without the concern of human engagement with it as the relationship between landscape and man, Meyer claims, is a human "poly-sensual experience" and that "immersive, aesthetic experience of landscapes leads to recognition, empathy, love, respect and care for the environment" (Meyer 2008, 7). Meyer combines the ideas of landscape architects, Catherine Howett and Anne Spirn. All systems and living and components, that interact in a landscape, are affected by its design (Howett 1987, 7 in Meyer 2008, 8). In addition, landscapes and our engagement with them are in a constant state of flux in time and therefore so is our experience of them and our aesthetic (Spirn 1988, 108 in Meyer 2008, 8). Meyer states that Howett and Spirn "argue that the act of experiencing designed landscapes poly-sensually, over time, through and with the body, is not simply and act of pleasure, but possibly, one of transformation" and that "these new types of beauty will be found through the experience, as well as the making of landscape. They promise to expand the public's, and many designers' conceptions of sustainability beyond the ecological health realm, and into social practice and the cultural sphere" (Meyer 2008, 8). The concept of our aesthetic therefore changes with our experiences of landscape but aesthetic nevertheless should be an important component of any sustainable project.

In “Sustaining Beauty” Meyer (2008) points out that “sustainable landscape design is not the same as sustainable development or ecological design or restoration ecology or conservation biology” and that “design is a cultural act, a product of culture made with materials of nature embedded within and inflected by a particular social formation [...] It translates cultural values into memorable landscape forms and spaces that often challenge, expand, an alter our conceptions of beauty” (Meyer 2008, 15). Sustainable landscape is also possible through “hybridisation” when we venture beyond the thinking of traditional architectural design practices (especially when engaging with the post- industrial and toxic landscape) when we consider polarities: “social and ecological, urban and wild, aesthetic and ethical, appearance and performance, beauty and disturbance, aesthetics and sustainability.” Sustainable design embraces the cultural but also natural processes of the environment such as seasonal weather (such as flooding and drought) and also embraces nature alongside and in-between the man made construction and its remnants and when it is restorative, promoting use of the senses and meditation, connecting past and present (Meyer, 2008, 16-18). A sustainably designed landscape should not only engender care for the immediate environment but inspire action for the care of a much wider environment (Meyer, 2008, 21).

036 Two contrasting images: Opencast Coal Mine Near Plains in 2006 (top) and in 2008 after having undergone reclamation (below).

Post-industrial landscapes as places of heritage

Maskit (2009) suggests that there are three ways of approaching brownfields: restoration, transformation or renovation. He points out that restoration, with the aim to turn the site into the ecological state existing before man's activities, is unrealistic because it negates the presence of man who was also part of the site's history. However, due to the need for more green space, attempts can be made to restore the site back to an ecological one with nature having the ability to re-adapt (Krinke 2001, 126). Transformation seeks to change the site into something different (e.g. turning industrial wasteland into a golf course) but this annihilates all ecological and cultural layers from the past. Renovation is a solution that aims to preserve the site or at least partially restore traces of its industrial past. However, industrial sites often pose challenges, not only in terms of the remaining construction and materials, but in the excavations that have taken place, tailings and the extensive pollution (often toxic).

Spoil heaps are an accumulation of deposited waste through time. Man-made sediments result in mounds of organised strata in much the same way that for example, Monte Testaccio in Rome was created almost entirely of *testae* (fragments of broken ancient Roman pottery) which were nearly all discarded amphorae dating from the time of the Roman Empire. It is one of the largest waste heaps found anywhere in the ancient world, with a perimeter of about 1km and a height of 50m at its base containing the remains of an estimated 53 million amphorae (Rodriguez 2019, 1) . Such a heap was attributed with other significance through time e.g. a religious and military one. As with mining spoil heaps, these sites talk to us of a constant arduous labour, of actions of subtraction and addition through time, creating a unique awe-inspiring landscapes with the potential to perform. Today, post-industrial mining sites have the capacity to inspire for example, an open pit being used as a stage on which to dance in the 3D documentary film about the dance choreographer, Pina Bausch[53].

When considering place, Norwegian architect and architectural theorist, Christian Norberg-Schulz (1980, 6) reminds us that "the spaces where life occurs are places [...] A place is a space which has a distinct character. Since ancient times the *genius loci*, or spirit of the place, has been recognised as the concrete reality man has to face and come to terms with within his daily life. Architecture means to visualize the *genius loci* and the task of the architect is to create meaningful places, whereby he helps man to dwell." Therefore when considering the use of any site, it is important to take into account what has taken place there before. Loures and Panagopoulos (2007, 793) state that a site should be understood historically and culturally, before its future use is considered. They point out that, while it is possible that a derelict site can be reclaimed and "filled with a new spirit" of nature, the spirit of the industrial past can be kept alive – i.e. its history – thus "creating a perfect symbiosis between the past, the present and the future."

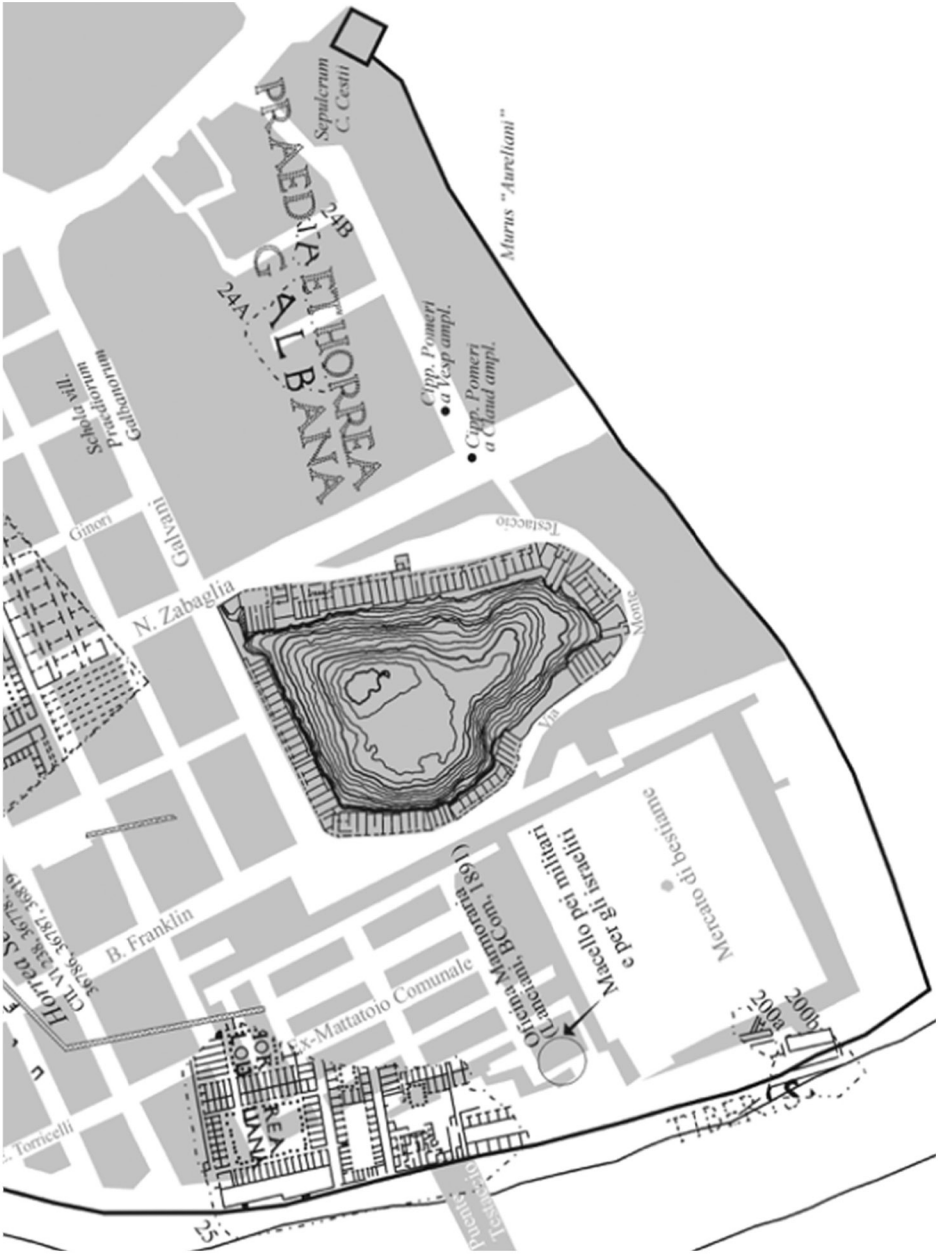
Landscape architects, Luís Loures and Jon Burley (Loures and Burley 2012, 223-226) argue that Industrial sites should not merely be dismantled and become building sites, whose function and aesthetics are entirely determined by architects and planners. In being given a new life, the public should be given a voice as to their use; the sustainability of projects being more likely when environments are valued by people because they benefit from

them and also because post-industrial sites are part of human culture and heritage and, as such, should receive protection - even when they are not monuments or old enough to be classified as patrimony. Loures and Panagopoulis (2007, 793) advocate three approaches to reclamation projects: historical; environmental; sociocultural. In redevelopment, post-industrial sites need to be realised as landscapes "representing multiple layers of time and cultural activity therefore being part of the identity of a people and a place." Industrial landscapes "should be seen as assets, once as historic sites they enhance the possibilities of creative practice in preservation, design, and planning, given that they are often unique, as a result from the combination of natural landforms and buildings defining a particular place or region" (Loures and Burley 2012, 228).

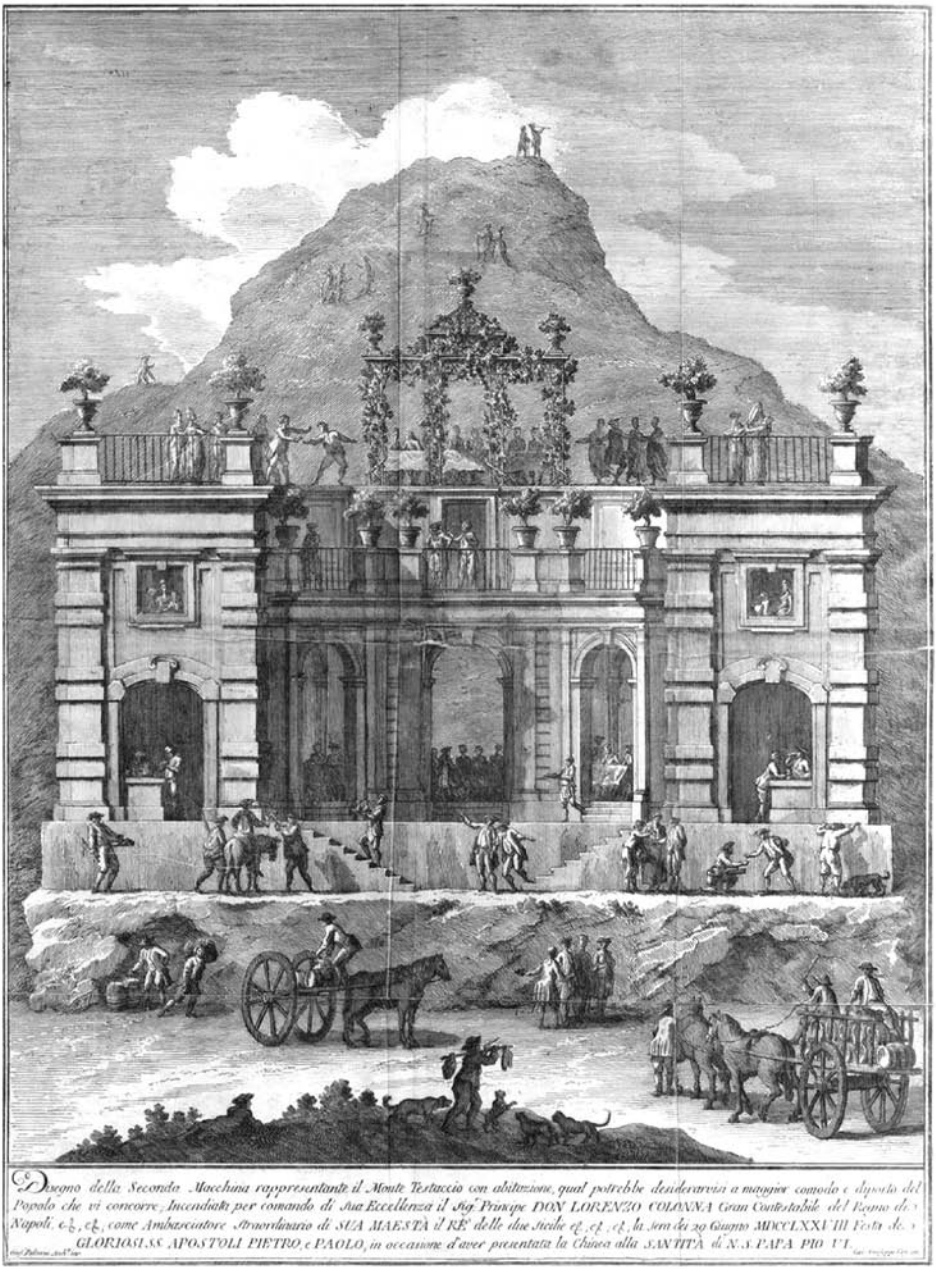
"A place is only a fragment of a cultural space, which was given consciously or subconsciously certain meanings during the course of its creation. In this way, industrial preservation and reclamation becomes more than the celebration of the past, as important as that is; it becomes part of reconstructing the future. Thus, industrial heritage preservation that connects people, place, and history fosters a sense of place and the power for community renewal" (Loures and Burley 2012, 240).

Architect and writer, Ruth Oldham suggests that not all post-industrial sites should be reclaimed and that they should be considered individually rather than homogeneously when considering their future. She gives the example of Nord-pas-de-Calais mining area which was considered to have a cultural interest after the mine closed in 1990 and was declared a UNESCO heritage site. However, the terrils, listed as the least important elements of the site to be preserved, are enjoyed by the community that lives there. Also, they give the place its bearing and identity as do the pyramids to the place where they were made. Oldham notes ironically, "the upheaval left behind after over three hundred years of mining has become the defining feature of the landscape – it is the landscape" (Oldham, R., 2015, 47).

Meyer (2008, 15) points out that the consideration of beauty is often neglected in landscape design. She argues that "design is a cultural act, a product of culture made with the materials of nature, and is embedded within and inflected by a particular social formation; it often employs principles of ecology, but it does more than that. It enables social routines and spatial practices, from daily promenades to commuting to work. It translates cultural values into memorable landscape forms and spaces that often challenge, expand, and alter our conceptions of beauty." Art she claims, has an equally important role to play in landscape because it evokes a "poly-sensual experience which can lead to recognition, empathy, love, respect and care for the environment" therefore making it truly sustainable. (Meyer 2008, 7)



037 Plan showing the general view of the sub-aventine plain with *Mont Testaccio, Rome.*

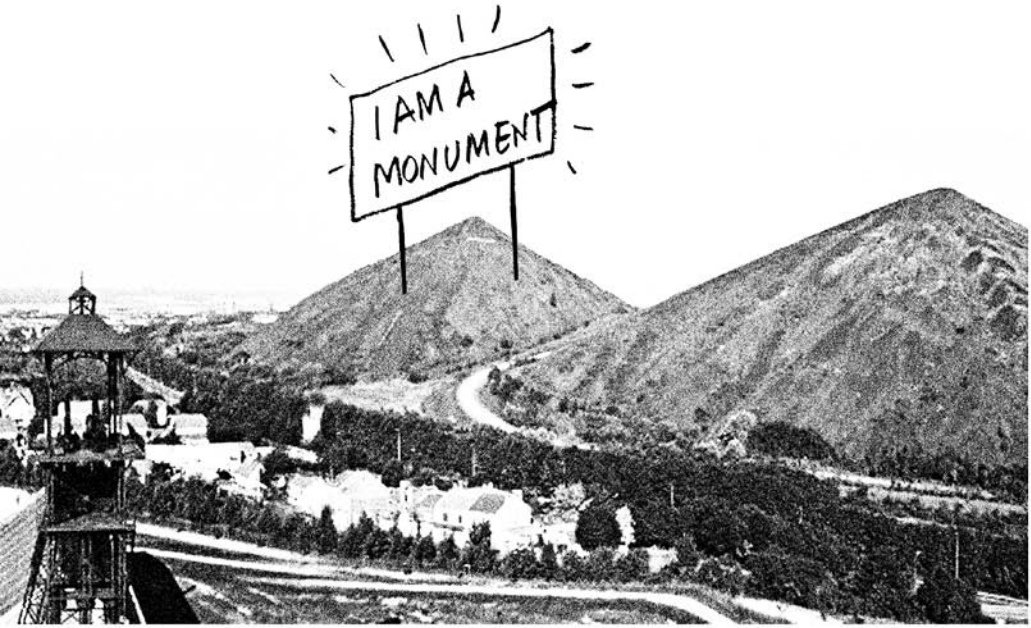


038 Vasi, Giuseppe. *Disegno della seconda machina rappresentante il Monte Testaccio*. 1778. In this engraving, the spoil heap of Monte Testaccio in the background is depicted as a recreational landscape where people engage in leisure activities and treat the mound (once a refuse tip of broken *testae*) as a viewing point of the city.

039 Still image from *Pina*, a 2011 German 3D documentary film about the contemporary dance choreographer Pina Bausch. The depicted still image shows a dancer (in the post industrial mining site - just in view is an open pit). Post industrial sites are places of heritage; places that can be stages on which to perform artistically.

040 Photomontage: Robert Venturi and Denise Scott Brown's *I am a Monument* of 1972 (depicted on the right) with a photograph by Hemmer in 2005 showing the town of Liévin combined showing the spoil tips on the site Écopôle 11/19 in Loos-en-Gohelle, France (left). © Jared Miguel Fantasia. 2019

The combination aims to point out that the massive mounds created from mining waste, are monuments in their own right and poses the question of what should be done with them ?


I AM A
MONUMENT

Earthworks as reclamation

Land artists, Robert Smithson and Robert Morris who documented their ideas in the 1970s can be seen as innovators of reclamation. Not only did they use industrial sites for the creation of their sculpture, they documented the idea of art playing a role in post-industrial reclamation – especially that of surface mining. They did not advocate a whole-site approach to reclamation or create environmental art, addressing the social and political issues relating to the environment, but rather their perspective is site specific and their work acknowledges the post-industrial site for what it is – a work of man of its time.

In the USA, legislation began to take place with the creation of the federal Surface Mining Control and Reclamation Act in 1977 with regard to all new strip mines (Dreher 1992, 26). This opened up opportunities for American artists to produce works and receive funding for them as long as the projects were labeled "land reclamation" (Morris 1979, 98). German landscape architect, Udo Weilacher, (1996, 28) points out that opportunities for art to play a role in the reclamation of industrial sites in Europe initially weren't considered because of legislation stating that such sites had to be cleaned-up by pollution 'specialists'. Smithson and Morris can therefore be seen as innovators in this field. Weilacher also observes that avant-garde artists, associated with the Land Art movement, now saw land art as a means of connecting the 'devastated' industrial landscape with industrial society.

Robert Smithson, influenced by the scientific law of entropy, saw the environment embodying chaos and steady disintegration (Martin 2001, 172-173). In 1967, he ventured into degrading industrial landscape (plagued with pollution and unfinished infrastructure) and photographed it, combining his observations and thoughts in an essay entitled, T*our of the monuments of Passaic, New Jersey (1967)*. The title of such a work may seem ironic but it reflected Smithson's view of industrial landscape as a cultural monument of the industrial age created by man – a landscape of preference to him because of its decay with time. Beardsley states that Smithson "recognised we are physically and culturally bound to the earth and that the classic metaphor of nature as a primordial garden was obsolete for a landscape that bore so many scars of disruption." Smithson's concern for the environment was therefore rooted in reality and not in an ideal that would make it attractive or conform to the aesthetic of the pastoral (Beardsley 2006, 2). Maskit (2009) links Smithson's work to idea of picturesque as it evokes a sense the powerful and to entropy and so his aim was not to "restore", "transform" or "renovate" post-industrial sites to a preconceived notion of perfection, but rather create, in a realistic and empathic relationship with transmuted nature, an acceptance of the environment as it is. "In such time and in such a landscape, Smithson asserted, the creation of artificial Edens is at best problematic, at worst a sham" (Beardsley 2006, 23).

Although Smithson's work *Spiral Jetty* (1970) was created on Great Salt Lake (a natural body of water) in Utah,

Smithson was drawn to the site by the industrial wreckage on its shores from attempts at previous oil extraction and moreover, by its almost cataclysmic overpowering light and a sense of it shaking constantly – "a gyrating space" which inspired the work (Beardsley 2006, 23). In addition to the abandoned oil rigs, further influence of the post-industrial and inspiration for a jetty can perhaps be seen as coming from the Golden Spike Monument commemorating the completion of the Transcontinental Railroad. The Transcontinental Railroad of 1904 cut across the Great Salt Lake like an enormous jetty dividing the water and asserting the dominance of man's technological achievement over the landscape. Smithson's *Spiral Jetty*, a coil (with associations to nature -as in the structure of molluscs and the unfurling action of plants) is almost 'primordial' in nature and suggests movement. The work performs as it is subject to entropy; the rising and falling water levels act upon its earthen composition causing the collapse of its sides and, encrusting them with salt crystals [54]. *Spiral Jetty* is not mine reclamation but it can be can be seen as a reclamation earth work nonetheless; Smithson used the techniques of land reclamation by the cut-off of water through the method of dumping rock and backfilling - a construction method typically employed in the construction jetties. Ironically, in opposition to reclamation, he invited the forces of entropy to deconstruct his work.

From 1971, Smithson began projects for post-industrial mining sites such as *Broken Circle* and *Spiral Hill* at *Sonsbeek 71* exhibition in the Netherlands (Beardsley 2006, 22). Smithson's concern for environmental issues are evident and he viewed them through his art; he began to see the artists role as a necessary "mediator between the ecologist and the industrialist, facilitating the aims of both" and, that "artists have not only the capacity but also the social obligation to make a beneficial contribution to the use and restoration of the landscape" (Beardsley 2006, 23). Smithson's design, *Bingham Copper Mine Pit - Utah / Reclamation Project* (1973) for the Hannah Coal Company in the USA, however never came to fruition as, having not received a definite response from the company, he moved on to initiate another project which resulted in his premature death in 1973.

Beardsley points out ironically that public support for art in post-industrial reclamation, "began with what is certainly among the most inscrutable and, in visual terms, the least captivating works of this genre" (Beardsley, 2006, 30). Smithson's idea of aesthetic and utilitarian aims of recent art in the landscape became more popular and inspired the idea to involve artists in reclamation projects.

Robert Morris - unlike Robert Smithson, Michael Heizer, Walter De Maria and other land artists - chose not to work in remote areas and did not experiment with the idea of reclamation works (like Smithson had done) until 1979 when he participated in the site rehabilitation program, *Land and Reclamation as Sculpture*, launched by the King County Arts

Commission in Seattle, Washington USA. His paper on land reclamation, *Notes on Art as/and Land Reclamation* (1979), is his revised text of his address there (Morris 1979). In the paper he considers the relation of Land Art to site rehabilitation and begins by condemning man's abuse of the environment (especially that in surface mining associated with the worst environmental consequences) in order to perpetuate his dependence on commodities reliant on natural resources. While supporting the need for reclamation of mines, Morris also observes that the wording of legislation caused loopholes where reclamation simply involved more "aesthetic" levelling of earth. In some cases, reclamation was simply unaffordable. Morris criticises the idea of art as a commodity – an object given value by society based on its aesthetic value. Rather, he sees the need for art to play an innovative role in the service of mine reclamation. With implementation of legislation for land reclamation projects, Morris points out that the availability of funds for this can support artists in site-specific projects. However, he points out that receiving funding for 'land reclamation' compromises the artist. The artist, in the creation of any public monument, is at risk of projecting the ideology of the patron (in this case the sanitised ecological image the mine public relations wants to convey). In addition, the artist - by making reclamation possible through his work - is guilty of perpetuating further environmental damage because it can be followed by reclamation. Morris' point of view is one of perspective; we can choose to see the physical evidence of our faith in science and technology as "monuments [celebrating] the leading faith of the age - or, in retrospect, the prevailing idiocy." He justifies the creation of art works in reclamation ventures because it is an "epiphenomena" (Morris 1979, 100); art has always served forces of ideology and history – without questioning its morality. He asserts that "if the only rule is that art must use what uses it, then one should not be put off by the generally high level of idiocy, politics and propaganda attached to monuments – especially if one is in the business of erecting them" (Morris 1979, 102).

In contrast to Robert Smithson and to some extent Robert Morris, Michael Heizer rejected the creation of Land Art as reclamation. Heizer stated, "I'm not for hire to go patch up mining sites. The strip-mine aspect of it is of no interest to me. I don't support reclamation art sculpture projects. This is strictly art. I love mining sites. My whole family has been in the mining business – and still is" (Celant 1997, 398). Heizer's *Land Sculpture / Anaconda Project* commissioned by the Anaconda Minerals Company for a site in Tonopath, Nevada and begun in 1981 would have been 1. 6 km long and 304.8 metres wide. Although never completed due to closure of the mine, the idea opens possibilities for sculpture and architecture as with the 100 million tonnes of compact waste rock from tailings from the molybdenum mine being transformed into imposing geometric forms. *Effigy Tumili* mounds completed in 1985 in the Buffalo State Park in Illinois were, in Heizer's opinion, sculpture on a massive scale and the fact that they formed a mining reclamation project was inconsequential to him. However, despite Heizer's repudiation of land art being created for reclamation, his work is worthy of consideration when employing sculpture as architecture

in reclamation projects – in terms of its extensive awe-inspiring monumental scale influenced by constructions of prehistoric Mesoamerican societies and his juxtaposition of space - positive space alongside the negative to give meaning and social and political statement. Heizer's artwork however has been criticised with regard to its environmental ethic as it is claimed that his excavation has led to degradation by erosion and so paradoxically these sites are now seen as requiring reclamation (De Groat 1994, 3).

Maskit (2007, 327) defines four stages to the dialogue between art and the post-industrial: Appreciation - "recog nition that there is something worth being engaged with or represented"; Intervention - "in which artists engage more directly with the postindustrial, either through their choice of materials or through the siting of their work."; Renovation - "artists […] in collaboration with architects, planners and the like, seek not merely to intervene in a postindustrial site for purposes of artistic production, but to transform that site in some way." To these categories Maskit adds the category of *The Interesting* – "the character of an object of aesthetic appreciation that leads us to think otherwise. For to see otherwise is to think otherwise. It is to see things standing in different relations that we had previously seen. It is to see possibilities previously unseen" Maskit, (2007, 331). Furthermore, Maskit (2007, 331) connects the 'interesting' post-industrial aesthetic to Kant's idea of the 'sublime' in that it: both attracts and repels us; awes and disgusts; impresses and depresses us, make us lament what is lost and captivates us at the same time. This, he claims, gives post-industrial sites the possibility of intervention and even renovation. Land artists, Robert Smithson and Richard Serra, are seen by Maskit as "postindustrial interventionist artists" who do not represent the post-industrial but make it the 'medium' in which they work. Smithson, in using the industrial site to create a work of art, "incorporates within his work, the very same natural processes by which nature recolonizes such sites… and he calls upon us to reflect upon these sites and, by extension, our relationship to industry and industrialism" (Maskit 2007, 328). Serra's use of material, for example steel, allows us to see the beauty of industry but also that of decay in the rust. Unlike traditional restoration that "seeks to re-create nature to some degree", these works of art have aesthetic merit because they change how we see and to think about the past; they reveal the slow process of decay and accentuate what has been lost (Maskit 2007, 330). Maskit notes that Smithson does not attempt to renew the post-industrial site or to give it a more acceptable aesthetic, but his work allows us to see the site afresh - its history and existence as part of our environment. "Smithson's work does not allow us the luxury of forgetting – instead it helps us see the affront that is the site itself and to realize that all is not lost (even if much is lost)" (Maskit 2007, 330).

Art museum director and writer, Michael Hedger (2014, 9) notes that "Michael Heizer, Walter De Maria and Dennis Oppenheim were all interested in geology and geography, the conditions of which were necessarily incorporated

into their art. The creation of Heizer's work is analogous to the materialisation of the project of an architect: Anthropologist and author, Robert Kett notes that, "Photographs from Heizer's construction sites are populated with heavy machinery including bulldozers, cranes, and dump trucks. Accounts of the elaboration of earthworks note the importance of mapping, geological surveys, and other forms of scientific knowledge and scaled visualization"(Kett 2015, 141). Heizer dug and carved voids into the ground, with particular attention given to right angles, and his locations were chosen according to the spatial relationships of the planned works to the natural features of the sites." Through a study of Land Art which involves excavation and demolition, landscape architect Martin Hogue explores the idea of architecture incorporating the "idea of subtraction as an act of construction," because the hole itself is the "unmaking" which is a creative process constituting an object. "It is the hole itself that constitutes the very object of the removal, a discovery that can only be brought into existence with digging" (Hogue 2000, 527). Hogue asserts that furthermore, being fixed to its place, the site constitutes the museum (Hogue 2000, 528). American painter and graphic artist Rauschenberg's *Erased de Kooning Drawing*, 1953, exposed the drawing's existence by removing it. In the same way, Hogue explains that by creating "solids and voids", what is removed is also exposed. Works such as Michael Heizer's voids which show that negative is both absence and presence, challenge the idea of architecture merely as a means of creating buildings for human occupation as absence reveals what was once there (Hogue 2000, 531 - 532). In 1999, when referring to the consideration of scale in his works, Michael Heizer is quoted as saying, "I think size is the most unused quotient in the sculptor's repertoire because it requires lots of commitment and time. To me it's the best tool. With size you get space and atmosphere: atmosphere becomes volume. You stand in the shape, in the zone"[55].

The debate over the ethic of creating land art as reclamation or, simply using mining sites as sculpture (as engaged in by land artist Robert Smithson) is no longer. Reclamation is now a necessity and one where land art can have an important architectural influence. The creation of land art with its use of earth as material and in its monumentality, invites human engagement within it and consequently opens up the idea of architecture using voids and tailings of abandoned post-industrial sites to create what Maskit refers to as 'the interesting' (Maskit 2007, 331).

Public Law 95-87
95th Congress

An Act

Aug. 3, 1977
[H.R. 2]

To provide for the cooperation between the Secretary of the Interior and the States with respect to the regulation of surface coal mining operations, and the acquisition and reclamation of abandoned mines, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Surface Mining Control and Reclamation Act of 1977".

Surface Mining Control and Reclamation Act of 1977.
30 USC 1201 note.

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041 Copy of the first page of the Surface Mining Control and Reclamation Act of 1977 (SMRA) in the United States of America.

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b *[The Bridge Monument—Piling View]*
c *[The Bridge Monument—Long View]*
g *[Highway Construction—White Edge]*
h *Monument with Pontoons: The Pumping Derrick*
i *The Great Pipes Monument*
m *[Unidentified Construction—Manholes and Planks]*
n *[Unidentified Construction—Marker]*
o *[Unidentified Monument—Concrete Cube]*
s *[Unidentified Monument—Shell Facade with Statue, Close-up]*
t *[Unidentified Monument—Peri]*
u *[Unidentified Monument—Golden Coach Diner]*

042 Combination of photographs from *Monuments of the Passaic* taken by Robert Smithson outside the Passaic High School football stadium, New Jersey, USA in 1967.











d [Highway Construction—Bulldozer]

e [Highway Construction—Concrete Abutments]

f [Highway Construction—Concrete Abutment]

j *The Fountain Monument: Bird's Eye View*

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l [*Unidentified Monument—"Passaic Boys are Hell!!!"*]

p [*Unidentified Monument—Storage Tank*]

q [*Unidentified Monument—Storage Tanks*]

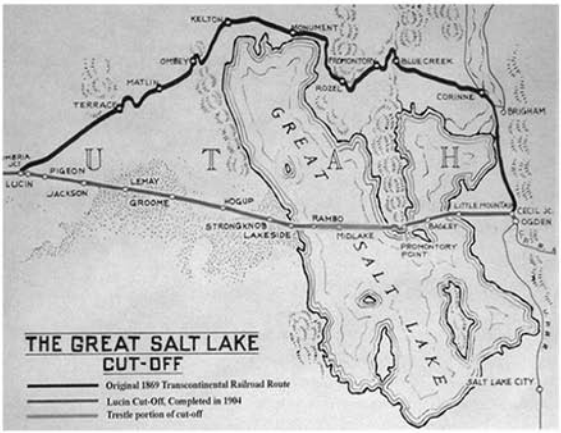
r [*Unidentified Monument—Shell Facade with Statue*]

v [*Unidentified Monument—Central Theatre*]

w [*Unidentified Monument—Parking Lot*]

x *The Sand-Box Monument* (also called *The Desert*)

043 Gorgoni, Gianfranco. *Robert Smithson on the Spiral Jetty, 1970.*



044 Top: *The Train Crossing the Great Salt Lake Causeway Near Pormontory Point, Utah, 2017*. Photograph by Todd-Stewart. Bottom: Plan showing the Great Salt Lake Cut-Off completed in 1904

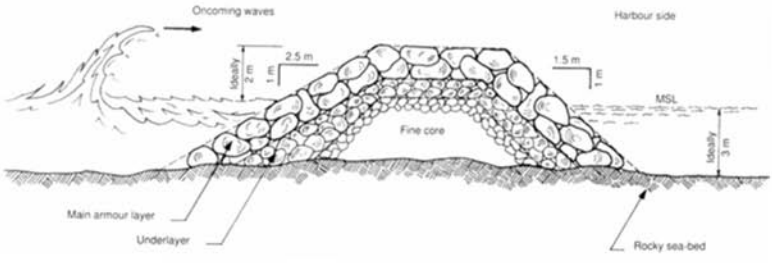


Figure 31
Placing the rubble core

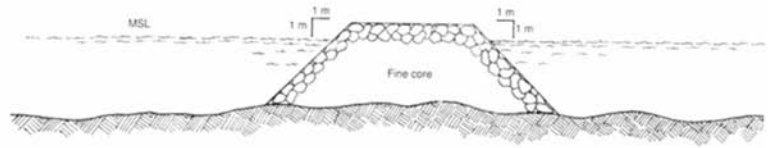


Figure 31a
Cross-section

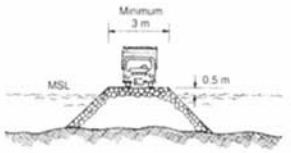


Figure 31b
Tipping by truck

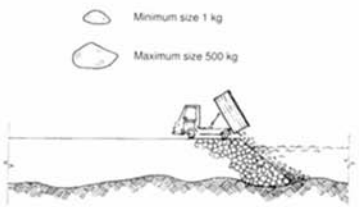
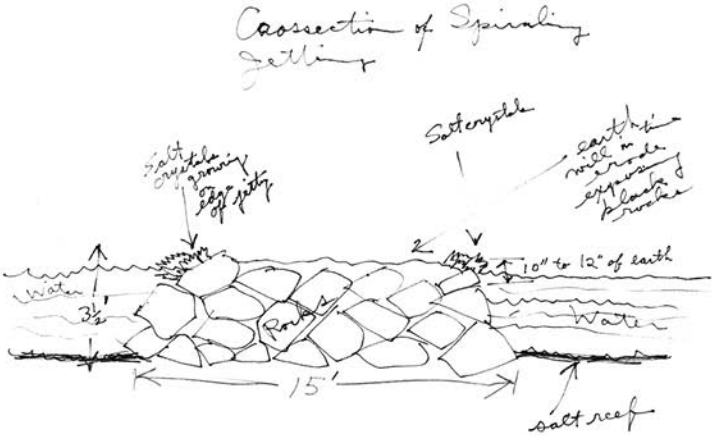
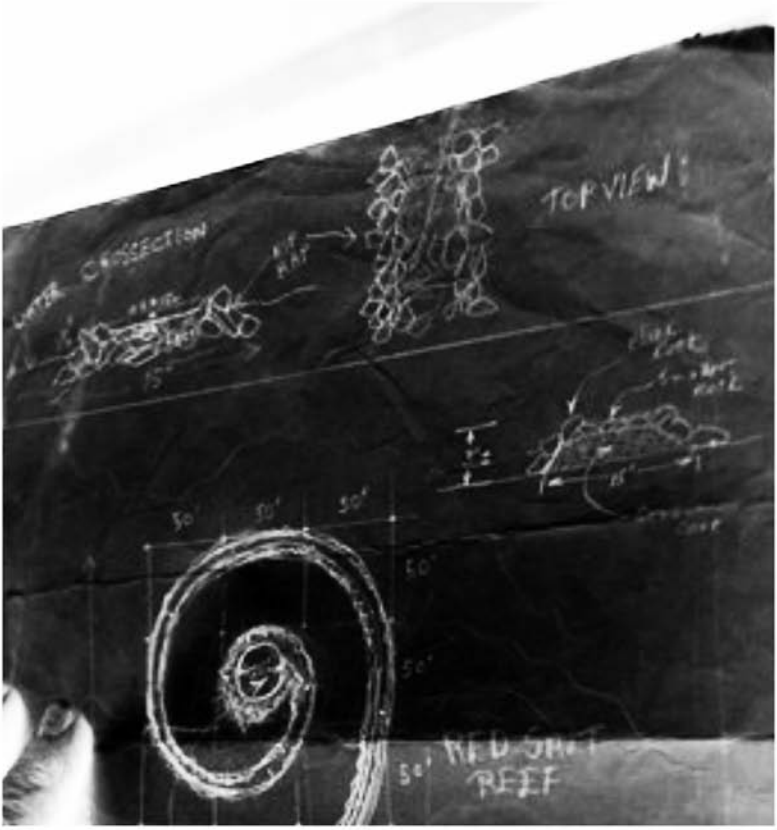


Figure 31c
Tipping by truck

045 Four figures showing the typical cross section and method of construction of a coarse stone jetty or breakwater. This is an inherent method of construction of jetties such as that used Great Salt Lake Causeway. Robert Smithson's contractor, Robert Phillips, employed this process in the construction of Smithson's project, *Spiral Jetty* in 1970, through continuous back loading (by tipping truck) of various grades of basalt rock and earth extending into the lake from land, just above the waterline. This process can be observed in the lower two diagrams, illustrated above.



046 Top: Sequence of photographs by Gianfranco Gorgoni showing the inherent process of construction, by sequential dumping of basalt rock into the salt lake, that was employed in Robert Smithson's Spiral Jetty in 1970. Bottom: Smithson, Robert. Cross section of Spiraling Jetty (c.1970) The drawing shows the intentions that Robert Smithson had for the laying of rock on the salt reef. The choice of dimensions reveal knowledge of the heights of fluctuating water levels and the crystalisation of salt on the edges of jetty over time - both which were an integral part of the work.



047 Griffin, Steve. Photograph in The Salt Lake Tribune. 2011. The photograph shows a drawing from the process of design for the construction of Robert Smithson's *Spiral Jetty* (1970). Robert Phillips, the Utah contractor hired by artist Robert Smithson looks over photos and original designs. The top two sketches comprise of simplified section and plan drawn by Robert Smithson with the intention of showing Robert Philips the contractor his intentions. Below these drawings (to the right) we can see Robert Phillips' drawing defining the method that would be employed in making the jetty comprising of filling with an overlay of rocks which defined the process due to the limitations posed by machinery employed. Smithson's intentions were redefined by Phillips due to the constraints of ground pressure and subsidence. (Phillips 2005,188 in Rubio 2012, 149-150)

Notes on Art as/and Land Reclamation•

ROBERT MORRIS

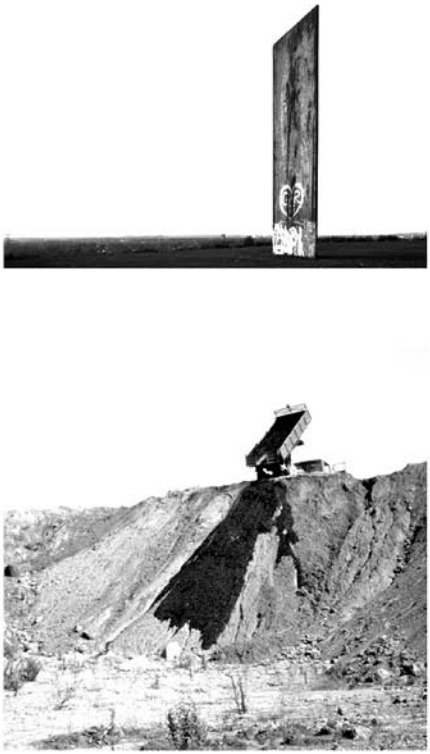
"Maybe only God can make a tree, but only that shovel, Big Muskie, can make a hole like this."
—anonymous strip miner

The issue of art's potential involvement in land reclamation can only be focused through a perspective on the history, conflicts, and confusion involved in that admittedly broad cluster of topics related to land abuse: technology, mining, governmental policy and regulations, ecological concerns, and public opinion. For some time there has been public concern over the effects of constantly accelerating programs for the extraction of nonrenewable resources from the land. Adverse effects on the environment range from the aesthetic to the toxic. Leaving aside for a moment the aesthetic effects, mining operations for natural resources have threatened the following: loss of topsoil; wind and water erosion; landslides; elimination of wildlife; acid, toxic, or mineralized water pollution; sedimentation; floods; loss of water table; destruction of man-made property from the effects of some of the above, plus those of blasting; other socially related degradations such as local economic losses, poisoning of livestock, etc.

With these various degradations to the environment, three basic types of mining operations have been associated: deep mining and two types of surface mining, open pit and strip. Surface mining, especially stripping operations, has the worst environmental consequences. With recent technological developments of mining equipment such as large augers and gigantic shovels and drag lines like the Gem of Egypt and the Big Muskie (the latter having a scoop capacity of over 200 cubic yards, over 300 tons), stripping has become the dominant mining operation, especially in the extraction of coal. In the immediate future, the surface mining of coal will increase enormously. Even though in the United States the ratio is 8 to 1 in favor of deep reserves (355 billion tons versus 45 billion tons), between 1966 and 1971 the number of surface mines roughly doubled, while the number of deep mines dropped by more than one half. The reason for the shift is

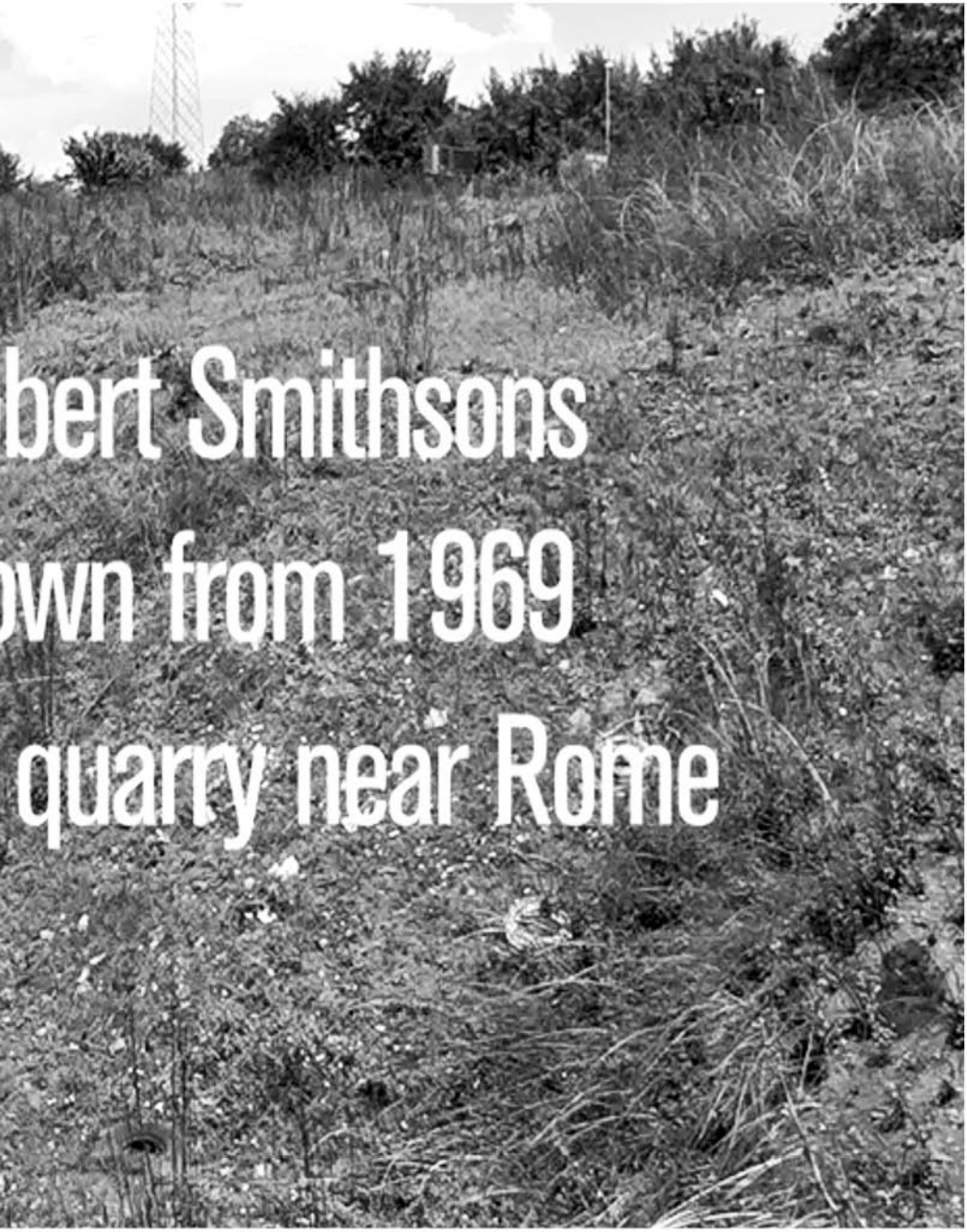
• This text is a revised version of the keynote address for a symposium, "Earthworks: Land Reclamation as Sculpture," sponsored by the King County (Washington) Arts Commission. It was delivered on July 31, 1979.

048 Front page of the article, *Notes on Art as/and Land Reclamation* by Robert Morris published in 1979.



049 Top: Serra, Richard. Slab for the Ruhr. Essen, Germany. Installed in 1998. The 67-ton steel plate towers over 14.5m (47 ft) into the air - an unadorned monolith echoing the bleak, but proud legacy of the mining industry. Photograph by Robin Thomas. Bottom: Smithson, Robert. Asphalt Rundown. Cava dei Selce, Rome, Italy. 1969. A dump truck offloaded a load of asphalt into a quarry in Rome with the flow of material revealing the processes of entropy.

050 Still image from *Digging for Robert Smithsons "Asphalt Rundown" from 1969 in an abandoned quarry near Rome.* The video which was part of the exhibition: *Markus Karstiess Zeigt/ presents Claudio Abate/Robert Smithson was die erde sieht/ with the eyes of the earth. The exhibition took place at Van Horn,* Düsseldorf, Germany from the 17 of January - 27 of February 2015.



The video documents a quest for the remains of Robert Smithson's *Asphalt Rundown* (October 1969) in an abandoned quarry in the outskirts of Rome. Over time and due to abandonment, Smithson's work has in turn been reclaimed by nature - as he intended (just as all man's works are subject to entropy). Although the original work disappeared, it continued to exist in Smithson's documentation of it, showing the process of its construction. Now, much like Roman monuments of the past are unearthed and brought to view, Smithson's monument is being revealed, giving the quarry value. Although the monument cannot be seen today, due to its disintegration, Smithson's work has reclaimed the abandoned quarry of Cave dei Selce through the imaginary. *Asphalt Rundown* is a work of art that will forever exist through documentation and, create discussion on the place of intervention.

051 Heizer, Michael. *Munich Depression (Final Stage)*. 1969. The huge conical depression (100 feet wide and 16 feet deep) was created using heavy machinery such as bulldozers. The work beckons the experience of negative space through descent into the depression and facilitates the illusion of a seamless boundary between earth and sky.

052 Rauschenberg, Robert. *Erased de Kooning Drawing*. 1953 The work consists of an almost blank piece of paper (an erased drawing by Willem de Kooning) in a simple gilded frame. The idea is that the work will be missed once erased and more importantly so, when the erased work was one that was valued before erasure. The erased work therefore becomes more valued by its absence rather than by its previous state of existence.

"Absence is an idea which can only be understood in opposition to something else – the presence of another object, or the realization that something has gone missing. A memory. An artist. A silence."

(Hogue 2000, 532)

Reference situations

Introduction

Udo Weilacher (2008,1) considers the relationship between art, land art, and landscape architecture to be a complex one. Distinction between them is often blurred with the latter two evading a concrete definition that would separate them entirely. Weilacher, (1996, 9) observes that the term, 'land art' "is now too often uncritically applied to virtually any kind of design in public space which appears to have artistic qualities, irrespective of the meaning it conveys," and because both land art and landscape architecture concern the creative process in the medium of landscape, it is therefore often difficult to establish a firm difference between them.

Landscape historian, John Hunt (1996, 6 in Lehenbauer 2012, 46) points out that perhaps the separation that existed between art and landscape architecture was a question of professionalism and one where we have tended to see art as a lesser. Landscape architect, Margaretha Lehenbauer (2012, 46) sees American land artists of the1970s and 80s as having brought a new dimension to art which entered into common territory with architecture as land artists, "used nature not to reveal its beauty and evoke emotions but rather to dig, mark, plot, and transform"(Parsey 2000, 30 in Lehenbauer, 2012,46). Lehenbauer (2012, 46) quotes Hunt (1996, 6) stating that land art has developed landscape architecture as it has restored the idea of "'melding of site, sight and insight'" and that "'land art has the ability to respond to the landscape and bring about ideas of art and design, even inspiration. Land art's great appeal to landscape architecture rests upon other foundations, above all its emphasis on process, its invocation of abstraction and its confidence in its own artistry'"

Architect, Gabriela Raposo (2017, 80) asserts that during the 1970s and 80s, the dematerialisation of the artwork happened as a direct consequence of minimalism of the art scene in the USA. Works were contextualised in conceptual art where relevance was given to the process from the development of the idea to the formal realisation of the object. The connection of these processes in art now approached that used in the field of architecture, where the scale of the object and the importance of its implantation is an elementary factor in the characterisation of the work, being part of it and where there is the need for direct contact with the manufacture of the works. Raposo refers to Paulo Nunes comparison of the minimalist sculptor Donald Judd with process artist, Richard Serra found in Nunes' article, *Objecto, Espaço e Corpo: Judd, Serra e heizer (três poéticas do espaço)* (Nunes 2001, 101). With reference to this comparison, Raposo states (2017, 80) that "despite resorting to the so-called 'heavy mechanics' and working with heavy materials with a strong connotation with the industry, unlike Donal Judd, Serra favours manual work in the workshop and intimacy with the 'doing' process, with 'way of forming' of the work and with the 'logic of the material', with the way of feeling its qualities, its characteristics and its dynamic behaviour'" Raposa (2017, 261) refers to architects Aires Mateus (2005, 77), stating that when investigating the precision of Richard Serra's work, they saw that rather than understanding the work of art, it rather needed to be understood as a form of communication design - not just the material but the underlying construction of the work. The process of the

sculptor, in conceptual artistic methodology (in experimentalism and materiality) therefore approaches that of the architect.

Sarah Watson (museum curator of the exhibition of *Robert Morris' twenty, Para-Architectural projects (ink on paper drawings) from 1971* notes that these drawings fall into the realm of art and architecture with the "precision of a draftsman, though the artist's hand remains visible". They can be seen as sculpture on an architectural scale relating to the monumental but also inspired by it for example, as Neolithic complexes. Through these drawings for sculpture, Morris poses timeless hypotheses for architecture where architecture requires the realm of art to liberate it from constraints (of the political, social and civic institutions which dictate it) and to give it imaginative potential.[56]

Portuguese architect Manuel Aires Mateus (Aires Mateus 2007, 25) in Raposo (2017, 261) considers that:

The classic definitions between architecture and sculpture are no longer of interest, because they are quite reductive. The field of artistic experimentation is of great interest, mainly because of the clarity it conveys […] For me, architecture is an art and it is in this field that I am interested. The difference between art and architecture will lie in the transportation of the idea. When we are facing a work by Richard Serra it is. Because if it is not, it is nothing. This identity is central, because it carries the idea, the tension, the materiality, the interference with our life and its weight.

In addition Aires Mateus (Raposa 2017, 261) saw architecture as an art of permanence, not in the duration of material but because of the permanence of the idea. This idea of the work being a concept and the importance of its reproduction through the idea, was also emphasised by the artist Lawrence Weiner when explaining his work, A 36" X 36" *Removal to the Lathing or Support Wall of plaster or wallboard from a wall ,1968.* (This work was previously discussed on p.63).

Artists from the early 1900s began to expand the boundaries of their field - theoretically, conceptually and in the practical aspects of their work - resulting in numerous art movements that stimulated the imagination and pushed the boundaries of progress. Such innovation in the world of art inspired architecture which, by contrast, had been less fluid and which had tended to follow a more pragmatic path in innovation – especially in its role for social reconstruction after two world wars. Moreover, "the art sector was the pioneer of the concept of reusing waste, thanks to the work of land artists" for example Robert Smithson (Talento, K et al 2020, 10). In the latter part of the twentieth century, industry became more vulnerable to economic crisis and the appearance of abandoned

industrial areas became more common and widespread. With the need for urban space for development, recycling of such sites has been necessary contributing to improvement of the urban environment but it has also been necessary to conserve their industrial heritage (Loures and Burley 228). Architects Latz + Partner's ecological rehabilitation of the landscape and the re-purposing of the structure of a disused steel mill at Duisburg Nord in the Rhur area of Germany is one example of successful reclamation in a sustainable way, creating a new aesthetic and bringing social and economic benefits to the area from the once contaminated site (Loures and Burley 233-239).

Land art has used entropy – a force incorporated in the works of Robert Smithson and Michael Heizer for example. Beardsley, in pointing out the importance of landscape architecture in reclamation, notes that the natural process of entropy is considered in architectural works as "all designed landscapes can be seen, in some ways, as expressions of the entropic passage of time." However, he argues that although there is a process of enrichment between "contemporary sculpture" and landscape architecture, "the time of sculpture, usually, is limited to the perceptual experience. The time of landscape architecture is more complex. No place is a tabula rasa, without history; any intervention by any designer is part of a series of interventions, of marks already inscribed or yet to be inscribed on the site. Every design is subject to the actions of dynamic and unpredictable natural and cultural forces—the continual transformations produced by growth and decay, for example, or by changing patterns of social use and habitation. Robert Smithson once described a park not as a 'thing-in-itself' but 'a process of ongoing relationships existing in a physical region'—an idea now exemplified by much forceful design work."(Beardsley, 2000) It would appear then that land art has much to offer architecture in the area of reclamation of post-industrial sites.

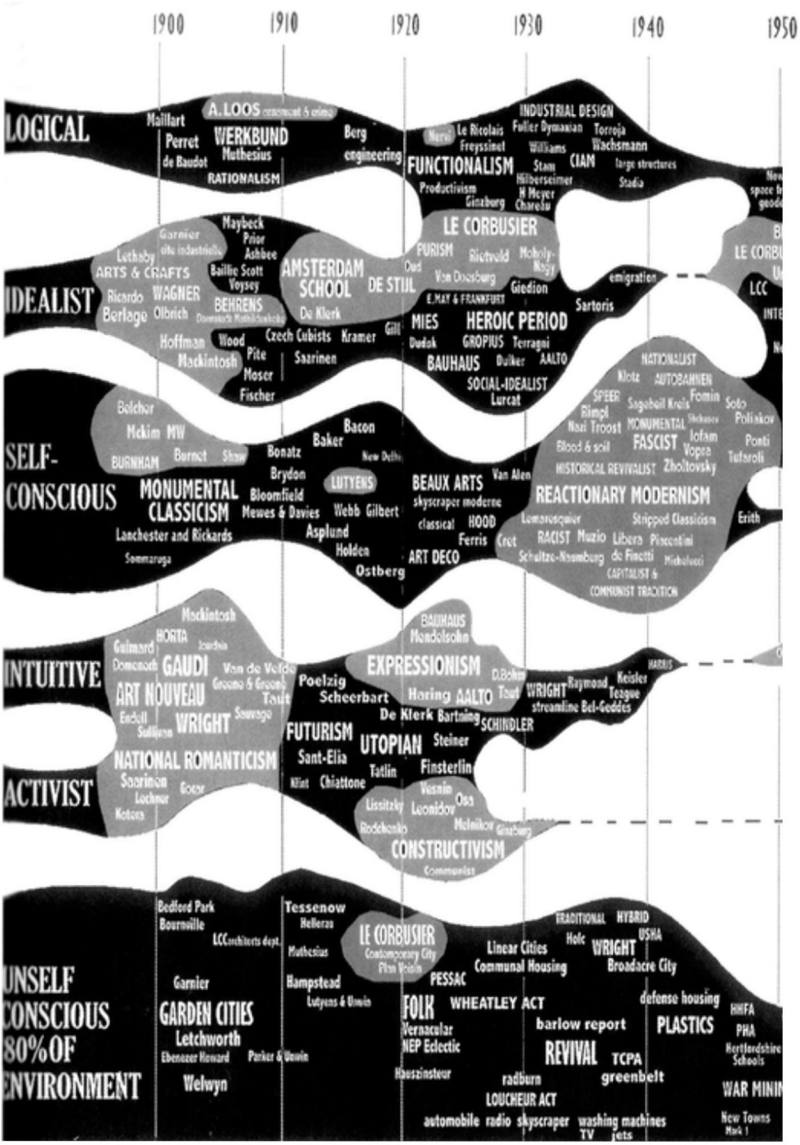
The following projects could justifiably be included in the situations of reference in this thesis; works by: architects, Inaki Abalos Juan Herreros of Ábalos and Herreros[57]; landscape architect, Martha Schwartz[58]; artist and architect, Maya Lin[59]; enviromental land artist, Hermann Prigann[60]; landscape architect, Peter Latz of Latz + Partners[61]; architect, Wang Shu[62]; architects, Enric Miralles and Carme Pinós[63]; sculptor, Andrzej Sołyga[64]; architects, Rafael Aranda, Carme Pigem and Ramon Vilalta of RCR Arquitectes[65] and others, considering that they have created projects connected with the post-industrial landscape or the use of waste. However, these works have been omitted from the following thesis as it more specifically concentrates on open-cast mining landscape from an earlier time period, viz. the1970s to the1980s, where we can see a response to the movement of a global environmental consciousness - marked by the consequences of the first Earth Day in 1970 and its stirrings before. Land artists in the USA in the 1960s and 1970s were looking for a free medium and vast open spaces to produce their art and found opportunities to create it while the mining industry sought a way around the newly implemented legislation of the USA Surface Mining Control and Reclamation Act of 1977 which they were bound too comply with. The opportunity therefore arose for sculpture, in the form of land art, to mutually benefit mines and land artists.

Particular emphasis is given to different approaches to sculpture in the form of monumental public earth works in the rural setting and, more specifically, that of open pits and quarries - thus excluding Robert Smithson's T*our of the Monuments of Passaic, New Jersey (1967)* and *Spiral Jetty* (1970) as, although they pertain to the post-industrial landscape, they do not concern quarries or open-mining pits. The reason for such focus is that the land art selected in the follow case studies was pioneering and not just in the field of art, but in reclamation which has been overlooked - especially as the works chosen have not previously been considered as an influential group in this respect. The methodology of construction that these artists used to create their works is one to look at in architecture and specifically the area of architecture as post-industrial mining reclamation - in the same way that architects Aires Mateus investigated the methodology of process artist Richard Serra's work and understood it as a form of communication design for its construction and replication. Art tends to influence architecture (art being more revolutionary and experimental) and so we can see innovative works from this period of land art as an inspirational starting point in architecture for reclamation works in post-industrial open cast mining sites (with open pits and waste heaps) for the creation of a new aesthetic. The use of the medium of earth and waste in open cast mining sites to create monumental works of land art from the 1970s and 1980s, is pioneering architecture today and opens up further possibilities for the future as architects now enter the field of mining reclamation and especially that of open cast mining. Architects are beginning to focus on the use of sustainable materials but should consider more the landscape beyond the urban.

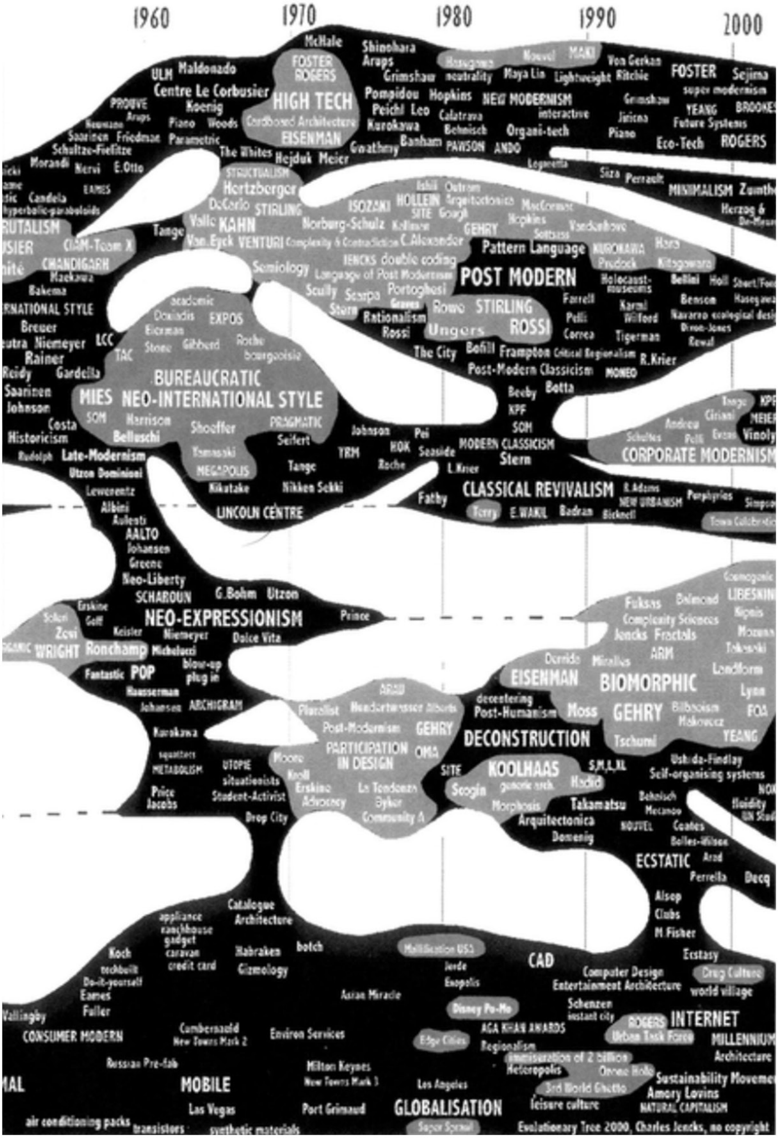
Landscape architect and architectural historian Charles Jencks in his diagram, *The Century is over, Evolutionary Tree of the Twentieth-Century Architecture* (Jencks 2000) made in 1999 (see diagram 053 on p.140-141 in this thesis). Six foremost traditions of architecture are projected on a vertical axis against a horizontal timeline of the twentieth century. Jencks diagram implies that 80% of architecture in the first half of the 20th century, did not come from architects but from technical sources associated with regulatory bodies. In the latter part of the second half of the 20th century, ecology begins to take on an increasing role in architecture but not entirely through ecological activism. Jencks points out that there are ecological movements: the Classicists with a 'New Urbanism' and the Post Modernist 'Green' architecture; the Sustainability Movement with what Jencks terms a 'Natural Capitalism' to be carried into the 21st century. (The latter movement, he points out is a trend that is likely one to be at odds with itself for it ironically it implies the combination of ecology and capitalism and 'tax incentives.) However, Jencks implies that in the 21st century, the focus of architecture on ecology will likely develop into further movements. It is also evident in Jenck's diagram that preceding art movements inspired architectural ones. As mentioned previously (on p.135) land artists can be seen as pioneers in the use of waste as a building material (Talento, K et al., 2020, 10). The following situations of reference in this chapter, were chosen as examples of a movement of land artists from the 1970s -1980s - artists who were not considered in Jencks in this diagram but

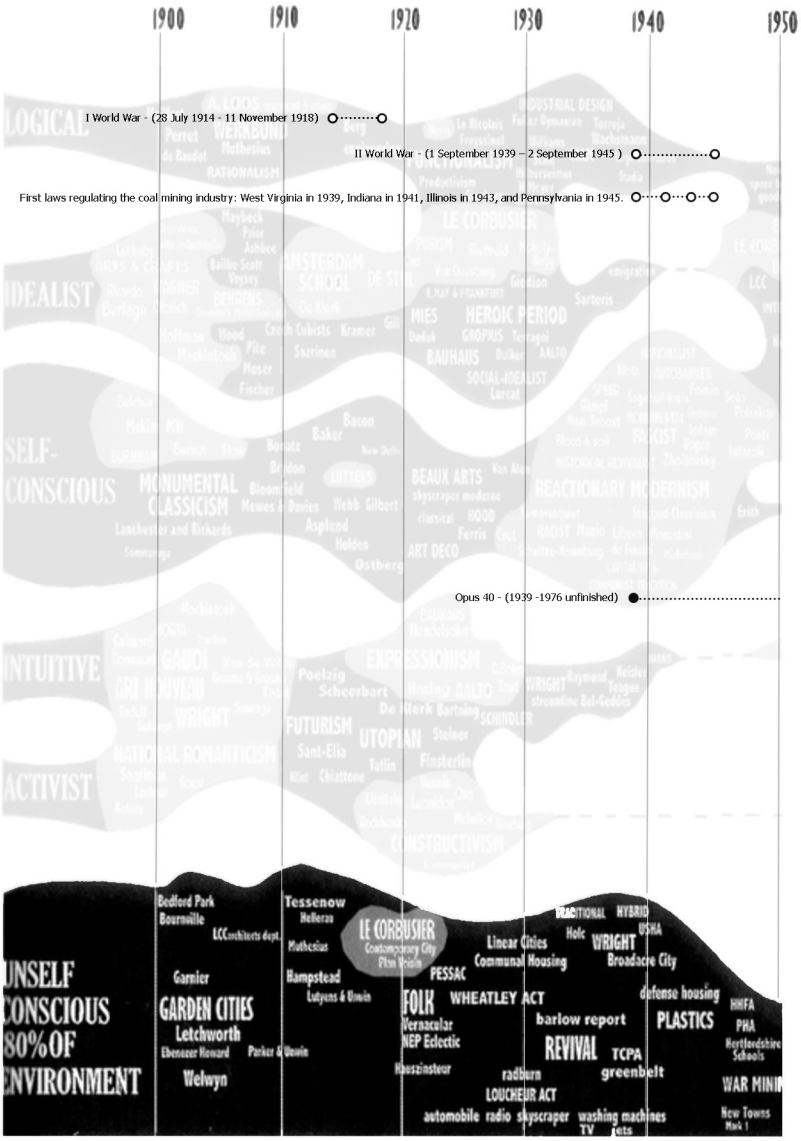
whose works can be considered to be para architectural in design (in terms of the *para architectural* drawings of Robert Morris mentioned above). They created works in a climate of environmental activism beginning in the late 1960s (a protest which has reached a new crescendo at the turn of the 21st century). These artists however have been largely overlooked as a group in their influence in the field of architecture concerning the use of land art in post-industrial sites - in particular those pertaining to mining and its waste.

Different approaches to sculpture, in the form of monumental public land art in the rural setting, have been selected in this study - all of them being responses to the reclamation of the post-industrial mining landscape. The studies below (organised chronologically) were selected from the 1970's to the early 1980s - with the exception of *Opus 40* begun in 1939 and which can be seen as a pioneering work in this field but one which gained focus as a reclamation piece in the later years prior to the artist's death in 1976. When we project the dates of the chosen situations of reference (to follow in this chapter) onto Jencks' diagram, *The Century is over, Evolutionary Tree of the Twentieth-Century Architecture* (Jencks 2000) (as seen in diagram 054 on pages 142-143), it is apparent that despite there always being an environmental consciousness in architecture, architects did not address post-industrial open-cast mining sites this period. By contrast, the work of land artists in the situations of reference gained momentum, during a period of increased environmental consciousness, from the late 1960s to the1980s in the USA in particular. The commencement of *Opus 40* by Harvey Fite in 1939 coincides with the first post war (World War II) environmental laws regulating the mining industry while the post 1970 land art works, chosen here, coincide with the rising tide of ecological consciousness evident in protest movements in the 1960s, the commencement of an annual Earth Day in 1970 and, the proposed Surface Mining Control and Reclamation Act which was signed into law in 1977 in the USA. What all these works have in common is that the post-industrial open-cast mining site was chosen as the 'canvas' for a work of art. We can also argue that these land artists, in the following case studies were 'para architects' as they created with the notion of materiality and, inherent in their construction techniques was the notion of reclaiming a landscape.

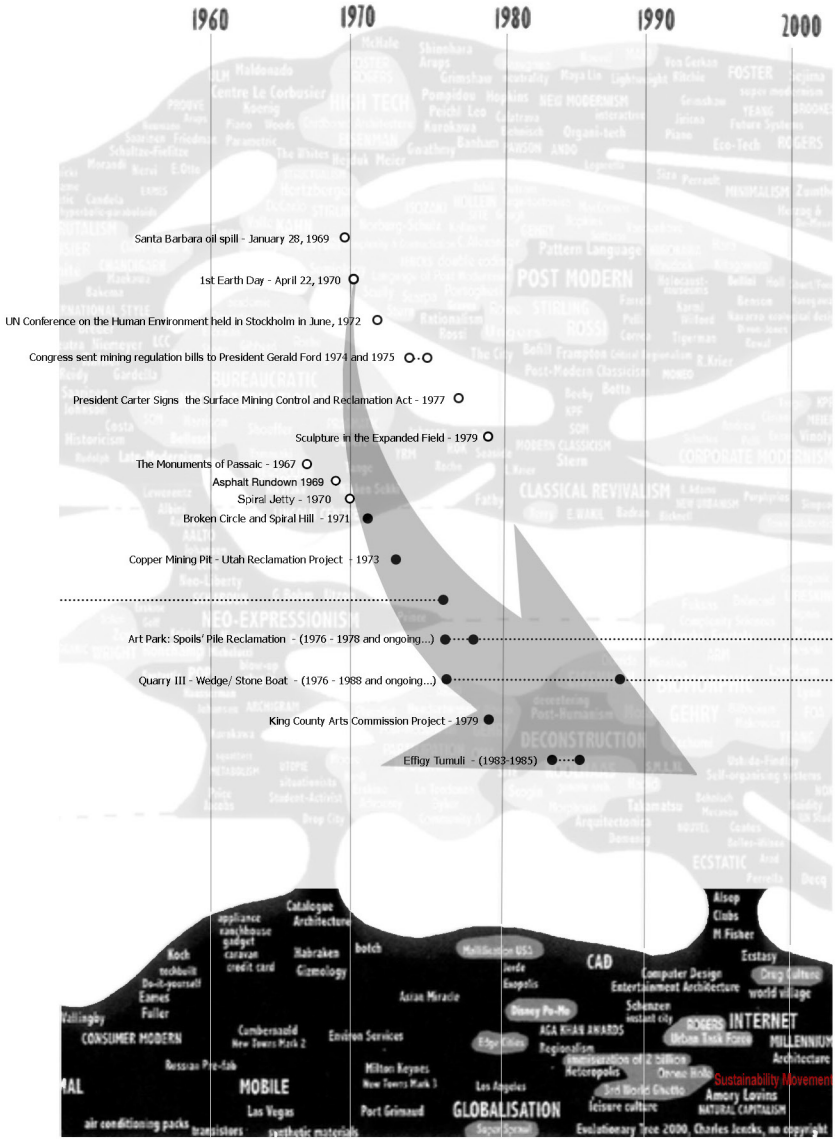


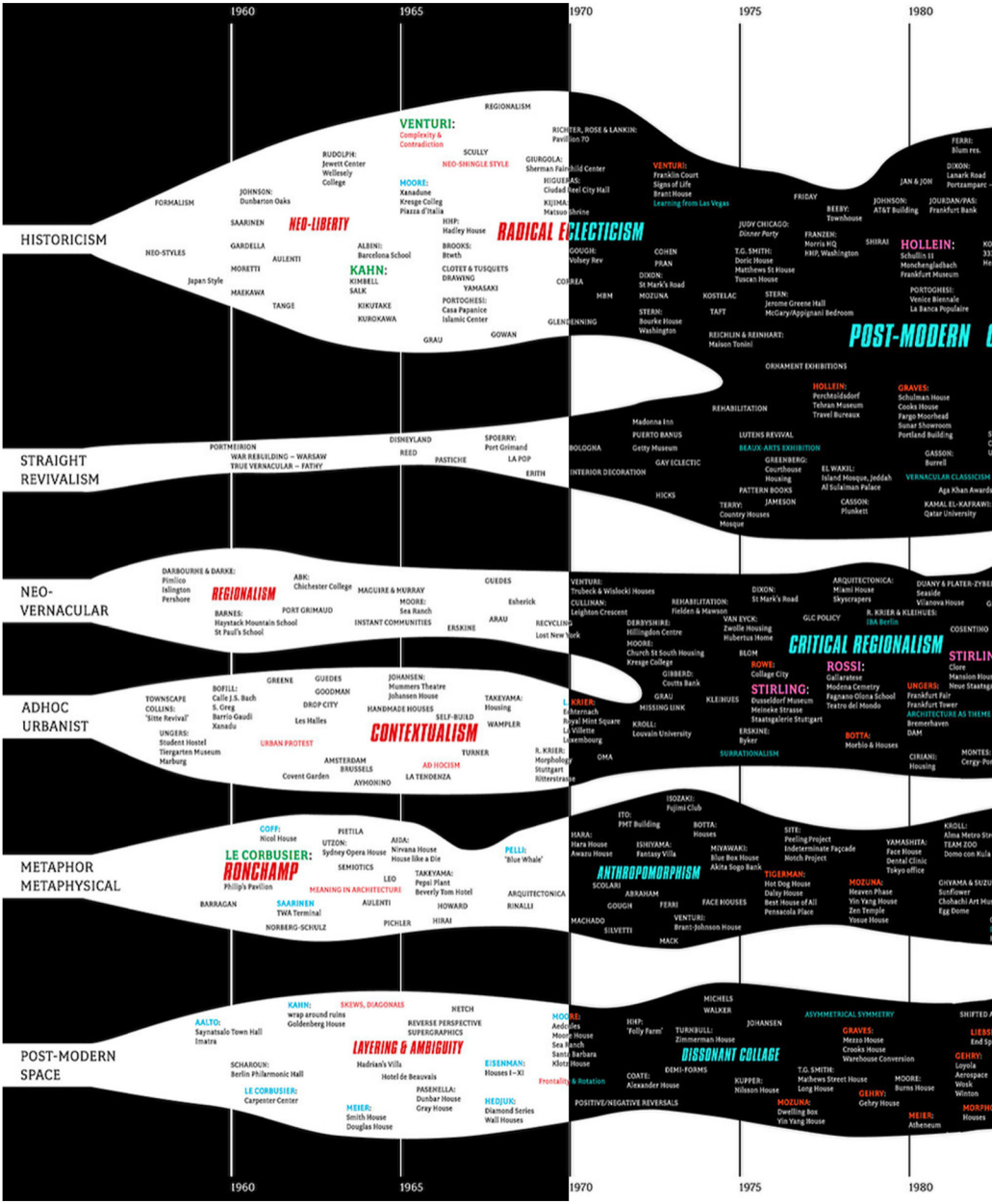
053 Jencks, Charles. *The Century is over, Evolutionary Tree of the Twentieth-Century Architecture.* Diagram. 1999. Originally published in Architecture Review, July 2000 in the article, *Jencks theory of evolution - an overview of twentieth century architecture.* The image here has been divided into two sections: the first half of the 20th Century (left) and the second half (right). The lower band, "Unselfconscious 80% of Environment" has existed throughout the twentieth century in various forms but the Sustainability movement only really begins to become established during the 1990s and beyond with architects now focused on ecology and sustainability. Although the Land art movement where pioneers in dealing with the reclamation of the landscape since the late 1960s early 1970s and have inspired landscape architecture in terms of how we should deal with the post industrial landscape, artists such as Robert Smithson, Michael Heizer and others do not appear in Jencks' evolutionary tree.


1960
1970
1980
1990
2000
HIGH TECH
FOSTER ROGERS
EISENMAN
Centre Le Corbusier
Maldonado
NEW MODERNISM
Organi-tech
FOSTER
ROGERS
Eco-Tech
MINIMALISM
Hertzberger
STIRLING
KAHN
VENTURI
ISOZAKI
HOLLEIN
GEHRY
Pattern Language
POST MODERN
JENCKS double coding
STIRLING
ROSSI
Ungers
Rationalism
The City
Frampton
Post-Modern Classicism
BUREAUCRATIC
MIES
NEO-INTERNATIONAL STYLE
MEGAPOLIS
CORPORATE MODERNISM
MODERN CLASSICISM
CLASSICAL REVIVALISM
LINCOLN CENTRE
Late-Modernism
AALTO
Neo-Liberty
SCHAROUN
NEO-EXPRESSIONISM
WRIGHT
Ronchamp
POP
ARCHIGRAM
Fractals
EISENMAN
BIOMORPHIC
GEHRY
DECONSTRUCTION
KOOLHAAS
PARTICIPATION IN DESIGN
Post-Modernism
Post-Humanism
Self-organising systems
Arquitectonica
ECSTATIC
CAD
Computer Design
Entertainment Architecture
INTERNET
MILLENNIUM Architecture
CONSUMER MODERN
MOBILE
Las Vegas
GLOBALISATION
Sustainability Movement
Amory Lovins
NATURAL CAPITALISM
air conditioning packs
transistors
synthetic materials
Evolutionary Tree 2000, Charles Jencks, no copyright

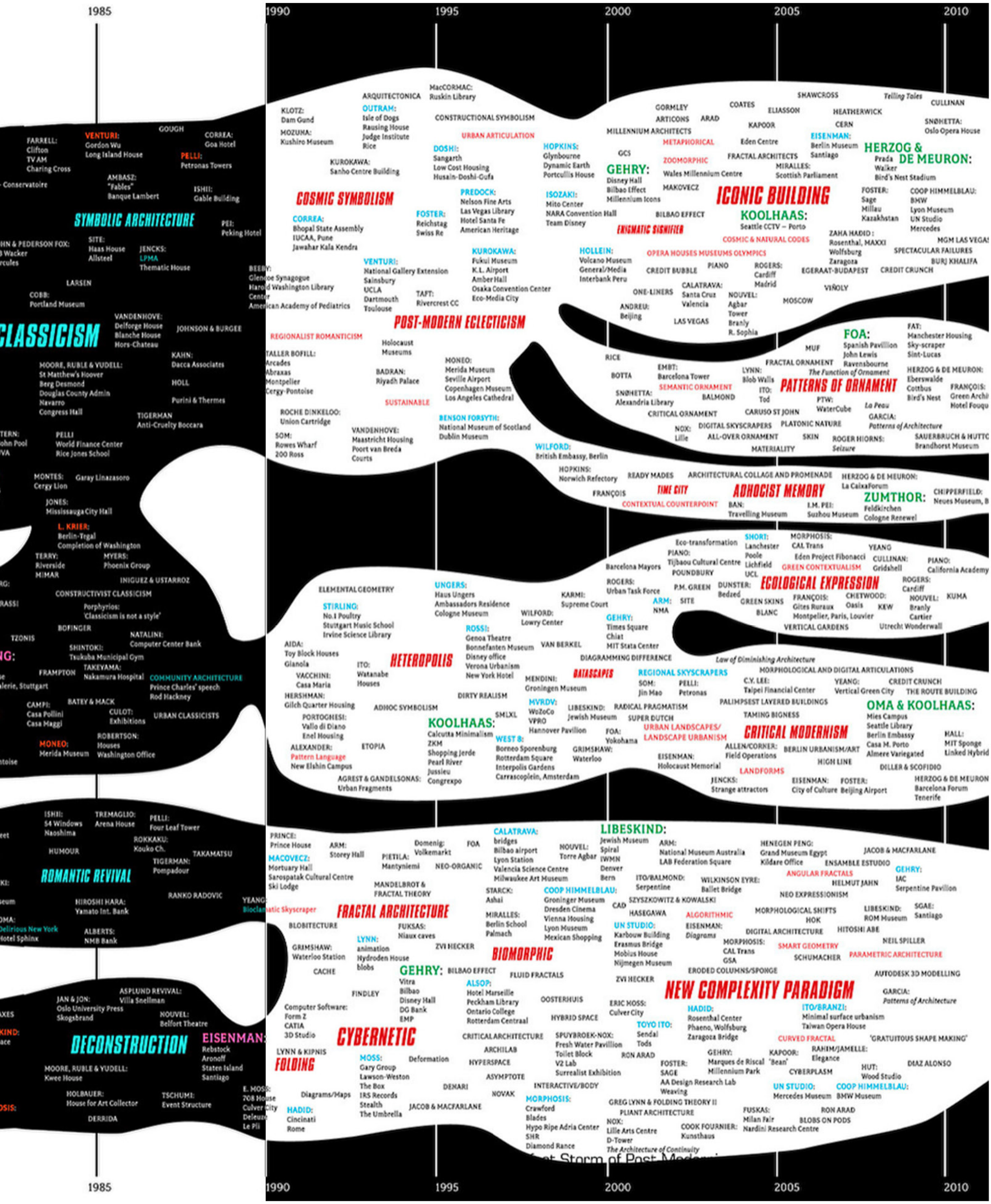


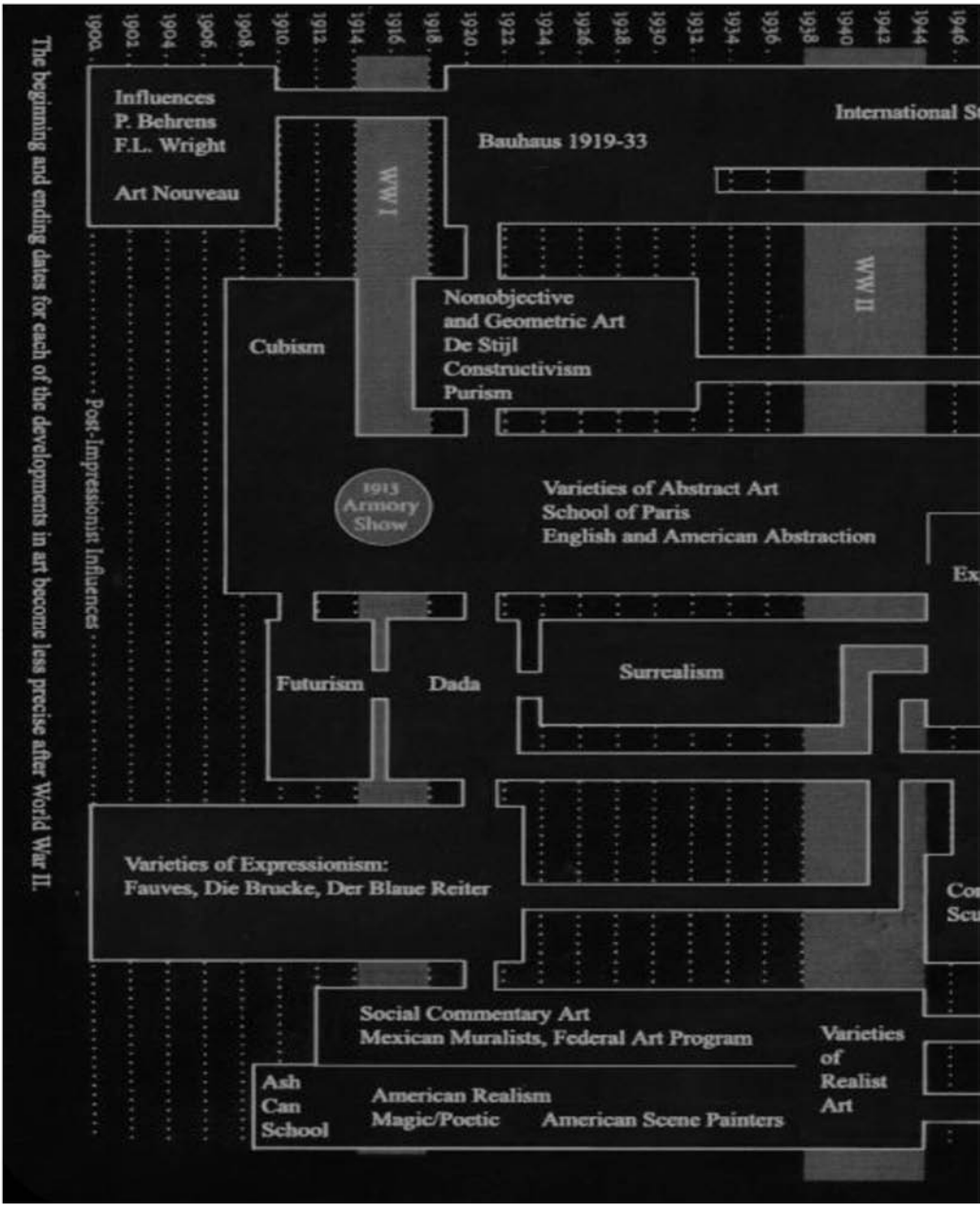
054 Over lapping of Charles Jencks' diagram "The Century is over, Evolutionary Tree of the Twentieth-Century Architecture" with situations of reference pertinent to the current reference situations in this thesis. We can now see the emergence of Earthworks, simultaneous with the environmental movement, propelled from the first Earth Day and, the implementation mining reclamation acts. In the first half of the century (left), the regulation of the mining industry is in response to the economy relating to the Second World War. Harvey Fite's *Opus 40* reveals an interest in the quarry as sculpture. In the latter half of the twentieth century (right) we can see an accumulation of world-wide environmental events initiated from1970s (from the first Earth Day) and, the creation of Earth works by land artists. This would suggest that the field of architecture in reclamation and sustainability, has tended to follow a much earlier movement in the field of art.


1960
1970
1980
1990
2000
Santa Barbara oil spill - January 28, 1969
1st Earth Day - April 22, 1970
UN Conference on the Human Environment held in Stockholm in June, 1972
Congress sent mining regulation bills to President Gerald Ford 1974 and 1975
President Carter Signs the Surface Mining Control and Reclamation Act - 1977
Sculpture in the Expanded Field - 1979
The Monuments of Passaic - 1967
Asphalt Rundown 1969
Spiral Jetty - 1970
Broken Circle and Spiral Hill - 1971
Copper Mining Pit - Utah Reclamation Project - 1973
Art Park: Spoils' Pile Reclamation - (1976 - 1978 and ongoing...)
Quarry III - Wedge/ Stone Boat - (1976 - 1988 and ongoing...)
King County Arts Commission Project - 1979
Effigy Tumuli - (1983-1985)
POST MODERN
CLASSICAL REVIVALISM
NEO-EXPRESSIONISM
DECONSTRUCTION
CONSUMER MODERN
MOBILE
GLOBALISATION
CAD
INTERNET
Sustainability Movement
Evolutionary Tree 2000, Charles Jencks, no copyright

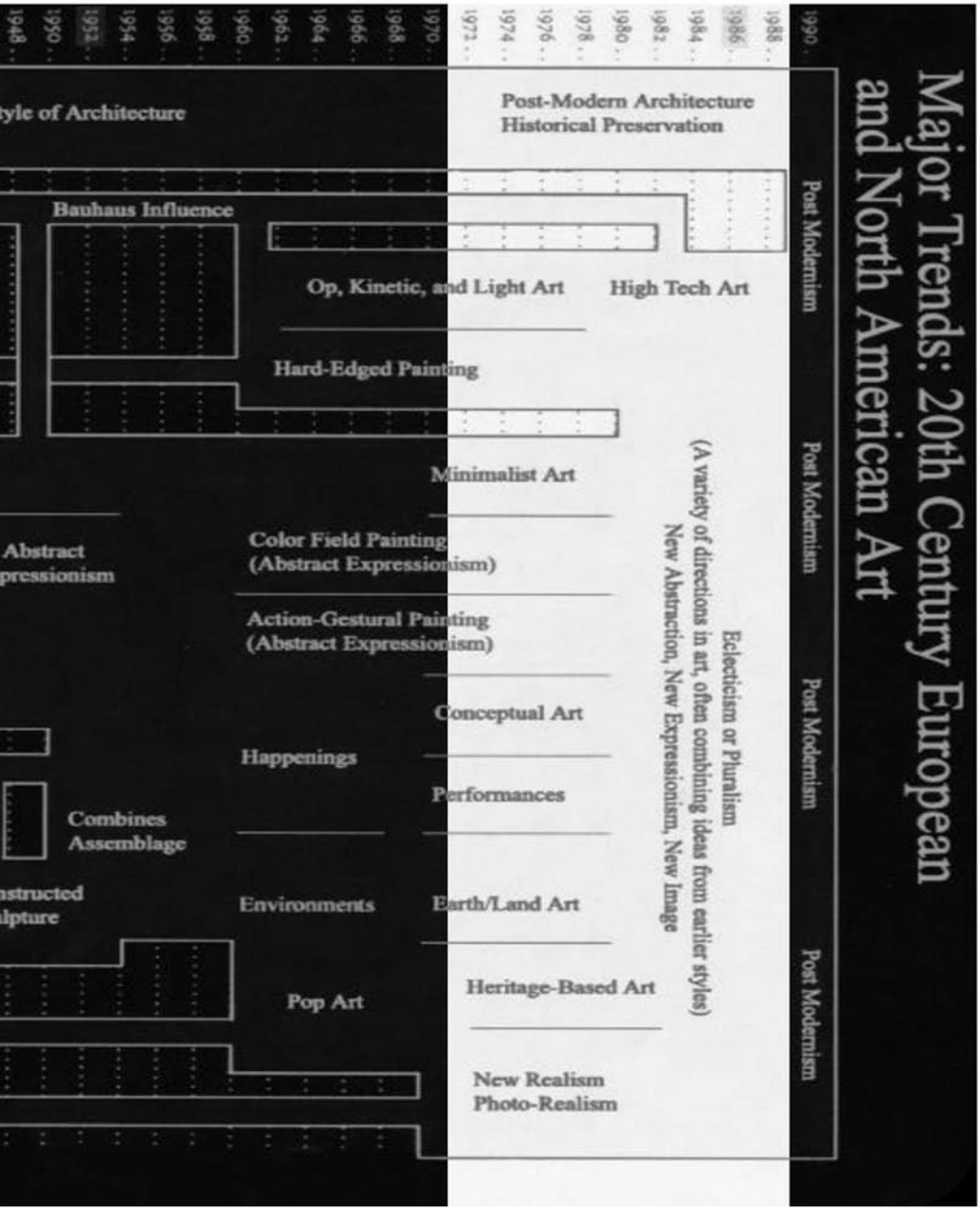


055 Charles Jencks's diagrams of Late, Neo and Postmodernism stretching from pre 1960 to post 2010. Here, the background colour of the middle section- the time frame from the 1970s to 1980s - has been inverted to show give emphasis to this period from which the situations of reference have been chosen. It is interesting to note that 'Ecological Expressionism' and 'Green Contextualism' appear on this diagram only just before 2005 which would indicate that the thought processes behind the reclamation earthworks appearing in the middle time frame (as in image 054 on pages 142 to 143) were innovatory.

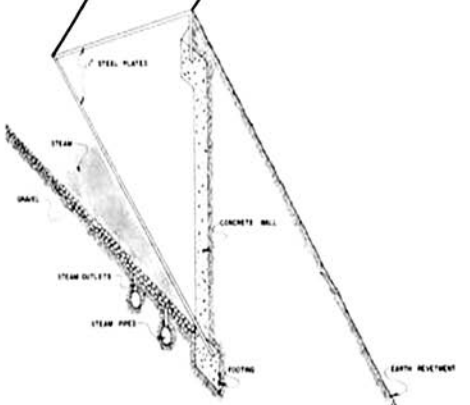

1985
1990
1995
2000
2005
2010
SYMBOLIC ARCHITECTURE
CLASSICISM
COSMIC SYMBOLISM
POST-MODERN ECLECTICISM
ICONIC BUILDING
KOOLHAAS:
HERZOG & DE MEURON:
GEHRY:
ENIGMATIC SIGNIFIER
PATTERNS OF ORNAMENT
FOA:
ADHOCIST MEMORY
TIME CITY
ZUMTHOR:
ECOLOGICAL EXPRESSION
HETEROPOLIS
DATASCAPES
CRITICAL MODERNISM
OMA & KOOLHAAS:
ROMANTIC REVIVAL
FRACTAL ARCHITECTURE
LIBESKIND:
BIOMORPHIC
NEW COMPLEXITY PARADIGM
DECONSTRUCTION
EISENMAN:
CYBERNETIC
FOLDING
1985
1990
1995
2000
2005
2010



056 Conceptual diagram titled *Major Trends: 20th Century European and North American Art* where the time period (relevant to the situations of reference in this thesis - from 1970s to 1980s) has been highlighted. We can see a complexity of multiple art movements suggesting innovation and fluidity in the field of Art but by contrast, Architecture - and Post-Modern Architecture in particular - remains linear. Architecture remains fixed on historical preservation of edifices while the Earth/Land Art movement pioneers reclamation of post-industrial mining sites through monumental sculpture.


Major Trends: 20th Century European and North American Art
1990
1988
1986
1984
1982
1980
1978
1976
1974
1972
1970
1968
1966
1964
1962
1960
1958
1956
1954
1952
1950
1948
Post Modernism
Post Modernism
Post Modernism
Post Modernism
Post-Modern Architecture
Historical Preservation
tyle of Architecture
Bauhaus Influence
Op, Kinetic, and Light Art
High Tech Art
Hard-Edged Painting
Minimalist Art
Eclecticism or Pluralism
(A variety of directions in art, often combining ideas from earlier styles)
New Abstraction, New Expressionism, New Image
Abstract
pressionism
Color Field Painting
(Abstract Expressionism)
Action-Gestural Painting
(Abstract Expressionism)
Conceptual Art
Happenings
Performances
Combines
Assemblage
nstructed
lpture
Environments
Earth/Land Art
Heritage-Based Art
Pop Art
New Realism
Photo-Realism

057 Morris, Robert. *Section of an Enclosed Courtyard*. 1971. This drawing is taken from the 1971 Tate Gallery catalogue which comprises of reproductions of some twenty very large, ink-on-paper drawings that illustrate a fantasy architectural complex and, which are titled, *The Para-architectural projects — observations, exercise courts, aqueducts, courts, concourse, etc*. In this section of an enclosed courtyard, we can see the deliberate constructive knowledge that results in the form and the identity of the art work because without this knowledge, the art work would not exist. American land artists such as Robert Morris, and others who are represented in the following reference situations, are pertinent to understanding the connection between their work and that the field of architecture. Although these artists were dealing with reclamation of the post-industrial landscape, at a time when architects were not, their physical and constructive relation to the place of intervention, and the thought process for the creation of the piece, are always linked to the inherent process of their construction.



SECTION OF AN ENCLOSED COURTYARD

1" = 1'0"

Broken Circle and Spiral Hill

Artist: Robert Smithson

Date: 1971

Site: Disused quarry

Material: *Broken Circle*: white and yellow sand; large boulder; body of blue-green water (in the pit) / *Spiral Hill:* brown loam

Dimensions: *Broken Circle* diameter: 42m.; Canal width: 3.5m.; Depth of water in the pit: 3-4.5m / *Spiral Hill* diameter at base: 23m

Location: Emmen, The Netherlands

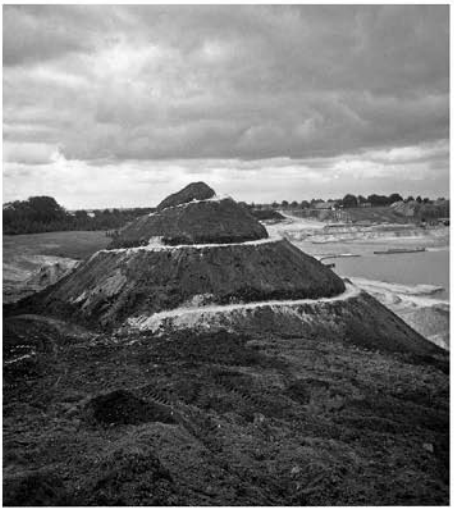
This work was created at *Sonspeek 71* exhibition in the Netherlands and was Smithson's first 'reclamation' project (Beardsley 2006, 22). It is still in existence, having been voted to remain there by the people of Emmen, in post-industrial land designated for recreation (Dreher 1992, 26). Initially, Smithson was offered 'green land' to work on, but he preferred to use a post-industrial site and consequently a sand quarry was found for him (Beardsley 2006, 22). In 1971, when talking about this site, he told Gregoire Mueller, "I somehow re-organized a disrupted situation and brought it back some kind of shape" (quoted in Kastner and Wallis eds. 1998, 60).

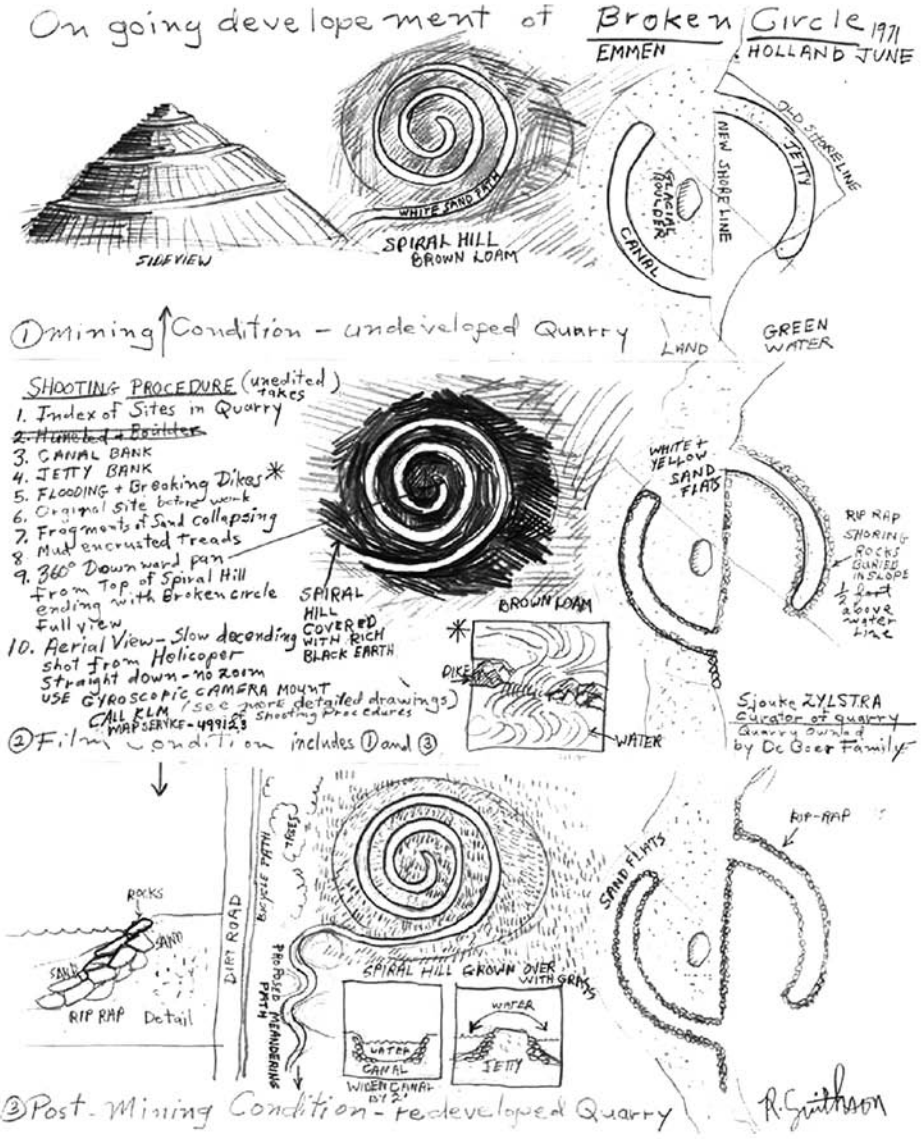
Smithson had the sandy slope graded flat at the edge of the water, creating a curved channel with a 'jetty' and forming a broken circle. Next to the body of water and with the *Broken Circle*, overburden and topsoil were then used to create the hill with a path, winding up counter clockwise (Beardsley 2006, 22). Beardsley notes the hill is "not particularly distinguished from either the deftness of its execution or the originality of its form" and that *Broken Circle* is "more intriguing" (Beardsley 2006, 23). However, art historian Thomas Dreher states that the top is an "observation platform, from which the best view of Broken Circle located on the edge of the flooded gravel pit, underneath an embankment, is possible" therefore suggesting that this was conceived as a necessary part of the work (Dreher 1992, 26). "With Smithson's Spiral Jetty and Broken Circle, the viewer is 'in' the work" (Dreher 1992, 30). They look beyond the work itself onto the surrounding environment and experience it; they feel as if they can almost walk upon the body of water (Dreher 1992, 30). The circle is a symmetry of opposites – with contrasting earth and water suggesting foreground and background or positive and negative space. Many interpretations

could be read into this artwork - similar to the fusion of opposites of the Taoist idea of 'Yin and yang' but it brings out many of the contrasting ideas associated with Smithson's art and industrial reclamation and, also that of the post-industrial place – a place of culture versus nature (industry) / nature versus culture (Smithson's sense of entropy in the decay of matter). Dreher notes that the vertical winding path and the horizontal "centrifugal" *Broken Circle* "complement each other as much as they neutralize each other" (Dreher 1992, 26). The unrolling circle could be associated with Pascal's 'eternity' and 'infinity' which Smithson relates to 'geologic time' which is eternal (Dreher 1992, 28). The apparent 'fragility' of the work, in its exposure to the elements causing change e.g. fragmentation and decay and therefore change in time, relates to Smithson's view of 'entropy'. The "focal point" (Beardsley 2006, 22-23) off-centre of *Broken Circle* is a large glacial boulder – a remnant from the Ice Age (Emmen being part of a glacial ridge) which, as Dreher notes, disturbed Smithson. He quotes from Smithson's writing: "'It became a dark spot of exasperation, a geological gangrene on the sandy expanse…a kind of glacial 'heart of darkness' – a warning from the Ice Age'" (Dreher 1992, 26). However Beardsley observes that Smithson warmed to the idea of this rock (after it was impossible to move it and as there were other rocks used as "prehistoric burial markers" in the area) (Beardsley 2006, 22). Smithson's written notes indicate a sublime view of the landscape which links to Maskit's idea of art in reclamation being in the realm of "interesting" (Maskit 1970, 327).

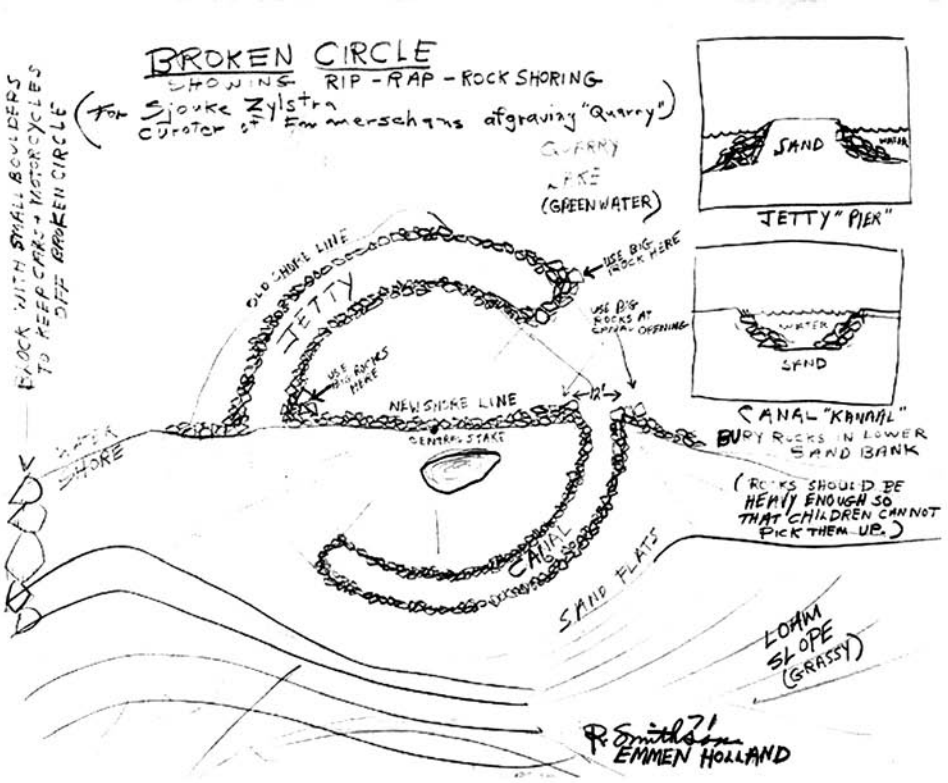
058 A video still from the film *Breaking Ground: Broken Circle / Spiral Hill* (1971-2011) showing Robert Smithson's work *Broken Circle / Spiral Hill* from above with the view of the surrounding lake in what was once a disused sand quarry. Photograph: Benito Strangio.

059 Smithson, Robert. *Broken Circle / Spiral Hill*. 1971. Top left: *Broken Circle* during construction, 1971. Bottom left: *Broken Circle / Spiral Hill*, 1971 after completion. Top right : *Spiral Hill* shortly after completion in 1971. Bottom right: *Broken Circle* shortly after completion in 1971

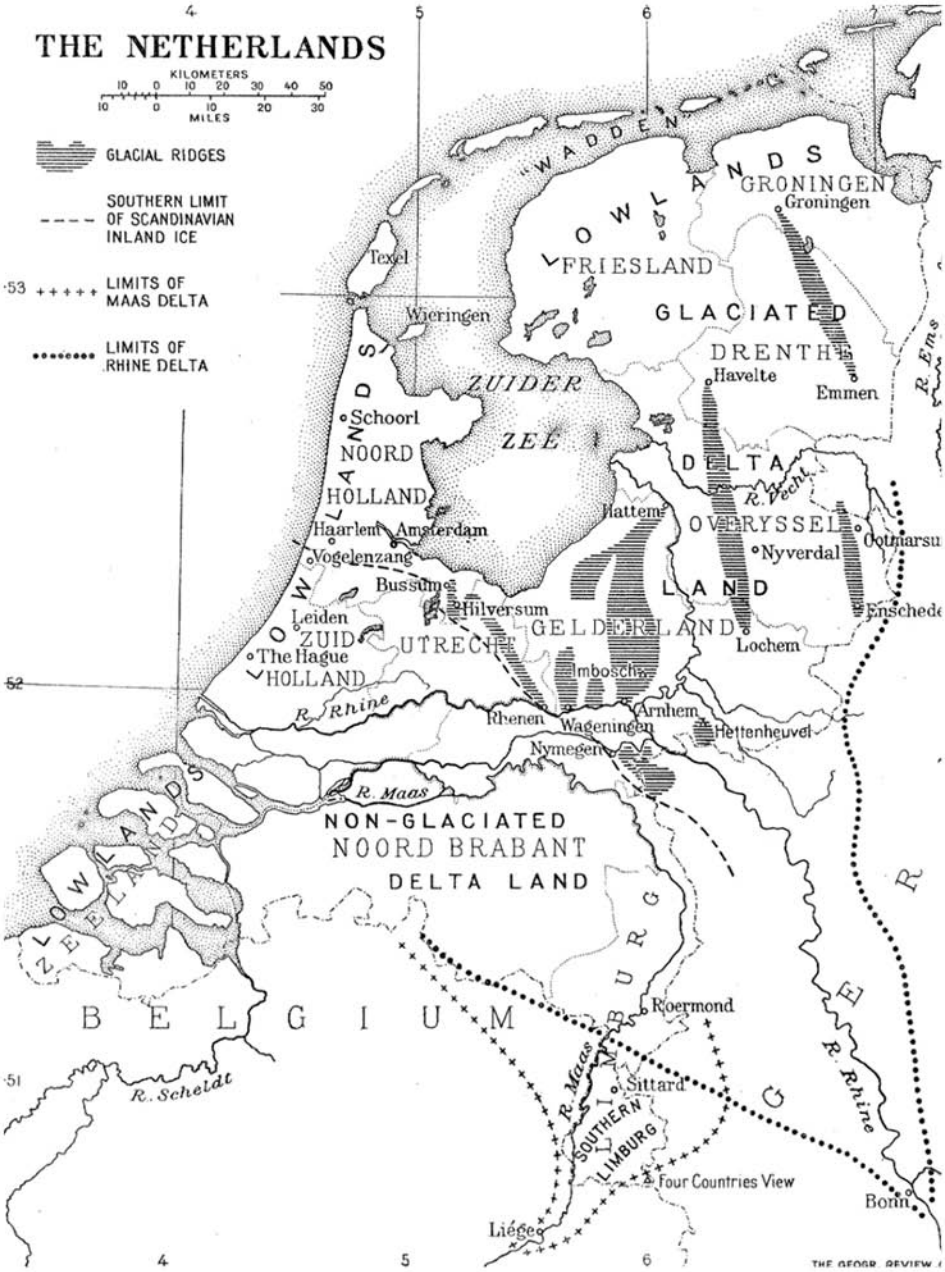




060 Smithson, Robert. Drawing for Broken circle / Spiral Hill. 1971. It can be noted in these drawings, the attention to detail that Smithson shows in his intention for the construction of the spiral hill and the broken circle in his work. This can seen in the "side view" and the top middle and bottom of these plans where his thought processes are noted down. He clearly desires the swirling white sand path going up the hill to contrast with its composition of brown loam. A knowledge of the inevitable process of entropy is implied in the conception of the project, as he notes the growth of grasses over the brown loam on the spiral hill (a stabilization which would prevent its erosion). Smithson's plans for the construction of the jetty show detail where rock plays a fundamental role in stabilizing the jetty of the broken circle through the use of "rip rap"to prevent its erosion. It is apparent that Smithson knows that the water table fluctuates in this lake (which was once a sand quarry)and predicts that periodically when the water rises, it will flow over the jetty.



061 Smithson,Robert. Drawing for *Broken Circle*. 1971. In this drawing we can see Robert Smithson's preoccupation with maintaining the form of his work through his notes. Rocks play a central role in the long-term stabilization of the sculpted sand which forms "Broken Circle" ensuring that its fixed linear geometry remains in place. Without the rip rap and use of heavier rocks (at strategic points at vertices), the sand would collapse (as a sand castle would when reclaimed by the forces of the movement of water). Smithson also takes into consideration, the effect of the visitor on his work; he notes on the far left of the drawing, that he wants a "block with small boulders to keep cars + motorcycles off the broken circle" which would make the piece only accessible by foot thus maintaining its stability and preservation. Smithson also notes that "rocks should be heavy enough so that children cannot pick them up", preempting again the negative effects of human behaviour on a work. The glacial boulder plays center stage in the piece, contrasting with its surroundings.



062 Map illustrating the physio-graphic divisions of The Netherlands. It shows the municipality of Emmen, where, on a glacial ridge, the lies the disused sand quarry site, used by Robert Smithson for his work, *Broken Circle / Spiral Hill* in 1971. The physiographic identity of this region is one linked to earth, sand, rock and the fluctuation of the water table as it once belong to the larger land mass of the Doggerland, eroded by glaciers and flooded by sea.

ACROSS THE COUNTRY THERE ARE MANY MINING AREAS, DISUSED QUARRIES, AND POLLUTED LAKES AND RIVERS. ONE PRACTICAL SOLUTION FOR THE UTILIZATION OF SUCH DEVASTATED PLACES WOULD BE LAND AND WATER RECYCLING IN TERMS OF "EARTH ART." RECENTLY, WHEN I WAS IN HOLLAND, I WORKED IN A SAND QUARRY THAT WAS SLATED FOR REDEVELOPMENT. THE DUTCH ARE ESPECIALLY AWARE OF THE PHYSICAL LANDSCAPE. A DIALECTIC BETWEEN LAND RECLAMATION AND MINING USAGE MUST BE ESTABLISHED. THE ARTIST AND THE MINER MUST BECOME CONSCIOUS OF THEMSELVES AS NATURAL AGENTS. IN EFFECT, THIS EXTENDS TO ALL KINDS OF MINING AND BUILDING. WHEN THE MINER OR BUILDER LOSES SIGHT OF WHAT HE IS DOING THROUGH THE ABSTRACTIONS OF TECHNOLOGY HE CANNOT PRACTICALLY COPE WITH NECESSITY. THE WORLD NEEDS COAL AND HIGHWAYS, BUT WE DO NOT NEED THE RESULTS OF STRIP-MINING OR HIGHWAY TRUSTS. ECONOMICS, WHEN ABSTRACTED FROM THE WORLD, IS BLIND TO NATURAL PROCESSES. ART CAN BECOME A RESOURCE, THAT MEDIATES BETWEEN THE ECOLOGIST AND THE INDUSTRIALIST. ECOLOGY AND INDUSTRY ARE NOT ONE-WAY STREETS, RATHER THEY SHOULD BE CROSSROADS. ART CAN HELP TO PROVIDE THE NEEDED DIALECTIC BETWEEN THEM. A LESSON CAN BE LEARNED FROM THE INDIAN CLIFF DWELLINGS AND EARTHWORKS MOUNDS. HERE WE SEE NATURE AND NECESSITY IN CONSORT.

063 Excerpt from Smithson, Robert. *Untitled* (1971) (Smithson 1996, 376) Written after the *Sonspeek 71* exhibition in the Netherlands in 1971, Smithson in his writings refers to his observation of a dialogue between man and landscape and a more committed consciousness regarding the environment, existing in the Netherlands at this time - and one which he proposes for the USA. He raises the argument for the need for the reclamation of disused mining sites - "devastated places" - through the creation earthworks, as well as the necessary need for dialogue, through the mediation of the artist, between industrialist and ecologist (parties which are polarities). Smithson implies that much can be learned from anthropology, where in non-consumerist societies (such as those of native Americans) there is a balance between human need and the environment.

Copper Mining Pit - Utah Reclamation Project

Artist: Robert Smithson

Date: 1973

Medium: Photostat and plastic overlay with wax pencil

Dimensions: 47 x 34.3 cm

Location: New York, The Metropolitan Museum of Art

In 1972, Smithson sent a proposal to the Hanna Coal Company in Utah suggesting the commission of an 'earth sculpture' to be incorporated in their reclamation program. He noted that "such a work would exist as a concrete example of how art can enter the social and educational process at the same time" (Smithson 1996, 379). Pursuing this, Smithson aimed to incorporate the project in the Ohio State University conference on new approaches to art education on April 2-8, 1973. The mine stalled their response to what could be seen as unwelcome proposition and also because the mine was still active (Oldham 2015, 44).

The Bingham mining site is an example of the problem posed by large mining pits and the need to consider other solutions e.g. "The Bingham site was the largest man-made hole in the world, and the paradox of its reclamation was that it would require the demolition of an entire mountain to fill it again" (Martin 2001,172). Land art would therefore have a role to play in the process of reclamation. However, art historian Ruth Oldham (2015, 44) notes that the attraction of land artists to such sites was not surprising "as the scale of the industrial interventions in the land tended to exceed anything they could hope to achieve on limited arts funding budgets."

At the bottom of the pit, Smithson envisaged a pool of bright yellow water (due to acid rock drainage) and proposed four arc-shaped jetties that would rise and fall according to rain levels and which would rotate (on a massive rotating disk) so that from one position, the viewer could have a 360° panoramic view[66] of the spiraling walls – the spiral being a concept that Smithson explored in earlier works e.g. *Spiral Jetty* in 1970 and *Broken Circle and Spiral Hill* in 1971. Paradoxically the pit could be seen as symbolic of the spiral descent into hell such as in Dante Alighieri's *Inferno* from his fourteenth century work *Divine Comedy*, but with the reflection on the surface water of the Bingham mine pit inverting the vast vertical vista of the sky above. The descending terraces of the pit resemble Dante's levels of hell as later illustrated in Botticelli's *Map of Hell* (1485). Architect, Timothy Martin states that "

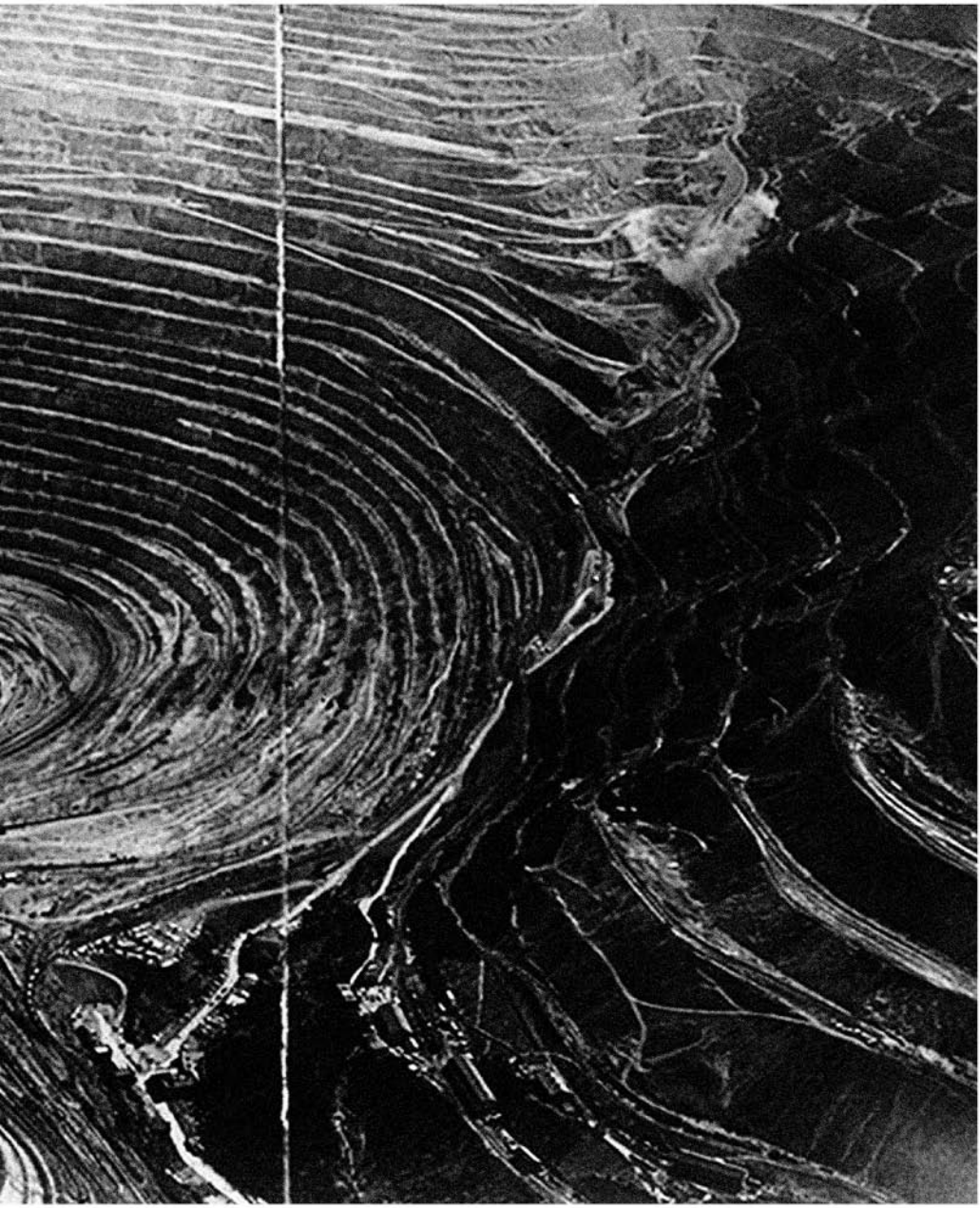
Smithson proposed his own paradox made of jetties and lake, part Dantesque vision of infinite descent, but also an inverse glimpse of the sky - double vanishing point of infinite depth and height" (Martin 2001, 172).

The work in being a paradox, therefore would have also reflected the "inconsistencies" and "paradoxes" of democracy needed in finding solutions in post-industrial reclamation (Martin 2001, 174). The site could have been seen as a 'garden' in much the same way as the British gardens operated – the pit would be a place where democracy can reflect, can see the material of the site as a narrative and "pre-narrative" in "solid time". Martin's view is that "things in this garden, are markers of time, and even people are subject to entropy, to the disintegration of biological life downward into the earth upon which they gaze. From the deepest hole in the world one sees a territory where democracy is democracy precisely because it is the political philosophy that includes and enjoys its own material inconsistencies and paradoxes" (Martin 2001, 174). Smithson therefore reasoned that, "Art on this scale should be supported by the [mining] industry" (Smithson 1996, 180). Martin states that through Smithson's work "such a remote site would encourage the ecologist to actually go out into the devastated areas of nature to encourage his or her material existence" (Martin, 2001, 172).

Had Smithson's proposal materialised (although perhaps impractical if the mine was still operational), one can envisage that his project for Bingham Mine would have been a profound one – not only as his largest and most ambitious work at the time, but also for his foresight in posing large-scale reclamation solutions. Smithson grasped the engaging aesthetic of open cast mining pits but in relation to the rejection of such a project, Ruth Oldham (2015 44) notes ironically in 2015, that the visitor centre (created in 1992) had received over three million visitors as the sheer monumentality of the pit viewed from above was an attraction in itself.

064 *Panoramic view of Bingham Canyon Open Pit Copper Mine, looking South TICA Negs. #1348, 1349 - 29 Oct 74*

065 Smithson, Robert. *Bingham Copper Mining Pit - Utah Reclamation Project. 1973.*



Opus 40

Artist: Harvey Fite

Date: 1939 -76 (Unfinished)

Material / Medium: Bluestone

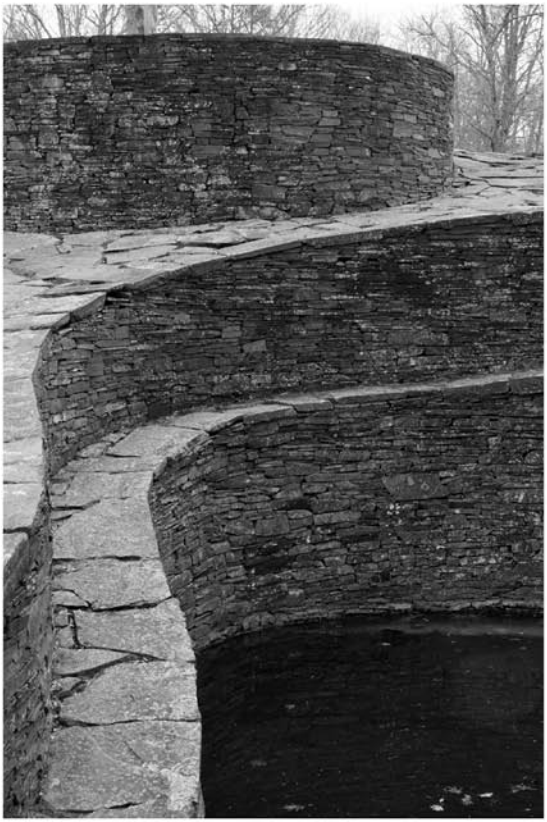
Dimensions: 6.5 Acres

Location: Saugerties, New York

Opus 40, begun in 1939, predated the Land Art movement of the 1960s and 70s, but this project's inclusion in the exhibition, *Probing the Earth: Contemporary Land Projects* at the Smithsonian's Hirshhorn Museum and Sculpture Garden on the National Mall in Washington DC in 1978 (after Harvey's death in 1876) alone - with works of well known Land Artists of the time - gave it prominence as an Earthwork[67].

Opus 40, was a forty-year project to re-purpose an abandoned bluestone quarry as a 'stage' for Fite's sculptures. He had previously engaged in a career in the theatre and fine arts and, after working with an archaeological team on ancient Mayan settlements in Honduras, had become interested in ancient masonry methods. Fite used the bluestone from the abandoned quarry on the property and single handedly employed ancient techniques of shaping the stone. Without a plan and conceiving of the work as he sculpted - using dry key stone masonry technique - Fite set about the construction of various forms of terraces, ramps, walkways and stairs on the 6.5 acre site. As the work progressed, nature was incorporated as Fite took cognisance of existing water and trees in his work and the natural lines and curves blend into the woodland environment[68]. When erecting a nine-ton, fourteen-foot monolith in the centre of the quarry in the 1960s, Fite acknowledged that the rock was in itself superior to anything else that he had created and therefore chose not to sculpt it. The rock was an earthwork in its own right and so Fite moved his statues to another location. It is suggested that "the image of the great rock rising above the ruins of modern industry, with art serving as a mediator, is a powerful one, and one that would be repeated by Smithson and Heizer in their quest to escape the high-entropy, dead-end path of the avant-garde" (Fisher 2000, 76).

066 Top: 1938? Photo of quarry. Harvey Fite bought the quarry from Rosalie Calson; Middle: 1903? Photo of Van Bermer Brothers quarrying before Harvery Fite. The bluestone quarry was used for flagging and house trimmings; Bottom: 1976? Harvey Fite died following a tragic accident while working on *Opus 40*.



067 (left) One of the many pools Harvey Fite built into the structure of Opus 40. (right) One of the deep recesses or "subterranean passageways" on site. Note the contrast between the original quarry wall on the right and to the left the wall built by Harvey Fite.

068 An aerial view of the Monolith at *Opus 40* in Saugerties. Devin Ross Aerials.

Art Park: Spoils' Pile Reclamation

Artist/s: Helen Harrison and Newton Harrison (Artists); Joshua Harrison (Project Organiser); Cam Slocum (Project Associate)

Date: 1976-1978, ongoing

Site: Disused Quarry containing clay and rock

Material / Medium: Approximately 3,000 truckloads of earth and organic debris (leaves, tree trunks, grass cuttings, sludge etc.)

Dimensions: 20 Acres

Location: Art Park, New York (Land next to the Niagara River, near Lewiston)

Artist/s Quote: "This restoration of the landscape (actually a 3000 pile earthwork that morphed into a flowering meadow) was far cheaper than the intensive rehabilitation typically undertaken to repair a site this damaged."[69] The artists took on works when the "client" or beneficiary was the environment. Additional prerequisites were, collaborative, with community involvement in the project[70].

The *Art park Foundation* used the quarry site which had been filled with debris from the Niagara Power Plant, for various earth works. The site was used by emerging land artists in the 1970s and most works were of a temporary nature. The *Harrison Foundation* that had been commissioned to create a permanent earthwork in part of the area, set about regeneration in the least labour-intensive and cost-effective way - using natural and native materials. A 20 acre area, consisting of surface (clay and rock) and closest to the entrance of the quarry, was regenerated by allowing the public to dump soil and organic debris according to a procedure posted on a signboard. Local public participation was motivated by the area being the nearest dump site and also through eligibility for tax deduction as the waste would then constitute a donation of art material. After about 300 truckloads of earth were accumulated over a period of two years, the piles were flattened and merged. Trees were then planted to create windbreaks and orchards and, after further soil enrichment, indigenous seeds - collected by local youth - were planted to create a flowering meadow[71].

069 Mounted sign showing the *Art Park: Spoils' Pile Reclamation*. 1976-1978.

070 Sequence of eight photographs showing the process of *Art Park: Spoils' Pile Reclamation*. 1976-1978. Left: A sequence of images shows the deposition of debris dumped on the site. Right: a sequence of images showing the subsequent growth of vegetation on top of the deposited debris.

Quarry III - Wedge/ Stone Boat

Artist: William Bennett

Date: 1976-1988 and ongoing

Site: Limestone quarry Southwest corner of Jamesville Quarry (disused) in Jamesville, New York.

Material / Medium: Limestone

Dimensions: *Wedge (Stone Boat)* begun 1976: 24.4m x 3m x 1.8 m; *Inverted Pyramid* (proposed): 48.8m x 48.8m x 6.1 m

Location: Southwest corner of Jamesville Quarry - Jamesville, New York.

William Bennett used the abandoned Bloomington Quarry in Indiana for material which the rubble pile provided and which could be sculpted on site. In 1972, he created *Quarry I*, a large freestanding sculpture on site from this refuse pile[72]. However, the scale of large sculpture paled in comparison to that of the quarry (Reuterswärd, 1982). and the layers of buff colour Indiana limestone with a charcoal coloured rock on the wall began to suggest the possibility the quarry wall itself being material to be sculpted, rather than viewing it as a source from which to procure stone for the creation of sculptures. In *Quarry II,* Bennett then embarked on a three-year project (1973-1975) of transforming the wall and the floor of the quarry with no set plan,[73] Bennett's ideas and work took shape as he progressed within the quarry. The cleared floor of the quarry appeared as a stage and carving the backdrop wall, by following the veins and contours of the rock, he created a 'lava flow' from a circular space which in turn changed the ideas he had for his 'stage'. Sculpture of the floor extended across it forming a transverse axis to that of the wall and changing the perception of the sculpted wall from merely being an attempt to represent nature (Reuterswärd 1982).

Earth Day in 1970, had begun to create increased environmental awareness however, Bennett did not set about his quarry projects with reclamation in mind. It was after hearing the manager of the Jamesville Quarry talking about reclamation on the radio, that Bennett saw the opportunity to approach him with the view to using the quarry to make his sculptures. The manager was sympathetic to art as reclamation, however the area which Bennett had selected was not destined for reclamation (which consisted of the planting of trees). In his artist's statement, Ben

nett describes the Jamesville Quarry Site as "a magnificent industrial ruin". He points out that, at the time, quarries were considered to be ruins, rather sites of destruction, because they were used as a source of material (such as limestone) to create beauty e.g. in sculpture and in buildings. The Syracuse escarpment on the Onondaga geological formation (stretching in a line from east to west across N. America) consists of sedimentary stone laid there when Great Lakes were bigger. Man's subsequent activity revealed a primeval seabed in the earth and the power of this drew Bennett to the site. Bennett says, "In my proposal to the quarry, I made the case that the remains of the quarry process, where I proposed to site my piece, were magnificent! It was a piece of the desert south west, eroded by man instead of by the natural elements."[74]

In 1976, supported by the National Endowment for the Arts, Bennett secured the use of the Jamesville Quarry from Allied Chemicals who also lent him the tools to create his work. This quarry was much larger and the limestone coarser and more brittle than the site at Bloomington and so a plan was needed before any work was undertaken (Reuterswärd, 1982). Bennett used photo simulation as preparatory work but, for this project he presented a cardboard model of the *Inverted Pyramid* structure proposed as one of the pieces. He points out that more detailed planning and drawings would have been required if workers were needed, but it was a solitary pursuit[75].

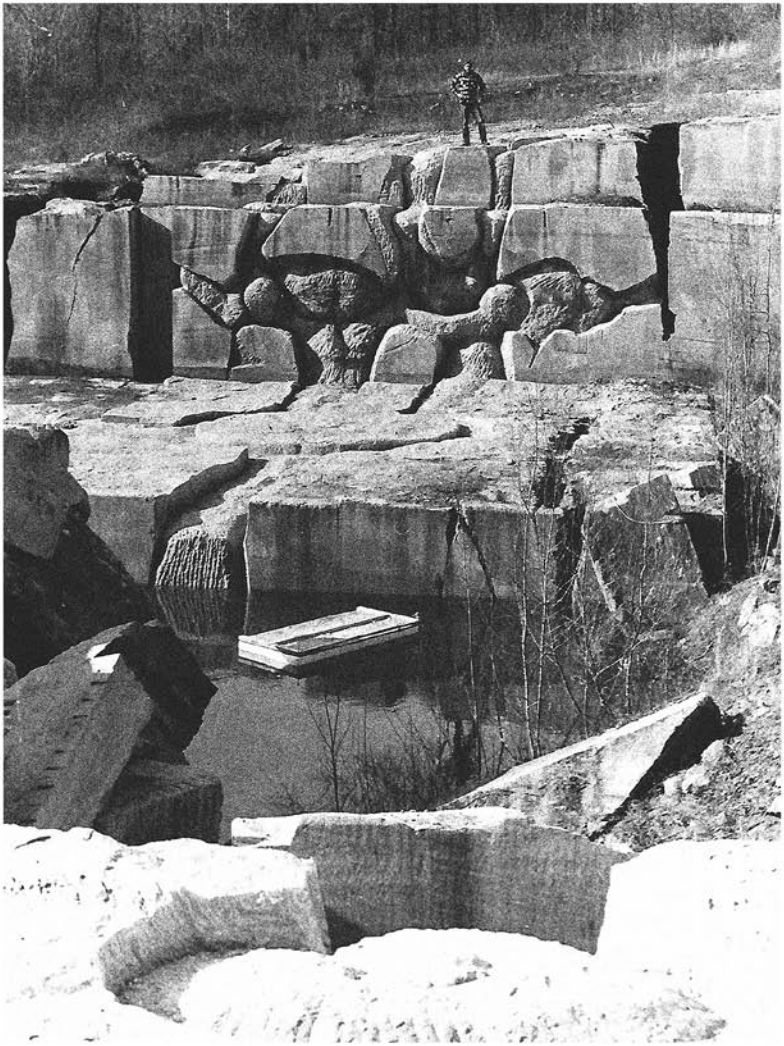
The quarry floor is often flooded after rainfall and this is when the idea of a boat came to Bennett; *Wedge (Stone Boat)* being the first piece made with *Inverted Pyramid* proposed. The visitor is meant to walk into the piece starting at the shallow end, following the path (the "keel" of the wedge), for eighty or so feet to the end, at which point they would be six feet under the surface level, facing a stone wall." The approximately 8 inch walkway means that you have to walk deliberately or ceremonially with one foot in front of the other, and then when at bottom the visitor turns around and faces the eastern sky. When at the deepest part of the keel below the grade of the quarry floor, the quarry floor would be a horizon for someone standing at this end. Bennett likens the experience to a telescope which channels the view but conversely launches you and your view into the bigger universe. Walking east to west is in the line of the Onondaga formation on which the quarry lies and the direction of this work. Also, walking into the earth, turning and walking is an architectural experience. The second part of the boat, the triangular end of the work, is made up of "stone laid flat, sedimentary layers aligned with how the layers of the stone were created" The third part, the sides of the wedge is composed of "planar surfaces of the stone parallel to the planes of the sculpture."[76]

Of the process, Bennett notes: "I originally wanted the Jamesville Sculpture to be carved into the floor of the quarry. I was interested in crisp geometric forms and the limestone was too broken up to yield a planar surface.

Plan B was to excavate into the floor of the quarry and build the surface using dry stone construction. I would drive to the port of the quarry which was still active. After the blast, I would walk through the rubble in search of pieces with a smooth surface. I would take these back to my site and carve them so they would form the planar surface I was after. Excavation of the Wedge Stone boat was mostly done with hand tools. Some very solid parts were drilled with a rock drill. Stone was split using slips and wedges, traditional quarrying tools."[77]

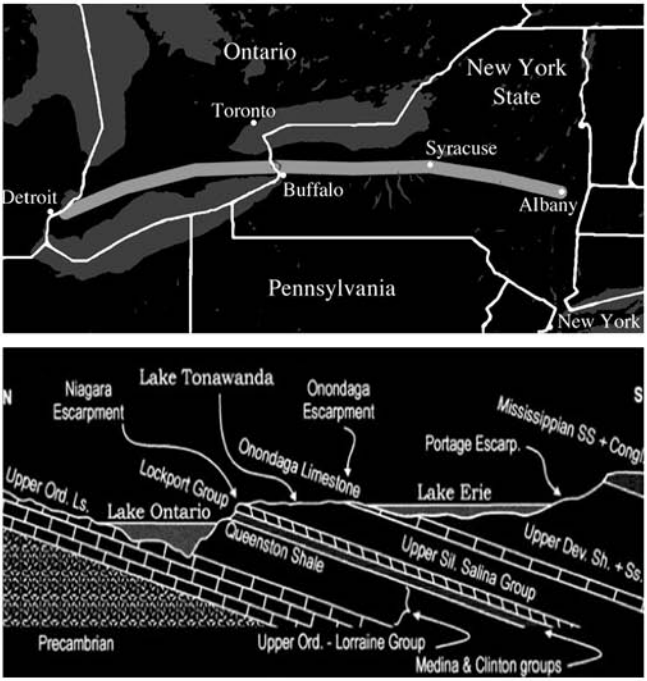
When referring to what Bennett calls *Quarry III*, Swedish art historian and writer, Patrik Reuterswärd (1982) describes this work as a "tomb-like" negative pyramidal depression of approximately 14m^2- within which a pyramid is set beginning halfway up to ground level - connecting to a wedge-shaped pit and acting as an "axial coordinator". The two connected pieces have the appearance of "the breech sight of a gun, as though aimed at an awaited solstice on the horizon". When referring to the edge-shaped pit (the apparently easier work and begun first) Reuterswärd notes that it "reverses the concept of a way down into a tomb, and instead of leading downwards, its upward narrowing pathway points back to the ground level and to the vast structure to come, beyond (Reuterswärd 1982, 145-146). This work is still in progress, evolving over time.

Reuterswärd implies the changing nature of the sculptor in the creation of large-scale earthworks, for once such a project "implies the cooperation of professional quarry workers with bulldozers and other equipment the sculptor-designer [is] raised to the level of art director" (Reuterswärd 1982,146). Furthermore, he notes that the relevance of earthworks in quarries and mines such as William Bennett's (which follow Smithson's earthworks and Smithson's advocation of art as reclamation), as being important for the future as "it has returned the artist to a place within society. And even more so a place where society has become aware of how useful, after all, art can be. Instead of remaining a voice in the wilderness, the artist may here become indispensable by the very utility of his services." Such "socialization of land art" gives a "platform" to the artist (Reuterswärd, 1982, p.146).



071 *Quarry II*, Large wall and Artist, 1975, carvings into wall and floor surfaces of an abandoned Limestone Quarry, Bloomington Indiana.

072 Aerial view of the abandoned Limestone Quarry, Bloomington Indiana.



073 Compilation of images showing Onondaga Formation. Top: The map of the orientation of the Onodaga Formation a line curving from east to west and vice versa passing between Lake Erie and Lake Ontario. Below: Geological cross-section cutting through the middle of the Onodaga Formation between lake Erie and Lake Ontario where Lake Tonawanda once stood 10,000 years ago at the end of the last ice age. This vast area, where the disused limestone quarry at Jamesville (New York) lies, was once beneath water in prehistoric times.

074 Quarry III. Photo Simulation. *Wedge/ Stone Boat*, foreground; simulation of *Inverted Pyramid*, background.1976-1988.

075 Aerial view of the Southwest corner of Jamesville Quarry - Jamesville, New York.

076 Views looking into facing east (left) and within (right) of Quarry III - *Wedge* within the Jamesville Quarry, Jamesville, New York.

077 View facing Quarry III - *Wedge* within the Jamesville Quarry, Jamesville, New York.

King County Arts Commission Project

The King County Arts Commission Symposium - July 31 - August 18, 1979 (King County 2013) which took place in Seattle, Washington, USA was a sponsored project entitled, Earthworks: Land Reclamation as Sculpture. The aim of the project was to reclaim "technologically abused land" in King County (comprising of open-cast excavations and landfill sites due to King County's extensive mining history - principally coal mining and quarries supplying the building industry). Reclamation would take the form of sculpted Earthworks - "where site and object are one and the same"- as an alternative to more costly, commonly-used methods of reclamation. The project claimed to be innovative as it was an endeavour no governmental agency had attempted on any significant scale before. And it aimed to serve as a national model with drawings of the works subsequently placed on exhibition throughout the country for two years.

The artists and projects chosen were as follows:

- Robert Morris. *Untitled Reclamation Pit (Johnson Pit#30).*
- Iain Baxter. *Told River Steppes (Carnation Pit#50).*
- Richard Fleisher. *Proposal for Lakeside Sand and Gravel Pit.*
- Lawrence Hanson. *Stoned Reflector (Snoqualmie Pit).*
- Mary Miss. *Enclosure for Viewing with Passages and Courts.*
- Dennis Oppenheim. *Waiting Room for the Mid-night Special (A Thought Collisions Factory for Ghost Ships)*
- Beverly Pepper. *Montlake Landfill Proposal.*

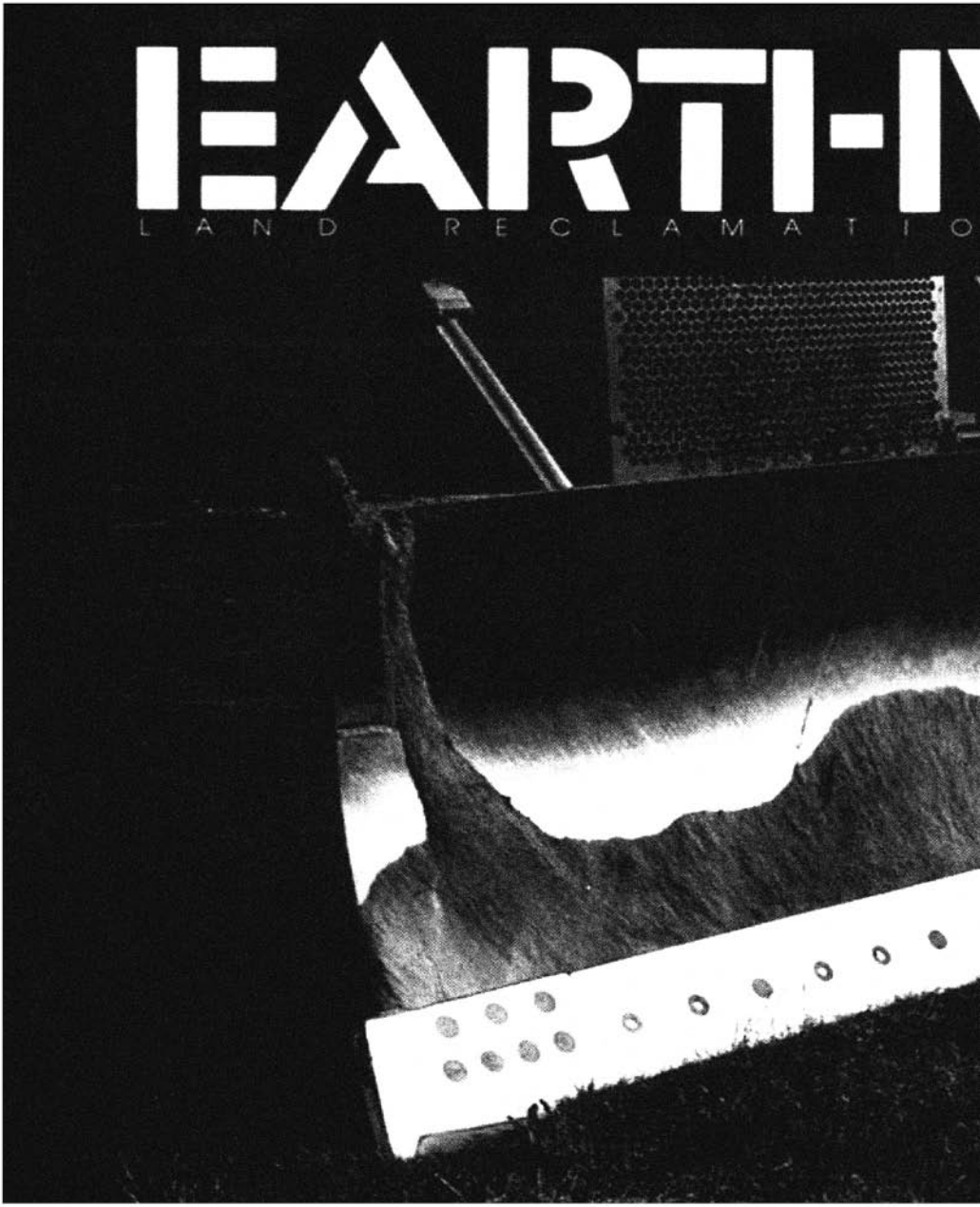
At the outset, the group of artists (already internationally recognised for their environmental art) consulted the communities in which their works were to be created. However local public reaction to the projects remained divided and so not all the works fulfilled an original purpose to be entirely a work of art and they did not have the longevity initially perceived - with the exception of Robert Morris' 1979 *Untitled Earthwork (Johnson Pit # 30)* which is the only one remaining. Morris' Earthwork, rather than being a work of art, is used by the public as a park and has had to be maintained by the local council with maintenance costs that were not considered at the time of its creation. Despite the demise of their works in later years, the artists in this Seattle symposium proposed noteworthy questions in relation to the idea of earthworks as reclamation:

- What constitutes art?
- Who decides?
- The "public" never really asks for "public art" so is there really such a thing?

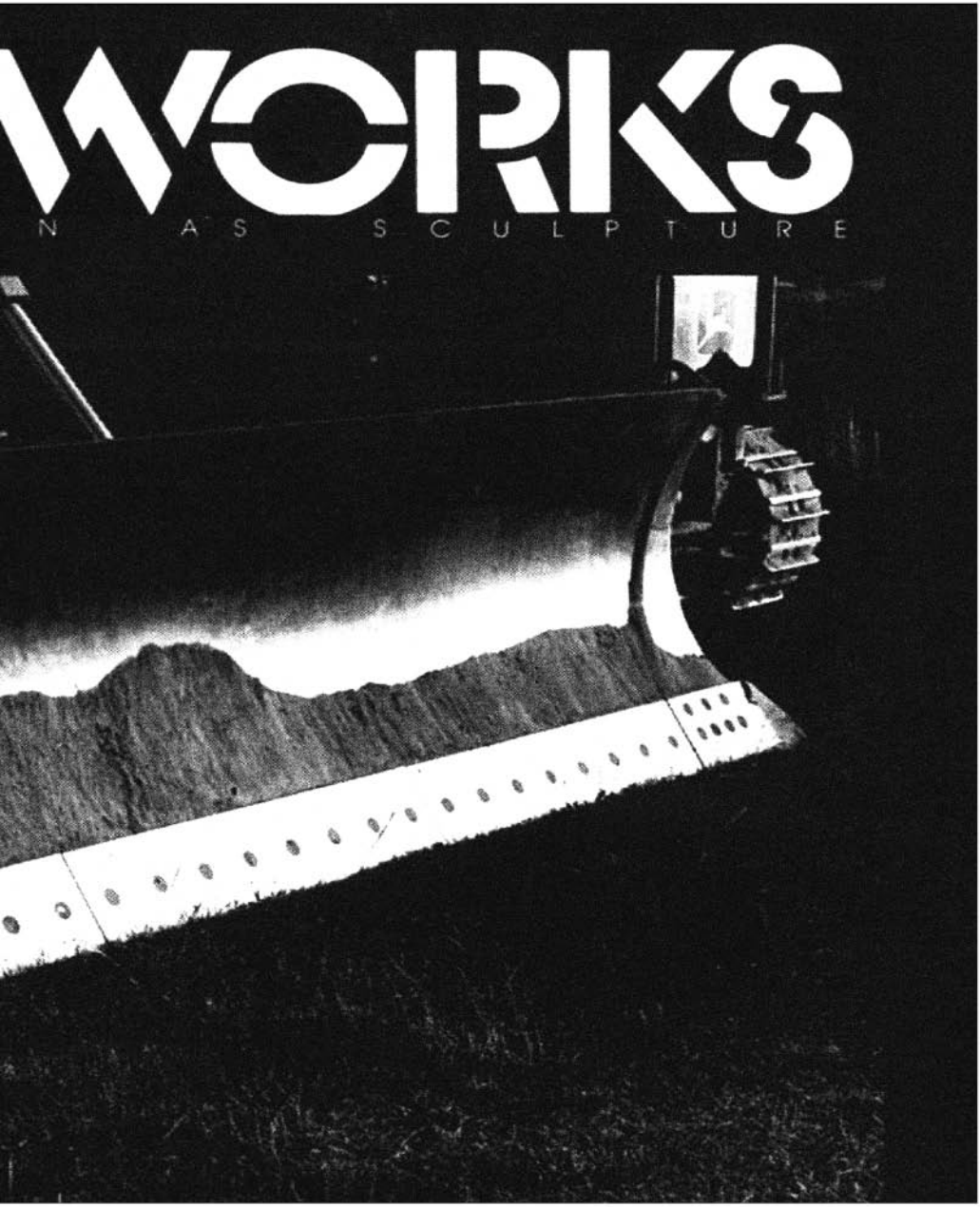
- Who is the public in public art?
- What makes public land a "park"?
- Is art itself acceptable as a publicly owned space, or must it perform a specific function to be useful?
- Can public art be proclaimed aesthetic by consensus, or will the artist retain the traditional right to make a personal statement?
- Should government buy art, or just support the arts?

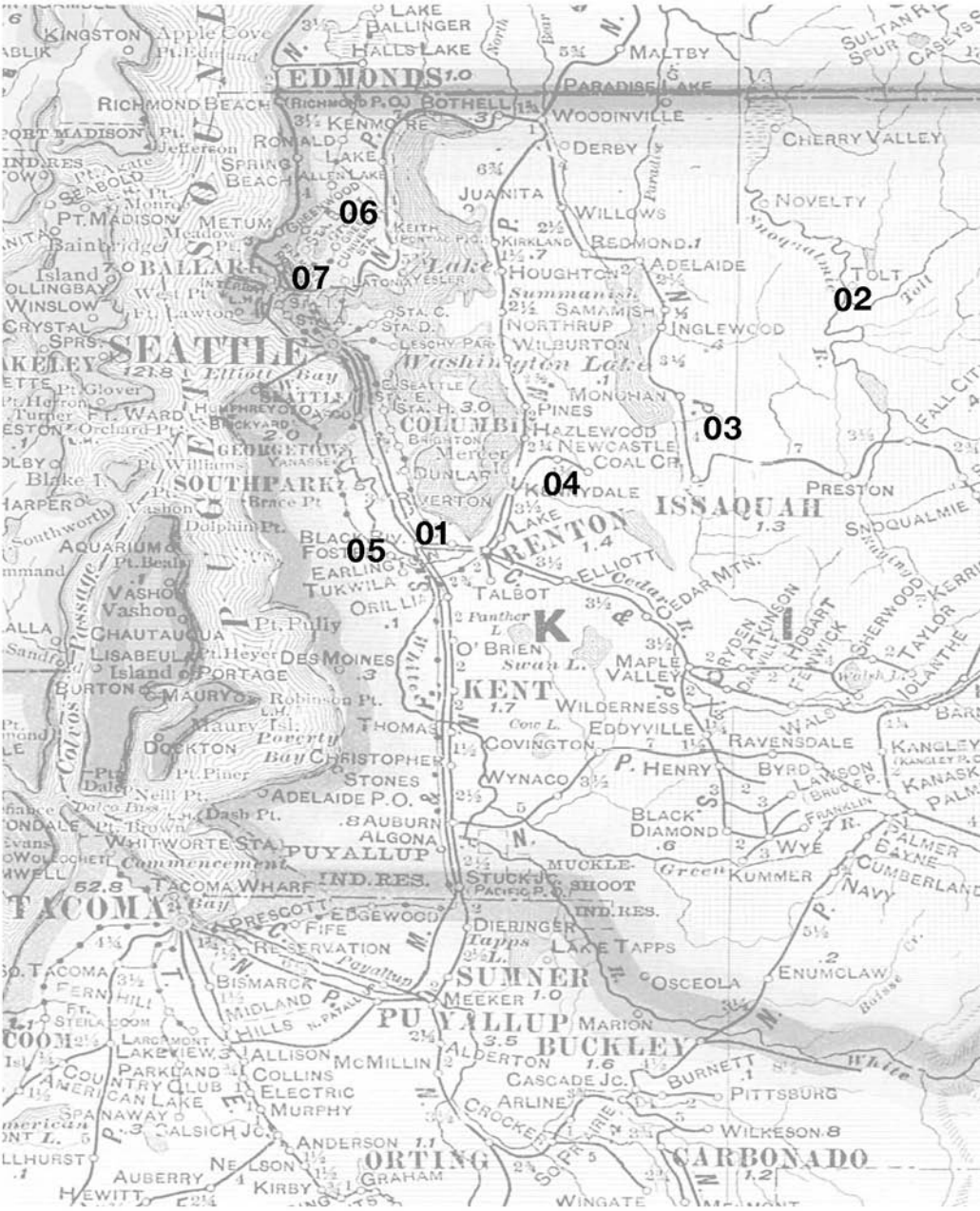
Robert Morris, in his address, opened up a further and somewhat contentious issue as he considered the degradation of art along with that of the earth. He pointed out that art as reclamation, could eliminate 'technological guilt' where destructive mining activities are sanctioned because these sites can be cheaply transformed into a work of art which can also be used for recreational purposes (Morris 1979).

In the revised text of his address at the symposium, *Notes on Art as/and Land Reclamation*, (Morris 1979) Morris condemned man's abuse of the environment (especially that in surface mining associated with the worst environmental consequences) in order to perpetuate man's dependence on commodities reliant on natural resources. Also he observed that the wording of legislation at the time, caused loopholes where reclamation simply involved mere "aesthetic" leveling of earth. With implementation of better legislation for land reclamation projects and availability of funds for site-specific projects, he proposed that artists could be supported. However, Morris criticised the idea of 'art as a commodity' – an object given value by society based on its aesthetic value and moreover being equated with a cheaper means of reclaiming environmental destruction and rather than a need for art to play an innovative role in the service of mine reclamation. He cautioned against mine reclamation 'sanitising' destruction of the environment and therefore perpetuating destruction because it could be 'cleaned up' afterwards. Morris' point of view is one of perspective; we can choose to see the physical evidence "of our faith in science and technology as "monuments [celebrating] the leading faith of the age - or, in retrospect, the prevailing idiocy" He justifies the creation of art works in reclamation ventures because it is an "epiphenomena" (Morris 1979, 100); art has always served forces of ideology and history – without questioning its morality. He warned that "if the only rule is that art must use what uses it, then one should not be put off by the generally high level of idiocy, politics and propaganda attached to monuments – especially if one is in the business of erecting them" (Morris 1979, 102).



078 Cover of the Earthworks Symposium brochure, 1979. King County Archives Series 278


WORKS
N AS SCULPTURE



079 Map of King Country (1909) with overlay (made for this thesis) showing the location of the various projects for the King County Arts Commission's reclamation symposium in 1979. 01. Untitled Reclamation Project (Johnson Pit #30); 02. Tolt River Steppes (Carnation Pit #50); 03. Proposal for Lakeside Sand and Gravel Pit; 04. Stoned Reflector (Snoqualmie Pit); 05. Enclosure for Viewing with Passages and Courts; 06. Waiting Room for the Mid-night Special (A Thought Collisions Factory for Ghost Ships); 07. Montlake Landfill Proposal.

Skykomish
River
Baring
Grotto
Berlin
Skykomish
Halford
Heybrook Spur
Corea
Nippon
Tonga
Alvin
Scenic
McCain P.O.
Wellington
Cascade Tunnel
Stevens Pass
Snoqualmie Falls
North Bend
Snow L.
Red Mt.
Mt. Thompson
Laconia
Kendalls Pk.
Snoqualmie Pass
Sallal (Tanner P.O.)
Ragnar
Garcia
Bandera
Moncton
Cedar Lake
Hemlock
Weston
Wesson
Mt. Anderson
Yakima Pass
Keechelus
Keechelus
Lake
Lake
Kachees
Lemolo
Eagle Gorge
Stampede Pass
3,639 feet
Stampede
Borup
Kennedy
Weston
Humphrey
Maywood
Hot Springs
Lester
Whittier
Martin
Upham
Easton
Easton Sta.
Talmage
Lavender
Nelson
Cle Elum Lake
Green
River
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01 Untitled Reclamation Project (Johnson Pit #30)

Artist: Robert Morris

Site: Gravel pit

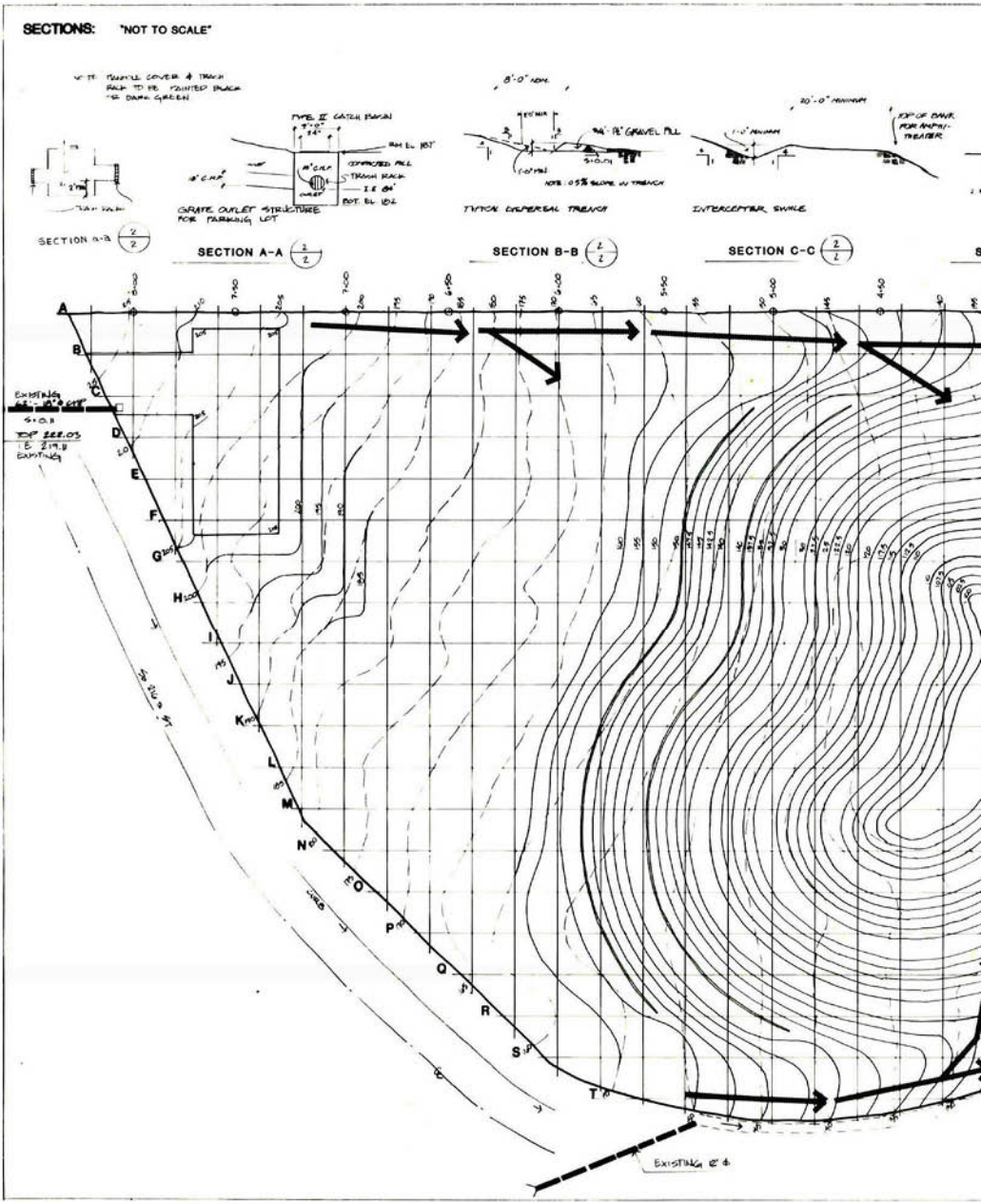
Dimensions: 1.5 hectares

Location: South 216th Street, King County, Washington, USA.

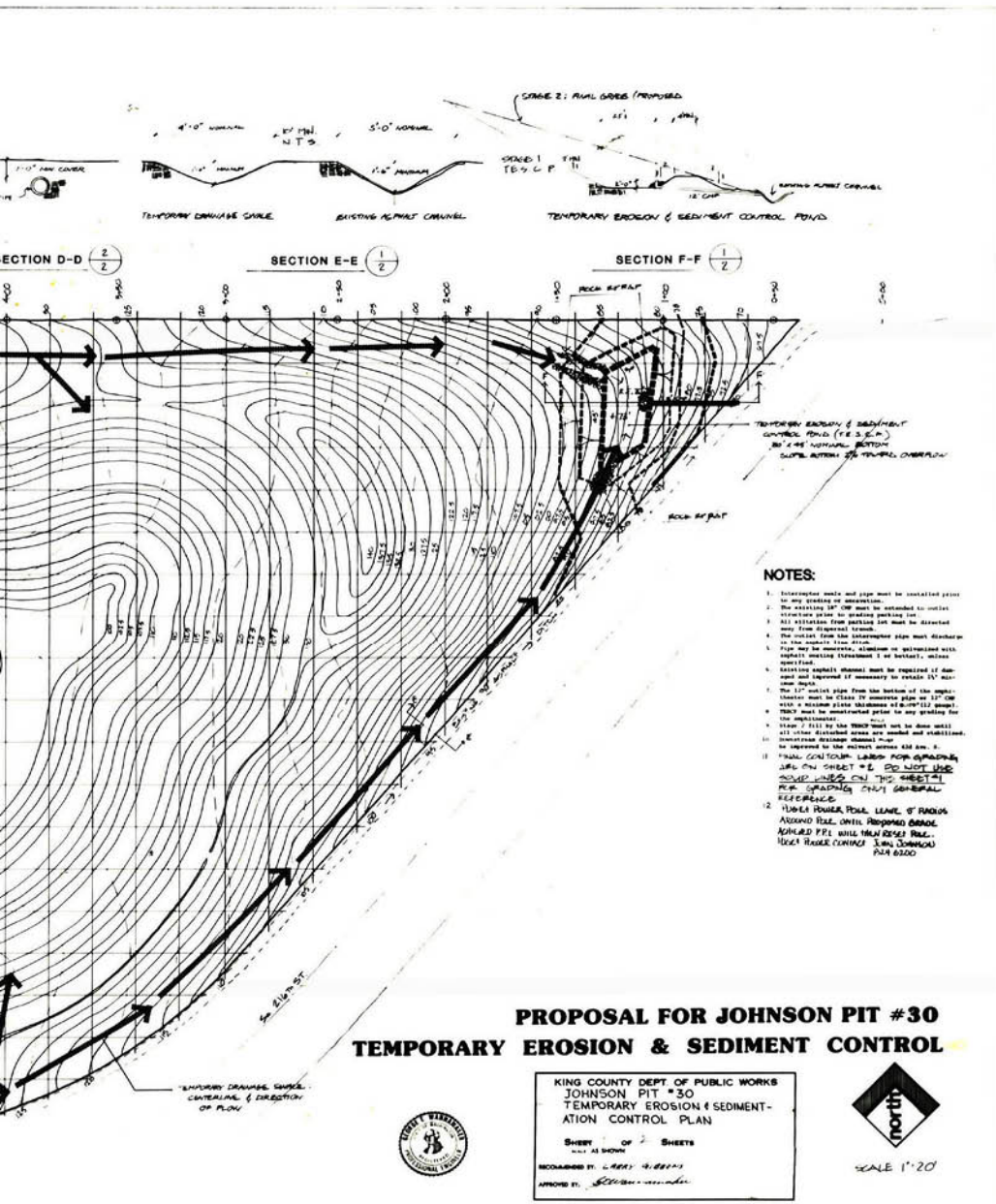
Robert Morris' work, *Untitled reclamation project (Johnson Pit #30)* - accompanied by the required delivery of an address, which Morris later revised to N*otes on Art as/and Land Reclamation, 1979* (Morris 1979) - was part of a project entitled, *Earthworks: Land Reclamation as Sculpture* (including the work of seven artists at different sites in the area). Morris' plan for the site was subject to review and approval by the King County Arts Commission and the County Department of Public Works who funded the work along with funding by Art in Public Spaces program at the National Endowment for the Arts (King County 2013). It was also one of the first post-mining sites to receive funding after the implementation of the 1977 Federal Surface, Mining control and Reclamation Act of 1977 [78]. Controversy over elements in the work e.g. the removal of vegetation and leaving of blackened tree stumps which Morris wanted as a "ghost forest" representing man's destruction of the area for industrial purposes, gave him a platform to defend not only the necessity of art as public work, but also the freedom that must be given to artists to make choices in such works. He pointed out that the artist's role was not to "transform devastation into inspiration" but rather to make moral and aesthetic choices which meant not choosing to transform such sites into "idyllic and reassuring places, thereby redeeming those who wasted the landscape in the first place" (Beardsley 2006, 90 – 94).

At the base of the asymmetrical gravel pit, with its lower section tilting towards a hill, only the sky is visible but from the outer perimeter the rural Kent valley and Cascade Mountains are visible (Beardsley 2006, 90 – 94). The west side of the slope was left as a gradual slope but terraces were cut into the eastern side as Morris was inspired by the use of terraces in Persian and Mogul gardens and Peruvian amphitheaters (and saw them as effective – still being used in hillsides, mines and embankments on roads). The site was cleared of vegetation with the exception of a line of blackened tree stumps, on the western side (seen as "symbolic of a ghost forest"). The entire site was planted with rye grass [79].

As landscape changes over time, so have the considerations as to the value and necessity of keeping such a work of art. From a work in a rural setting, it now has acquired a utilitarian use now having become a green space in a built-up residential area. Therefore, the desire for natural degradation (central to many land art works e.g. as Smithson's and Heizer's) is undesirable and the site has been reconsidered for redevelopment. However, being a cultural work of art worth preserving, it has been kept but with necessary modifications. In 1994 restoration, in consultation with Morris, saw the replacement of blackened tree stumps and the addition of a stepped wooden pathway (to prevent erosion of the terraces) and benches to sit on [80].



080 King County Department of Public Works proposal for Johnson Pit # 30 Temporary Erosion and Sediment Control. King County Archives Series 1747.


STAGE 2: FINAL GRADE (PROPOSED)
4'-0" NORMAL
5'-0" NORMAL
TEMPORARY DRAINAGE SWALE
EXISTING ASPHALT CHANNEL
TEMPORARY EROSION & SEDIMENT CONTROL POND
SECTION D-D
SECTION E-E
SECTION F-F
ROCK REPAIR
TEMPORARY EROSION & SEDIMENT CONTROL POND (T.E.S.E.P.)
TEMPORARY DRAINAGE SWALE CONTAINING & DIRECTING FLOW
NOTES:
PROPOSAL FOR JOHNSON PIT #30
TEMPORARY EROSION & SEDIMENT CONTROL
KING COUNTY DEPT. OF PUBLIC WORKS
JOHNSON PIT #30
TEMPORARY EROSION & SEDIMENT-
ATION CONTROL PLAN
SHEET OF SHEETS
SCALE 1"=20'

081 Morris, Robert. *Johnson Pit #30. Left:* under construction. Right: Just after completion. Photos by Colleen Chartier.

02 Tolt River Steppes (Carnation Pit #50)

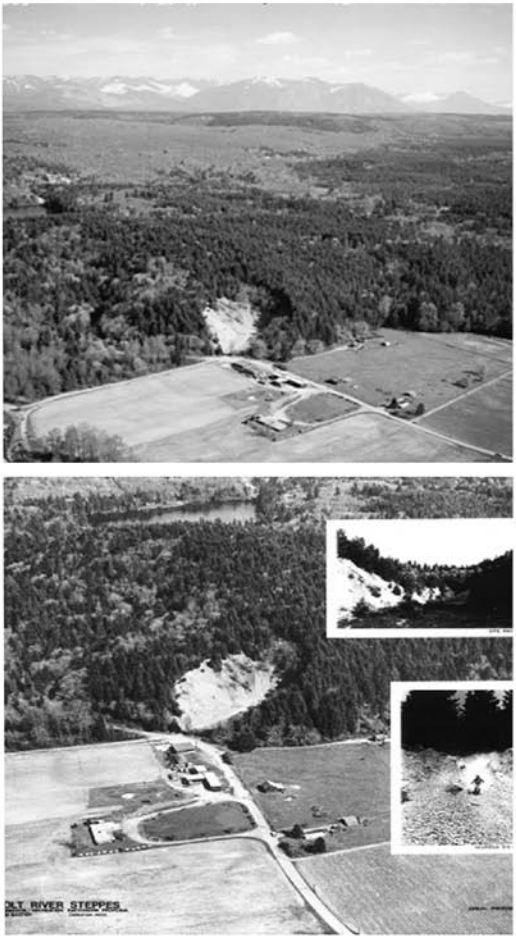
Artist: Iain Baxter

Site: Gravel pit

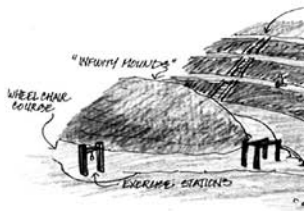
Dimensions: 134 acres

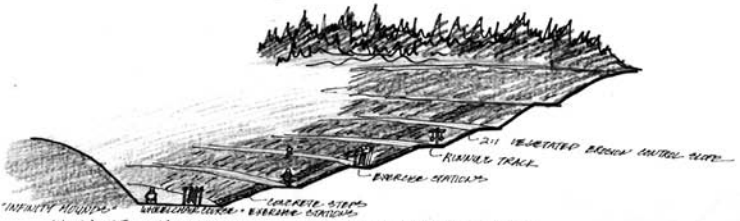
Location: CN.E. 32nd Street and 328th Avenue SE, Snoqualmie Valley, King County, Washington, USA.

Due to the steep sides of the gravel pit posing erosion problems, Iain Baxter (a conceptual artist) designed what he saw as "a great sculptural place … a sort of park, a whole family experience," in a "134-acre semicircular amphitheater-like pit that descended to a platform where two mounds were placed to form an infinity symbol." Its recreational use was facilitated by covering the "steppes" in asphalt for jogging tracks on which exercise stations were placed. A further track around the "infinity mounds" allowed wheelchair access and was equipped with ten fitness stations. The project appeared to have overlooked the close proximity of other family fun theme parks in the area and was impractical as an exercise park, being located away from populated areas. (King County 2013)



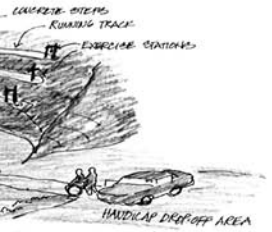
082 Aerial photos of Iain Baxter's intervention site (top and below). King County Archives Series 1747.



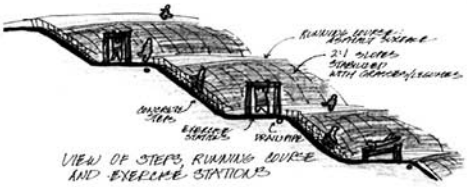


TOLT RIVER STEPPES
RECLAMATION / RECREATION EARTHWORK PROPOSAL
BY IAIN BAXTER **CARNATION, WASH.**

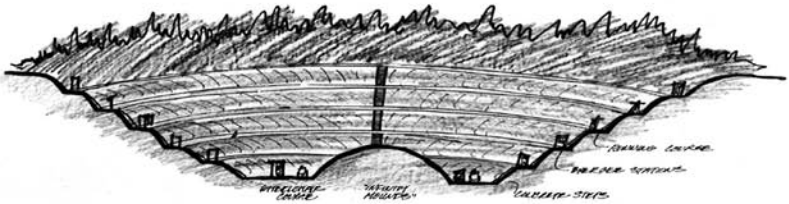
083 Design drawings for the Tolt River Steppes Earthwork by Iain Baxter. In the various drawings above we can see a design similar to that of a ancient Greek ampitheatre where the seating or steppes utilizes the naturally occurring semi-circular contour and incline of the terrain in the quarry site.



THE
FITNESS COURSE.



VIEW OF STEPS, RUNNING COURSE
AND EXERCISE STATIONS



VIEW FROM PARKING LOT AND
HANDICAPPED DROP-OFF AREA.

"INFINITY MOUNDS" WITH TUNNEL
WHEELCHAIR FITNESS COURSE AREA

WHEELCHAIR FITNESS STATIONS
CONSIST OF THE FOLLOWING
EXERCISE MANUAL DEVICES:

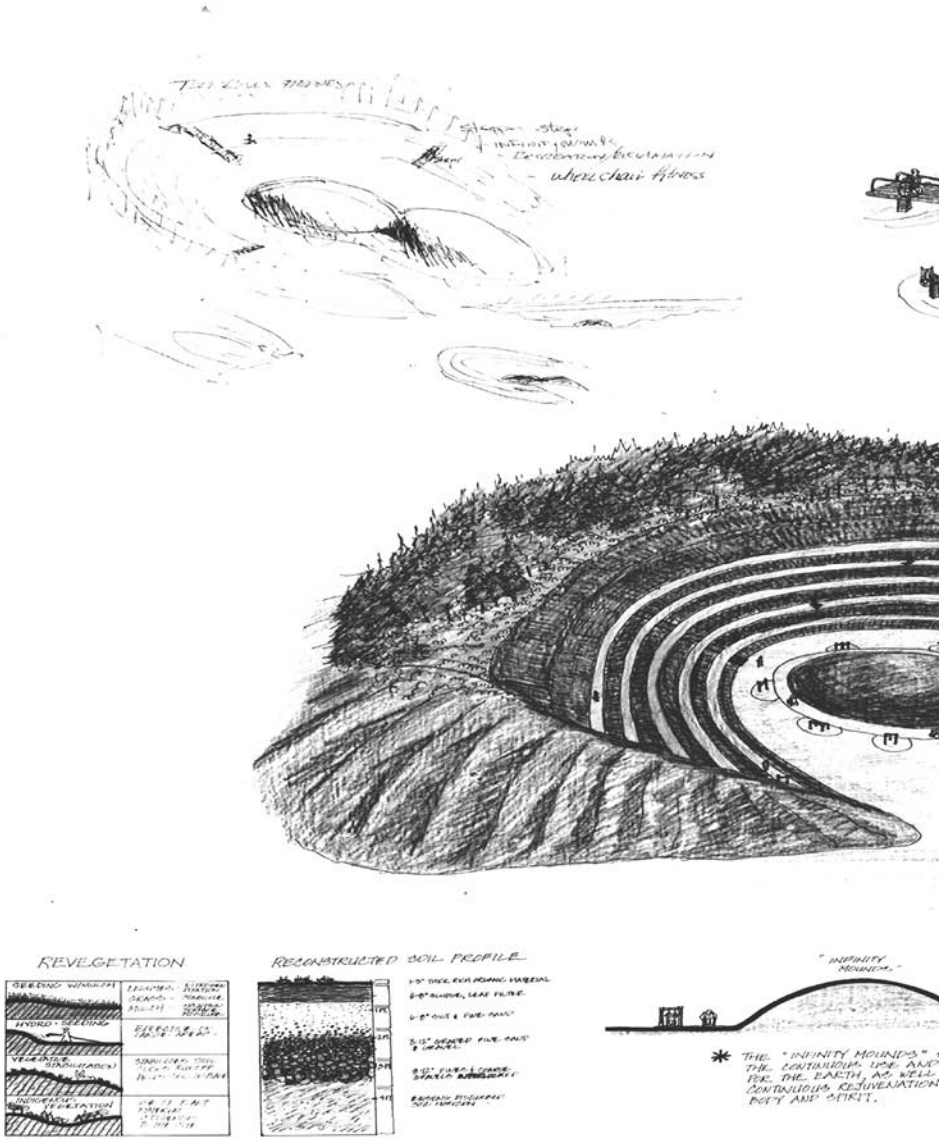
1. RING PULL UP
2. BALANCE BEAM
3. PARALLEL BARS
4. CHIN UP BARS
5. OBSTACLE COURSE
6. OVERHEAD LADDER
7. STATION TOUCH
8. ROPE CLIMB
9. BALANCE BRIDGE
10. TUNNEL

* THE COURSE WILL BE CAREFULLY DESIGNED TO PROPORTION UPPER BODY EXERCISE ALONG WITH LARGE STRENUOUS MANEUVERING AND BALANCING OF WHEEL CHAIRS.

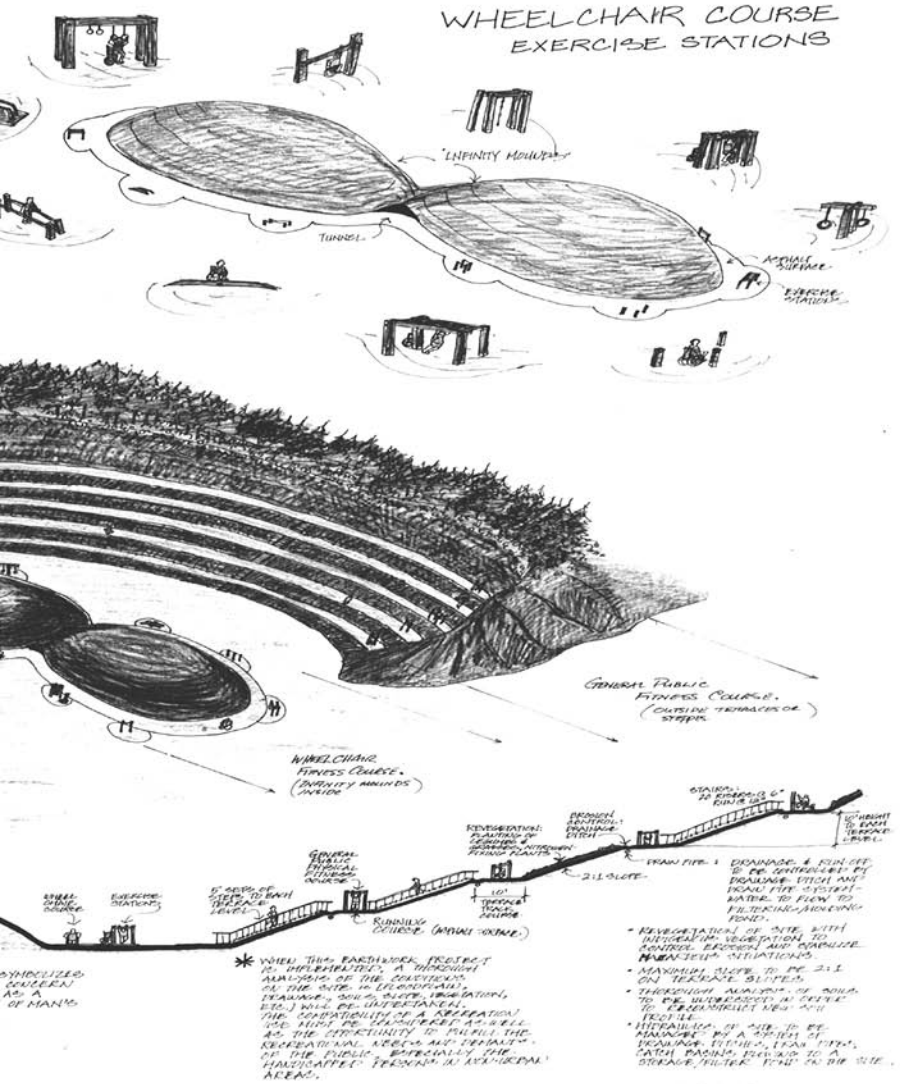
NUMBER OF REPETITIONS OF EACH EXERCISE IS TO BE LEFT TO THE DISCRETION OF EACH INDIVIDUAL AND TO THEIR CAPABILITIES.

VIEWS OF EARTHWORK PROPOSAL

Drawn by: Robin K. Lee, M.L.A.
Kailua-Kona, Hawaii



084 Design drawings for the Tolt River Steppes Earthwork by Iain Baxter. In the lower left corner, we can see tables detailing the stabilization of the earth at the site in its various stages: in strata of earth - facilitating drainage and; development of re-greening and establishment of natural flora and fauna which returns the site, in a manner, to its pre-industrial state.



PERSPECTIVE SKETCH/SECTIONS
Drawn by: Robin K. Lee, M.L.A.
Kailua-Kona, Hawaii

03 Proposal for Lakeside Sand and Gravel Pit

Artist: Richard Fleischner

Site: Gravel pit

Dimensions: 320 acres

Location: 5500-230th Avenue SE, Issaquah, King County, Washington, USA.

Richard Fleischner (sculptor, painter, installation artist and furniture maker who had worked with landscape and large-scale sculpture from the 1960s) was sponsored by the company - Lakeside Sand and Gravel - to create a project on land which had already been stripped of gravel down to clay, while mining continued on the rest of the site. The project focused on the design for the construction of a retaining wall, consisting of a triangular 200-foot-high office and residential complex across the cliff face with terracing and a square drainage area, in the form of an inverted sod pyramid dug into the earth, above and behind the building. Drainage pools are functional as well for aesthetic purposes while the terraces form recreational walking paths. (King County 2013)

085 Aerial photos (top and below) of Lakeside Sand and Gravel site.

086 Model (left) and drawing (right) for Richard Fleischner's earthwork.

04 Stoned Reflector (Snoqualmie Pit)

Artist: Lawrence Hanson

Site: Gravel pit

Dimensions: 5 acres

Location: 372nd Place SE and SE 84th Street, King County, Washington, USA.

Sculptor Lawrence Hanson proposed the reshaping of a partially refilled gravel pit into a 5 acre recreational area consisting of an oval bowl with spiral walkway and lined with white stones which would reflect sunlight during the day and, be lit up at night with a bluish light emitted from submerged solar powered airport-obstruction lights. The site would be experienced differently from varied vantage points and times of day. (King County 2013)

087 Lawrence Hanson at work.

088 Aerial photo of Lawrence Hanson's intervention site.

089 Site plan for Lawrence Hanson's Snoqualmie Pit earthwork.

05 Enclosure for Viewing with Passages and Courts

Artist: Mary Miss

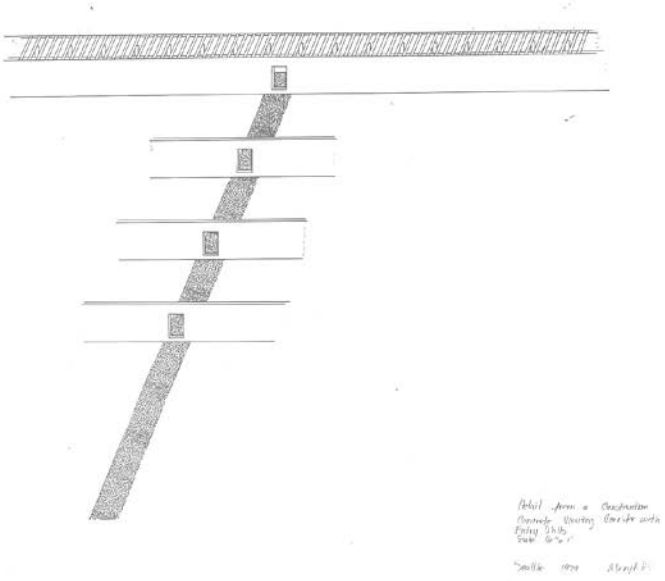
Site: Abandoned residential area

Dimensions: 8 acres

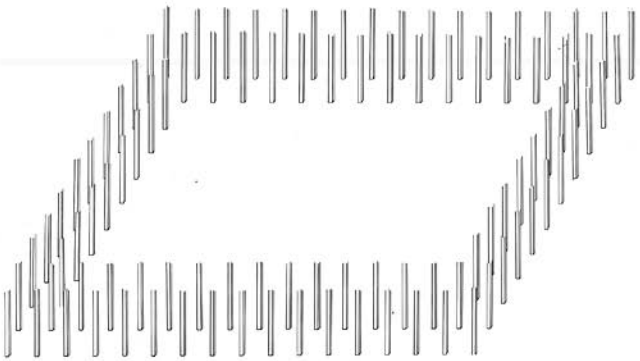
Location: Airport free zone at southwest edge of Seattle-Tacoma International Airport, east of 12th& 3rd Avenue South Port, Seattle, USA.

Mary Miss, whose sculpture had been influenced by abandoned sites and architecture, created a design for an abandoned residential area on a long strip of land bordering the runway at Tacoma International Airport. With no physical reclamation required, the walkway would perform social reclamation as a public recreational buffer zone between residential areas and the airport. The walkway, connecting various structures would give the walker a view of the surrounding landscape with its variations of scale as well as the airport. (King County 2013)

090 Picture showing four models for Mary Miss's Earthwork, *Enclosure for Viewing with Passages and Courts*.



091 Two Site plans (left and right) for Mary Miss's *Enclosure for Viewing with Passages and Courts.*



06 Waiting Room for the Mid-night Special (A Thought Collisions Factory for Ghost Ships)

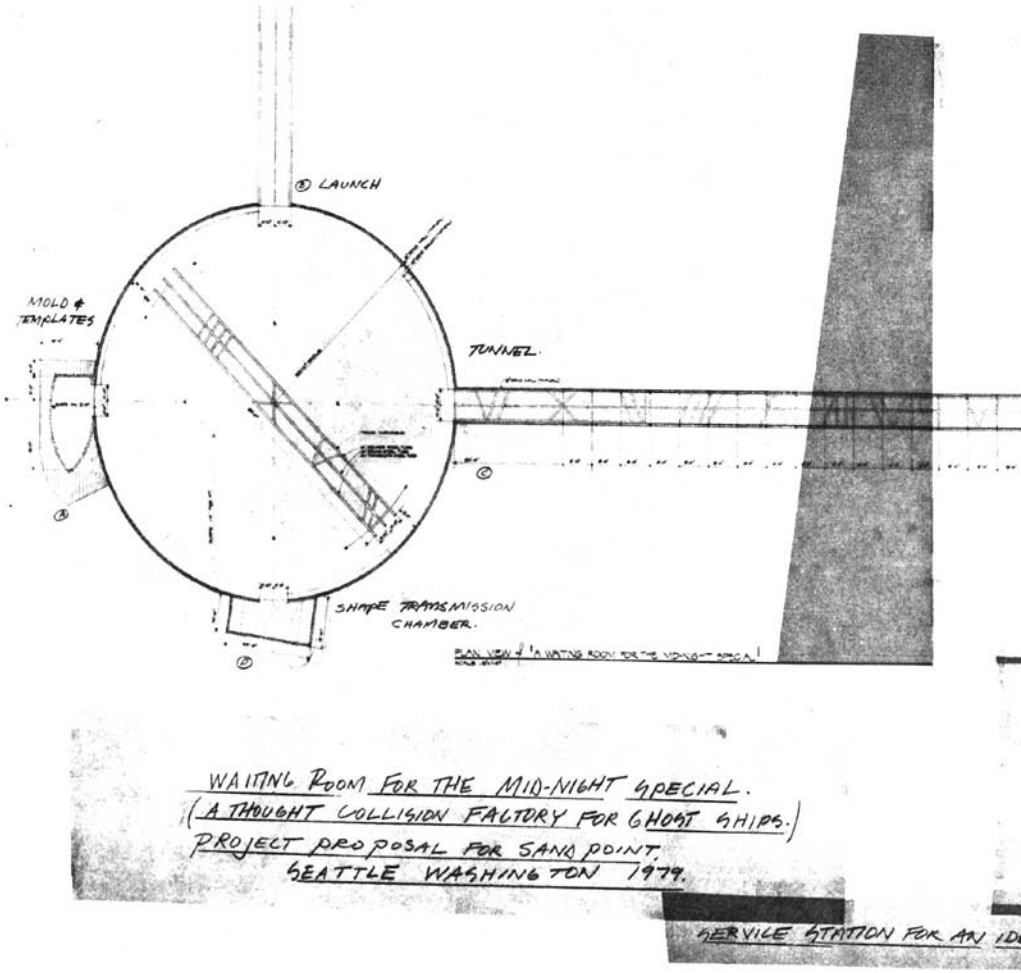
Artist: Dennis Oppenheim

Site: Abandoned naval airstrip

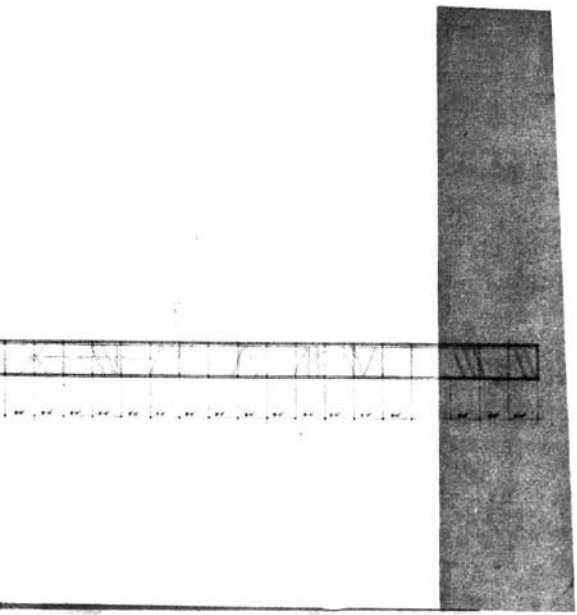
Location: Warren Magnuson Park, 7400 Sand Point Way NE, City of Seattle, USA.

Dennis Oppenheim whose works embodied conceptual art, brought together sculpture and architecture in later years. His project at this former naval airbase aimed to link a park with future government facilities. It contained a revolving 50-foot track pivoting a central circular transport waiting room connected to four gates: "a V-shaped launching canal or trough oriented to a circular boat basin on Lake Washington (for "ghost ships"); boat shaped templates ("for incoming energy"); a long concrete-arched walkway partially covered in sheet metal ("for entry of forces and ideas") and a structure resembling a furnace chamber ("for conceptual transformation from material to gas, power, communication")." (King County 2013)

092 Model for proposed Earthwork by Dennis Oppenheim.



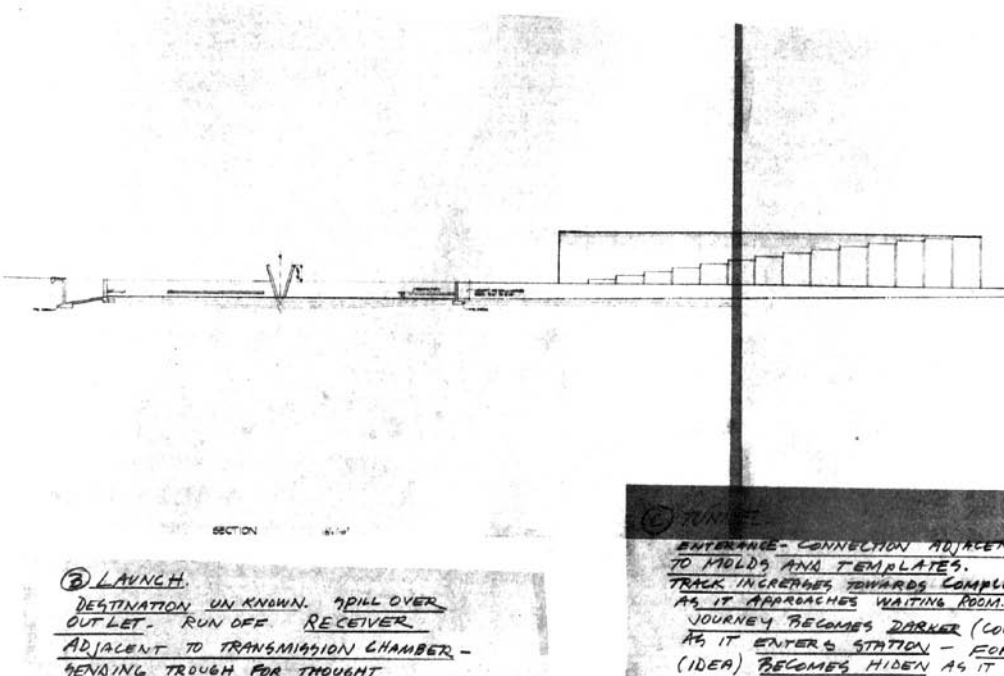
093 Drawings for proposed earthwork, by Dennis Oppenheim showing constructive detailing of the project and including notes describing the various stages of the project and predictions of the visitor's experience.



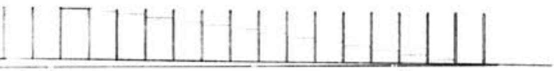
SECTION

(A) MOLDS OR TEMPLATES FOR INCOMING ENERGY. CONFIGURATIONS FOR THOUGHT (TO ENTER). HOLES TO FILL – PLACE TO GO FORMS CAPABLE OF JOURNEY – A MISSILE – A GHOST SHIP READY TO BE LAUNCHED – A DESTINATION FOR THE MID-NIGHT SPECIAL.

(B) LAUNCH.
DESTINATION UNKNOWN. SPILL
OUT LET. RUN OFF. RECEIV
ADJACENT TO TRANSMISSION C
SENDING TROUGH FOR THOUGHT
OUT GOING CHANNEL IN SERVIC
TO EXTERIORATE THE PRODUCT
SUBSTANCE - LAKE BECOMES
SYSTEM - EXTENDER - A
FOR GHOST SHIPS.



094 Drawings for proposed earthwork, by Dennis Oppenheim showing constructive detailing of the project and including notes describing the various stages of the project and predictions of the visitor's experience.



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Ⓓ SHAPE TRANSMISSION CHAMBER
FOR REDUCTION - CHANGE . CONVERSION.
FROM SPECIFIC SHAPED MATERIAL TO
GAS - TO POWER - TO COMMUNICATION.
THE ULTIMATE SMOKE SIGNAL.

07 Montlake Landfill Proposal

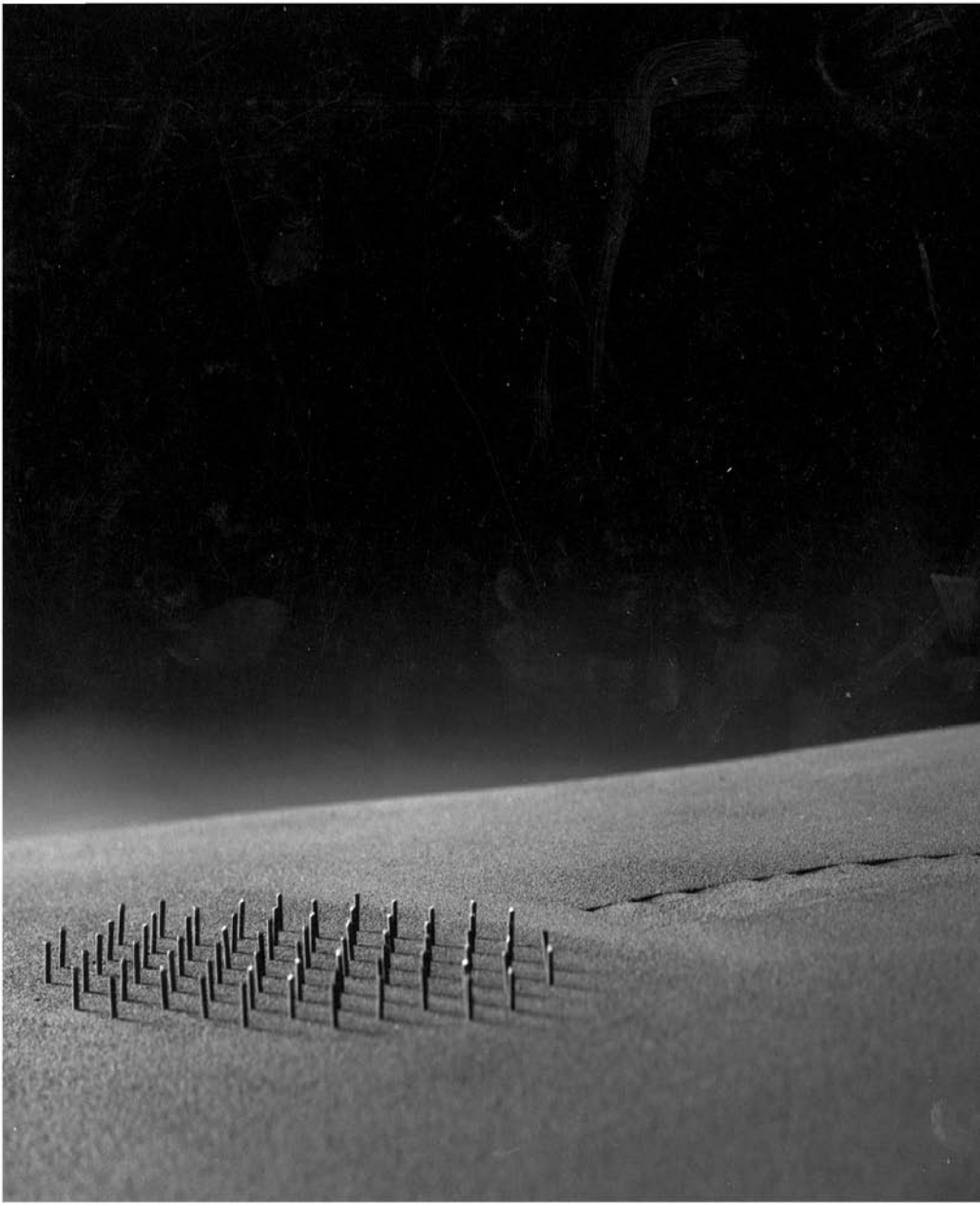
Artist: Beverly Pepper

Site: Garbage dump / landfill

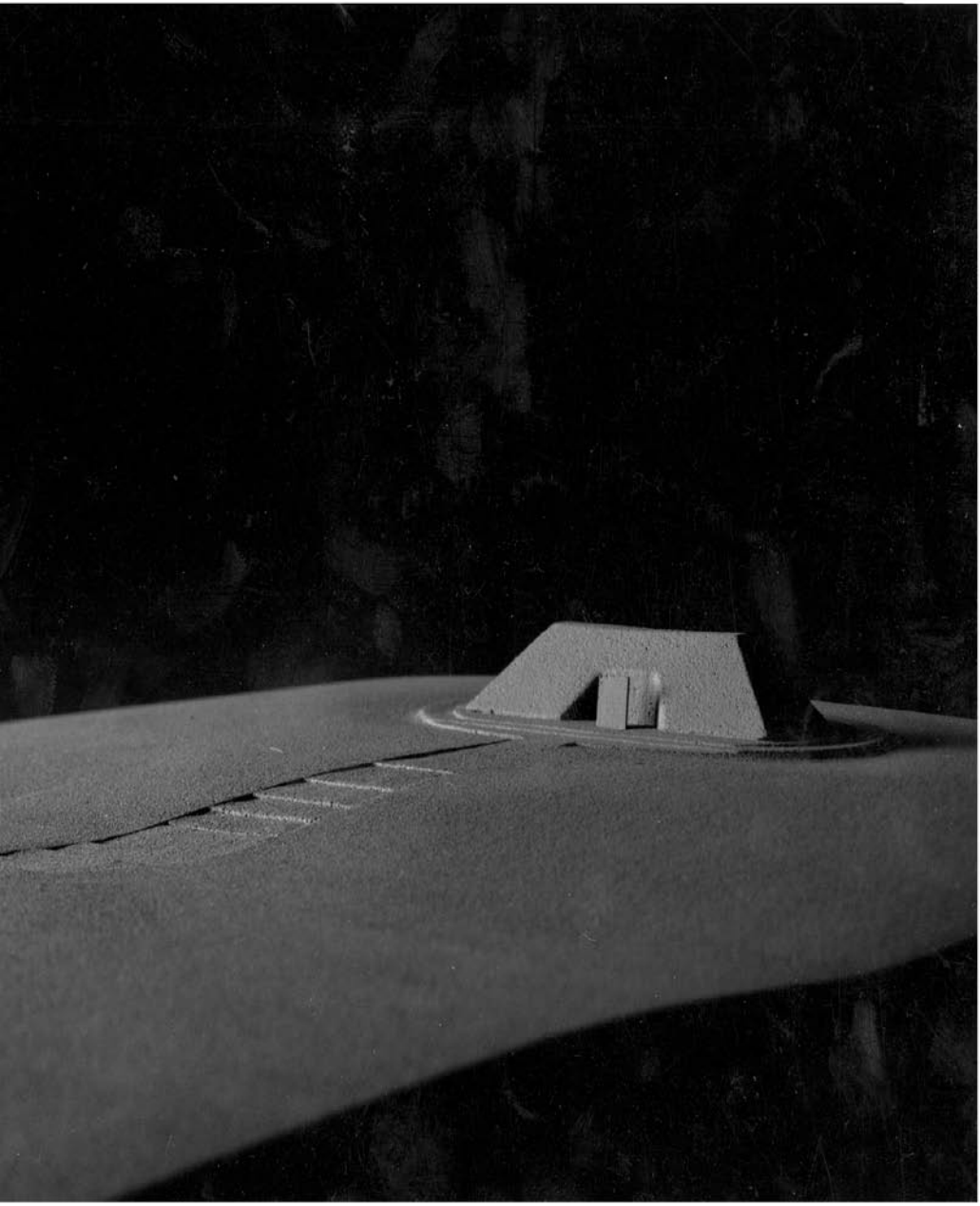
Location: University of Washington East Campus on Union Bay, Washington, USA.

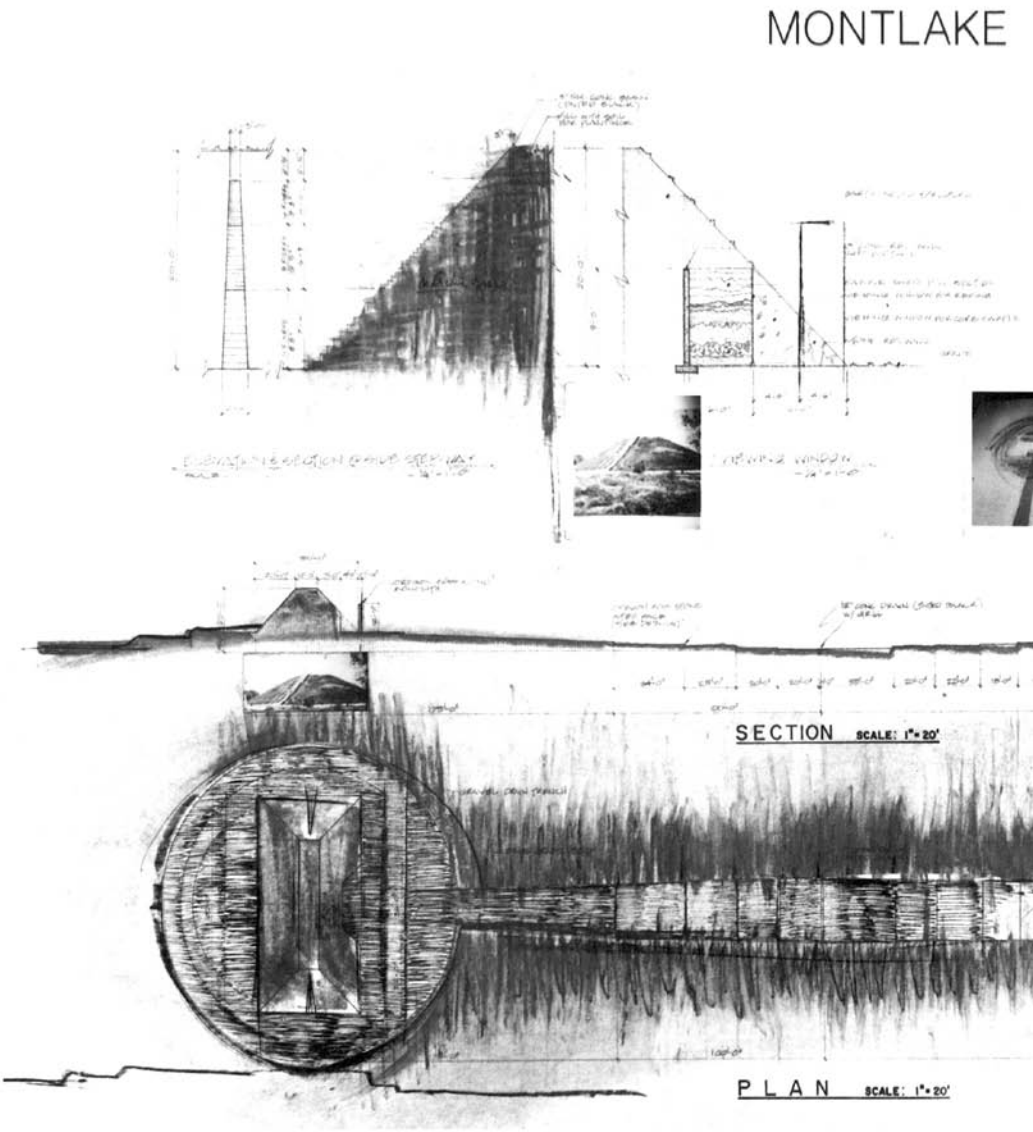
Beverly Pepper's design for a viewing structure on landfill situated between the University and Lake Washington's Union Bay was purposed for observation of nature. The design consisted of two structures connected by a straight, gently terraced three-hundred-foot pathway. A 150-foot-long, 20-foot-high earth mound on a circle of bluegrass could be climbed in part to view both the landfill and the surrounding environment. The mound would be cut on one side and faced with a glass - revealing the flora growing there as well as the strata of garbage and a layer of gravel. A 100-foot circle of white-capped posts would measure future subsidence in addition to the layer of gravel. (King County 2013)

095 Montlake Landfill site.1979



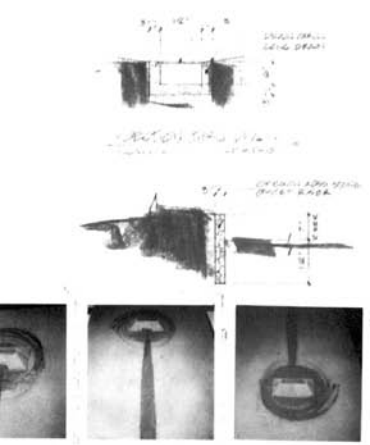
096 Model for Montlake Landfill Proposal by Beverly Pepper.

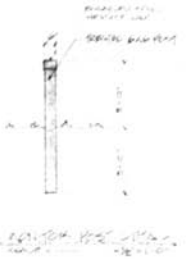


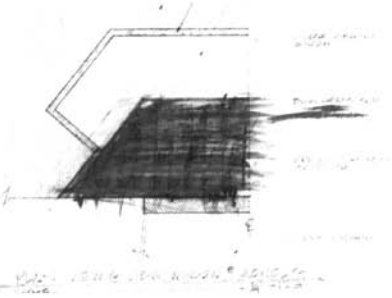


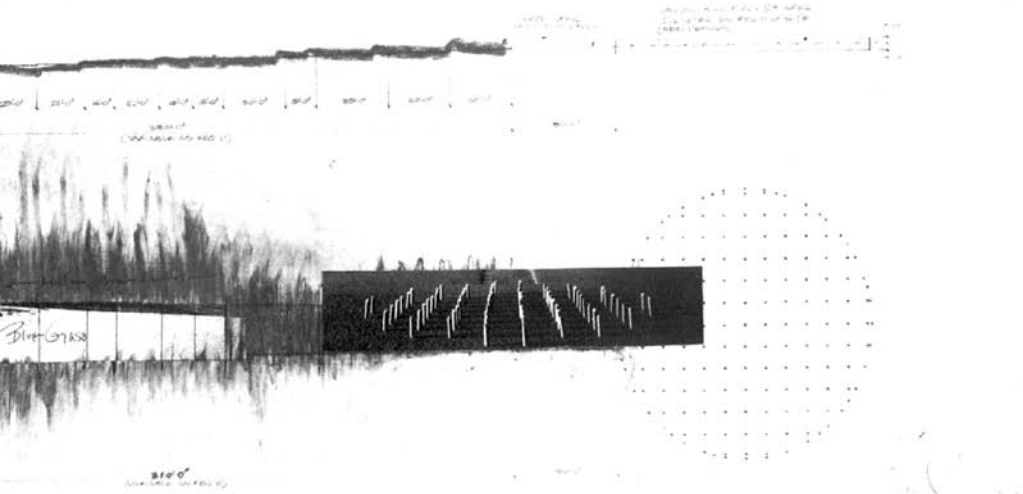
097 Drawing and cross section of earth from Monlake Landfill showing refuse by Beverly Pepper.

LANDFILL PROPOSAL









Effigy Tumuli

Artist: Michael Heizer

Date: 1983-1985

Site: 98 hectares / disused coal mining site – strip mining

Material: 10 m high earth mounds, neutralised with lime, covered with excelsior matting and mulch and planted with grass

Shape and dimensions: Combinations of geometric mounds in a curved line, 1.6km long and 800m wide

Water strider effigy – 208m; *Frog* effigy - 103m; *Catfish* effigy - 234m; *Turtle* effigy – 197,6 m; *Snake* effigy – 629m

Location: Buffalo Rock State Park, Illinois, USA.

The 0.4 km long, 27 m high section of Buffalo Rock State Park mesa, the site for the Tumuli Effigy, had been mined by the Ottawa Silica Company for silica and coal - the latter obtained by invasive coal strip mining using a 'walking beam' which left furrows and parallels of long 9m high mounds. Strip mining brought acidic shale and pyrite to the surface, poisoning pools of water and the adjoining Illinois river. (Mc Gill,1990,12)

Edmund Thornton, an Illinois mining executive took advantage of the Federal Surface mining Control Act of 1977 which provided the means for reclamation of destroyed soils of toxic and abandoned coal mines. Thornton, who had been appointed to the advisory council of the state reclamation agency and having conceived of restoring the mined land of Buffalo Rock plateau since the 1960s, was inspired by art curator Eva Pape to reclaim it using sculpture. The land, owned by the Ottawa Silica Company, would be traded with the state in return for tax deduction and state financed reclamation of it. Buffalo Rock was one of about 800 mines over 20,000 hectares where unregulated mining had taken place since the 1800s. Despite the lure of appealing tax deductions for their miming operations, the idea of artistic intervention was still innovatory and initially met with resistance within Thornton's mining company (Mc Gill 1990,15-17). In the late 1970s, Isamu Noguchi (famous for his sculptural parks e.g. his model for *Contoured Playground* of 1941) was initially considered by Thornton but he was not forthcoming with a design and a landscaped sculpture park proposal (by art consultant Mario Amaya, art critic Rosalind Kraus and landscape architect Phillip Winslow) in 1981 was rejected by Thornton as unoriginal and too costly. Art dealer,

Richard Bellamy and museum director Kröller-Müller, after becoming aware of Isamu Noguchi,'s decline of the project, proposed Michael Heizer as an artist with the potential to transform the mining site (Mc Gill 1990,17).

From early childhood in the 1940s, Michael Heizer had been inspired by works of ancient civilisations, having accompanied his archaeologist father, Robert Heizer on digs in South America and the Nevada Desert and was well-travelled. Heizer drew prolifically and photographed works from a young age. Kett (2015) suggests that in his earthworks, Michael Heizer was much influenced not only by his father's fascination with ancient transportation and use of building material, but his use of cutting edge technology (in a time of Cold War technological and scientific advancement). He states that although "Heizer's earthworks seek to recreate ancient relations to site and space, his methods are characterised by decidedly modern scientific collaborations and intensive technological interventions. (In this way we could consider Heizer's works within the realm of what Nye considers to be the "American technological sublime" [81].)

From attending archaeological digs, Heizer was accustomed to large scale interventions. This was to influence his engagement with Earth Art on monumental scale. However, Kett notes that "the methods through which Heizer's Earthworks are realised resonate less with ancient monumental construction than with the contemporary attempts at totality and timelessness" (Kett 2015 p.121). Mc Gill points out that Heizer was unintimidated by such a large undertaking at Buffalo Rock, having embarked on much larger works such as *Double Negative* (1969) and *Complex One* (1972 and ongoing) in the Nevada Desert and in 1983, Heizer's project for Buffalo Park was secured by Thornton for a sum of "'six figures'" (Mc Gill 1990, 21).

The name of the site, Buffalo Rock, stemmed back to its prehistoric period where native Indians hunted buffalo by driving them over the Mesa's cliffs (Mc Gill 1990, 21). Mound building became characteristic of prehistoric Americans in a shift from hunter gatherer to settled agricultural societies. Both form and material were dictated by nature; using the natural environment as a medium.

These early mounds were usually in the form of animals (but also geometric shapes) and were possibly site-specific - the form being suggested by the terrain and location. They were created through processes of subtraction and addition of earth (an alteration of the landscape) and without written record, we can only surmise their purpose. Lacking the modern benefit of aerial view, experience of such works was at ground level (Fisher 2000, 44-52).

The resurgence in protest for Native American social justice in the 1960s and early 1970s also brought with it

need to protect the environment (the first Earth Day taking place in 1970) and Native American culture (Fisher, 2000, 95). This movement resurged in the early 1980s, in opposition to anti-environmental policies adopted by the Reagan administration in USA government, when Heizer worked on *Effigy Tumuli*. Fisher notes that Heizer "exhibited in his statements an environmental consciousness that had not been demonstrated in his earlier works" (Fisher 2000, p.96). The success of Heizer's *Effigy Tumuli* also lies in it serving as a model for the changing nature of sculpture - a vision of the future - and the blurring of divides between sculpture and architecture. Modernist twentieth century sculpture had embraced man-made industrial and construction material and Heizer connected this to the demise of a collapsing world - materially and politically. In a 1984 interview, he said: "'Sculpture, paintings, and drawings using materials of the earth, are to my mind, a proposal and a projection about a period that may exist on this planet when synthetic and amalgamated industrial products will be unobtainable because of social dysfunction'" (Fisher 2000, 69). Heizer connected modern alloys to warfare in Vietnam as being symbolic of human decline, when he said that their use "seemed very degenerate to me, spiritually. When you make a sculpture by digging out dirt, you're negating all of these materialist concepts" (Mc Gill 1990,11).

Fellow artist Smithson, in his writings stated that art, nature and daily life are inseparable, citing native American art as the ideal (Fisher, 2000, 74). Also, in the prehistoric world there were no divisions between the utilitarian, sculpture and architecture and this was something that could be achieved in earthworks, creating a new aesthetic (Fisher, 2000, 89-90). A criticism of Heizer was that he was eager to accept the project at Buffalo Rock and embrace the idealism of primitive cultures but that in the creation of his works, he used modern machinery as his tools to cut large tracts out of the Earth and deposit them, thus dominating nature and changing the surface of the Earth irrevocably. However, Heizer rejects the purpose of his art being reclamation as his work is purely art (Mc Gill 1990, 35). With regard to this, he asserted:

I'*m not for hire to go patch up mining sites. The strip-mine aspect of it is of no interest to me.*

I don't support reclamation art sculpture projects. This is strictly art. I love mining sites. My whole family has been in the mining business - and still is. My grandfather was a mining engineer who ran the Nevada Massachusetts Company's tungsten mine at the turn of the century. (Celant, 1997, 398).

However the question remains whether the *Effigy Tumuli* could serve as a model for reclamation, regardless of Heizer's intentions. Heizer rejected Smithson's view of reclamation as a return to a "collaborative art - making process," (Fisher, 2000, p.65) where the "artist, ecologist and industrialist must develop in relation to each other,

rather than continue to work and to produce in isolation" (Smithson 221 quoted in Fisher 2000, 68). But in a similar way to the ancient collaborative communal process of mound-building, Heizer worked with a team of people from varied backgrounds to create *Effigy Tumuli*.

Heizer had knowledge of prehistoric effigy and ceremonial mound building in the American Midwest and his inspiration for Effigy Tumuli was also aided by the book, *Antiquities of Wisconsin* by I.A. Lapham published in 1854 which contained detailed engravings of effigy tumuli which had been surveyed by an engineer in Wisconsin. However, Heizer took into account the *genius loci* of the place. About the area he said, "The Native American tradition of mound building absolutely pervades the whole place, mystically and historically and in every sense" (Celant 1997, 398). Effigy Tumuli can be said to be site specific – in the way the landscape suggests or resembles forms of animals who can be found there - as they perhaps did to indigenous American peoples who inhabited the Midwest (Fisher 2000,44-47). Thornton, also knowledgeable about the history and prehistory of the area, sanctioned Heizer's idea to create tumuli on the site. Heizer was keen to create a "human dialogue of art" and although he was not keen on abstract "modernist sculptural geometry" he recognised the need to "directly confront a fundamental tensioning of twentieth century art, between abstract and figurative art." Sculpture was to serve as metaphor, as a dialogue of "numerous associations and interpretations" (Mc Gill 1990,22-23).

Fisher points out that "incorporation into Earth Art of eclectic formal elements that can be traced back to prehistoric mounds was a conscious attempt to escape modernist reductivism" (Fisher, 2000,4) and that earth artists by using the art of "hunter-gatherer and agricultural societies as a model, were doing their part to slow down the dissipation of energy and act according to a new entropic consciousness." (Fisher, 2000, 6). Rather than considering nature as a hurdle to be overcome or for man to dominate, the earth artist aimed to use earth as a medium "to weave his work into the fabric of nature" as prehistoric man had done (Fisher, 2015,12) and also to "borrow from prehistoric art to distance [himself] from modernism and the rationalist worldview that went with it" (Fisher 2000,36).

Initially Heizer avoided abstract art in the form of geometric shapes and settled on the idea of insects - although prehistoric Indians had never made mounds of such creatures. He remarked, "I tried mammals but mammals didn't work. They look like something you'd seen in a Disney Cartoon. Then I found insects. They have a very simple and profound geometry. They are neglected thematic material (Celant 1997, 398).

Heizer's idea changed to creatures of the Illinois River. His first model for the project showed 8 creatures: a catfish, a

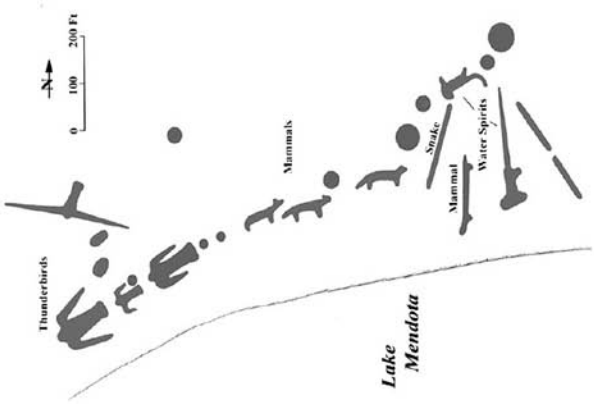
water strider, a turtle, a snake, a frog, a beaver and a hawk. Some of the animals were then removed for example, the beaver. The water strider was moved as it was pointed out that the original area would be flooded after rains and the subsequent idea of a water bug for this location was abandoned due to impracticality (Mc Gill 1990, 25). There was a reduction from 8 to 5 mounds and reduction of scale.

As with Smithson's *Spiral Jetty* (1970), it is apparent that Heizer's works of art at Buffalo Rock were "site specific" and "work specific" as the idea of the effigy came to Heizer after seeing the site and considering its *genius loci* but also they were formed to "conform" to the site (Fisher 2000, 39). Various pictures were collected and drawn over repeatedly and in this process a simple geometric forms were achieved as true as possible to the creature's forms (McGill 2000, 34). The shape of the creatures was defined by placing clear plastic film over a photograph of a horizontal section of the mesa on which Heizer sketched, distributing the forms over the mesa. Heizer made "topographical lift studies" of each individual animal so the earthmoving contractors could understand the idea. The creatures conformed to the terrain as the terrain suggested their forms e.g in the case of the catfish, turtle and snake (Mc Gill 2000, 25). On Heizer's model, the Mesa is literally a table - a flat space - where Heizer arranged and controlled the location and position of the forms. Fisher suggests the snake also being aligned to conform to the margin of the river was site specific - much like the ancient *Serpent Mound* on the bluff at Ohio Bush Creek "is crescent-shaped to echo the shape of the ridge top on which it is built, Heizer's mound curves round a horse-shoe-shaped indentation in the cliff that drops down to the Illinois River" (Fisher 2000, 41). Fisher also suggests that Heizer's mounds, in the same way as prehistoric ones, 'animated' the creature in the landscape e.g. "Turtle is positioned heading downhill, as though about to slide into the river. In the Snake, too, the head of the animal is closest to the water, suggesting that it to may be engaged in a similar activity" (Fisher 2015, 44). This is a radical departure from self-contained modernist works of art, for which prehistoric mounds provide a precedent. As *Alligator Mound* in Ganville, Ohio shows, prehistoric man probably altered the landscape to incorporate his subject matter by moving and adding earth to give it rounded curves or by even making the structure (Fisher 2000, 52). The absence of gestalt, also a characteristic of prehistoric mounds, is another break with modernism as the viewers would not have been able to perceive mounds in their entirety at once (Fisher 2000, 47). Heizer made much use of photography in preparation of his works - including aerial photographs of the site as was the case at Buffalo Rock (Mc Gill,1990) and to solve problems with workmanship it became necessary for workers to understand the works by providing and aerial perspective of their work by helicopter. However, the works are to be experienced from the ground; to walk the work and to piece together the knowledge of each form from its various angles and perspectives.

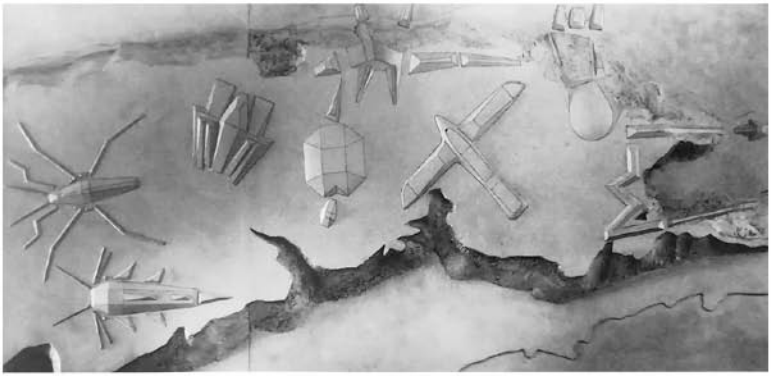
Construction of the mounds began in two phases beginning in 1985 with earth moving equipment and the second phase with excelsior netting and mulch being placed over the soil to encourage the growing of grass to prevent erosion (Mc Gill 1990, 37). The project was finalised in 1987 (Mc Gill 1990, 40).

098 Photographs (left and right) of the Buffalo Rock property before commissioning of the Michael Heizer's *Effigy Tumuli*.

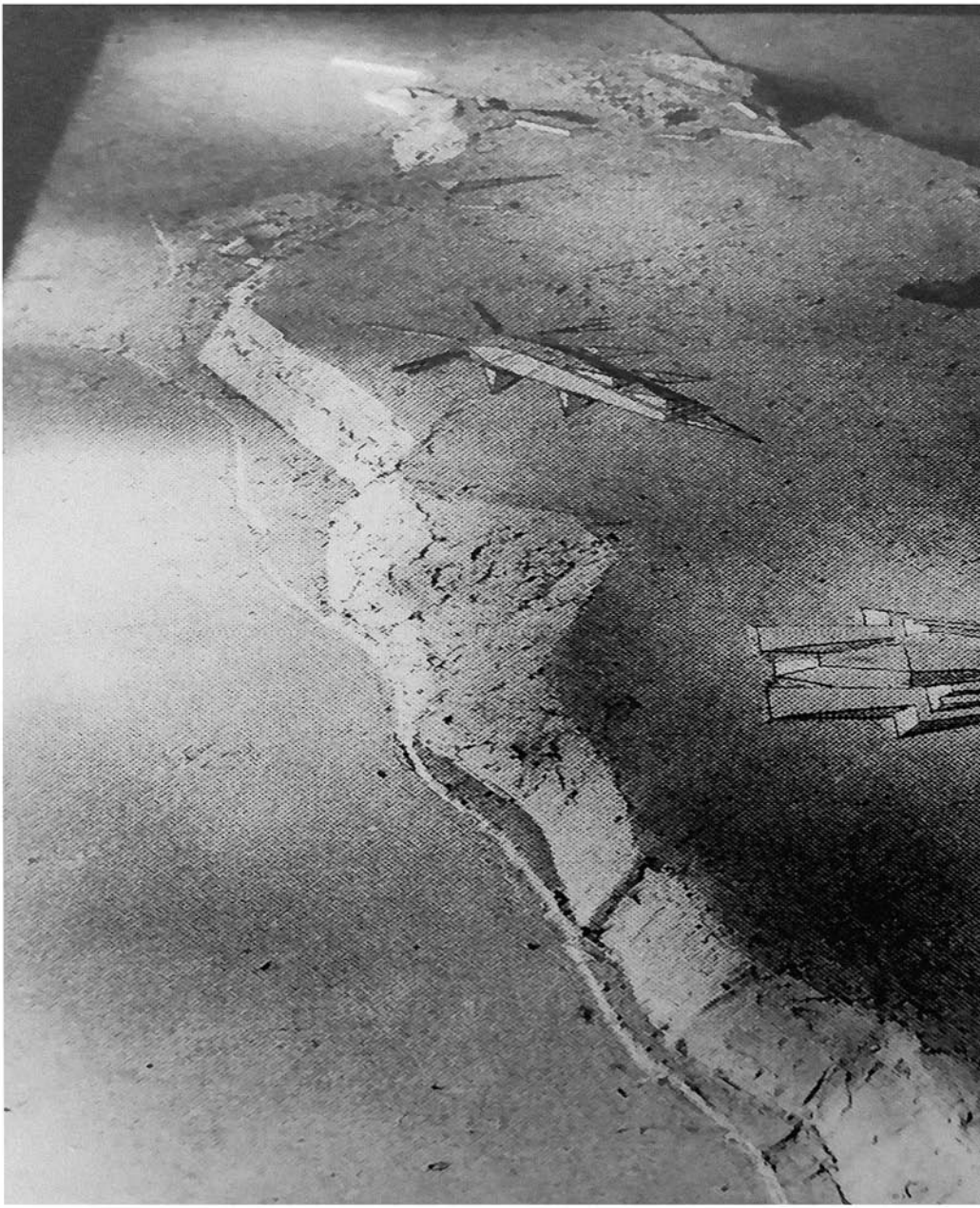
099 Composition of four photographs showing the final dirt construction of Michael Heizer's *Catfish Effigy*.



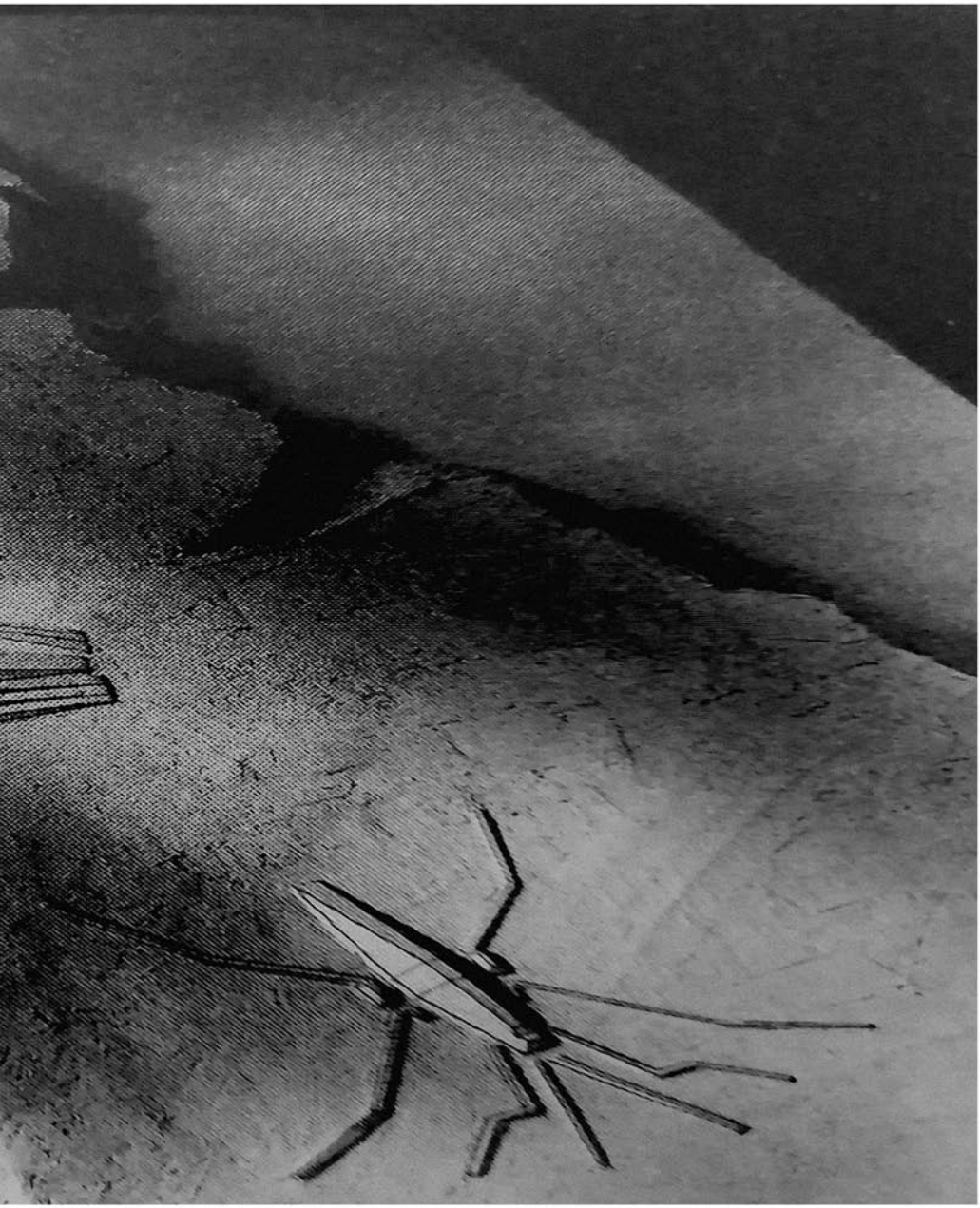
100 Survey of a native American effigy mound site in south-central Wisconsin on Lake Mendota, showing thunder-birds, animals, snake, water spirits, and conical mounds.



101 Photograph showing Michael Heizer's first finished study model based on the existing terrain and the material accumulations. The number of tumuli were later reduced from eight to five due to the fragile nature of the shale-ridden soil. Here we can see the *mesa* as a table where Heizer has composed the effigy as 3 dimensional figures as if placed on top of a flat table.



102 Photograph showing Michael Heizer's final model for the completed project.



103 Aerial Photograph showing the five completed *Effigy Tumuli* and the subsequent establishment of growing grass.

104 Aerial Photograph of an individual walking upon the *Water Strider* effigy.

S. Domingos, Portugal

37°40’05.8”N 7°29’28.2”W

A brief history through time, territory and place

The geological formation and constitution of a place are important considerations when attempting to understand a site for which an architectural project will be designed for they form part of the *genius loci* of a place. For this thesis therefore it is necessary to initially understand the Iberian Pyrite Belt and the relationship of the S.Domingos Mine to it.

The Iberian Pyrite Belt (IBP) is large mineral deposit, situated in the SW of the Iberian Peninsula, extending WNW – ESE from the Marateca area southeast of Lisbon, Portugal to Seville in Spain (Matos et al. 2012, 7) and is one of the most important volcanic massive sulphide deposits in the world having been mined for more than 5000 years, (Tornos, 2008, 57). The S. Domingos Mine is located on the northern branch of the IBP (Matos et al. 2012, 7) or Portuguese segment of the IBP "consisting of a sub-vertical lens containing ~ 25 Mt of sulphides (mostly pyrite), which is located on top of a Volcanic sedimentary Complex (VSC) sequence comprising black shales and different meta-volcanic rocks dated back from the Late Famenium to Late Visean." After consistent weathering, a "thick, iron-hat" was exposed and it was this that began to be exploited (Mateus et al. 2011, 137).

Copper is ductile, resistant to corrosion and has electrical conductivity making it an important metal in the technological evolution of man. We can only speculate on how copper was discovered but it is linked with early man's observation and control of fire as heated rock containing the ore, revealed a malleable metal which could fashioned into artefacts. The oldest piece of copper originates to Mesopotamia in 8700 BC at a site in Northern Iraq. By 4000 BC an alloy of copper and zinc, known as bronze, further revolutionised man's development as he could now mass produce much strengthened items. Copper increasingly became an important metal and by the 19th century, with Britain's smelting technology dominating, she procured sources globally. However, by the 20th century Britain's position was challenged by other industrial economies and mines opening in the Americas and Africa. New technology enabling the production of copper and byproducts from low grade ores (for example in the USA) brought about rapid expansion of the copper market[82].

The trade route in the Mediterranean region became extended along the Iberian coast in the Atlantic, to northern Europe – especially with the extended range of ships due to the invention of steam vessels. Traditionally from the north to the south, came wood and coal and from the south to the north, cereal, salted fish and olive oil were traded. S. Domingos Mine came to play an important part in this trade circuit. The mine's location in the South of Portugal with access to an Atlantic port on this route, made Portugal one of the most important copper exporters from 1859. – 1890. (Garcia, J.C., 1998, pp.291-292)

There are differences regarding the exact dates in which people in the Mediterranean area may have developed metallurgical skills but deposits in the IPB, on which the S. Domingos Mine (37°40'05.8"N 7°29'28.2"W) is situated, were explored in the transition from Neolithic to Calcolithic periods. Studies conducted on the mines in Huelva Province in Spain, by the Institute for Archeo-Metallurgical Studies in London, dated the oldest tools found at the Rio Tinto site, to 4th and 3rd millennia B.C. Remains of smelters of Timna Valley in the Sinai are considered to be of the same period but it is considered that the sophisticated copper metallurgy of the SW Iberian Peninsula evolved locally without any outside influence. In the SW Iberian Peninsula, the presence of copper carbonates, iron oxides and hydroxides (lowering the melting point) seem to have played an important role in the discovery of copper smelting here. A presence of up to 5% of arsenic in copper brought about accidental production of hardened copper or bronze beginning in the 3rd millennium B.C. (Gaspar 1998, 402)

No archaeological investigation has been carried out regarding the existence of pre-Roman workings at S.Domingos Mine, but the presence of megalithic construction would make mineral workings a strong possibility there. Analysis of slag at Aljustrel however revealed a distinct pre-Roman layer (Gaspar 1998, 404) and remnants of access galleries and slag piles at S. Domingos Mine show that this was area mined intensively during the Roman occupation (Mateus et. al. 2012, 137). Exploration and underground excavation here, and at the Aljustrel mines, which extended beyond the hydrostatic level and the volume of clearings during both the pre-Roman and Roman periods, is estimated at 150 000 m^3 which is equivalent to 750 000t. This would correspond to metallic processes producing 300 000t of slag. It appears that the Portuguese mines of Aljustrel, Caveira and S. Domingos Mine, which had not reached a tenth of the tunnelling of the Spanish mines at Rio Tinto, Tharsis, Sotiel, Coronada and Cueva de la Moura in the Tartessic and Roman periods, had deposits corresponding to exploration of about 2 Mt. (Gaspar 1998, 405)

Mining appears to have diminished in the Pyrite belt in Portugal when the Romans were expelled by the Visigoths around 405 BC and during the Islamic occupation between 711 and 1492. However, Aljustrel and Algares being Arab words, suggest that these IPB mines could have been worked during the Arab occupation. Estácio da Viega (in 1880) reported that King Sancho of Portugal (1154-1212) had granted the Castle of Aljustrel, land and a tenth of his mines and baths, to the Order of Santiago (as a reward for their military conquest over the occupants of this region). An official report from 1521 citing the production of Copper Sulphate gave importance to mining in this region. (Gaspar 1998, 405)

It was not until the eighteenth century and increasingly, in the nineteenth century, that there was an economically significant recovery in mining in this area. An article, in 1850, in *Revista Minera* in Madrid by mining engineer João Maria Leitao, on the Portuguese deposits and their possible relationship with the Spaniards, led the Tharsis mines director and French engineer Ernest Déligny, to send Nicolau Biava, to Portugal to investigate in 1854. "Discovery rights" of the deposits of Aljustrel, Caveira and S. Domingos Mine were then acquired and in 1858 a provisional concession of the São Domingos Mine was made to Ernest Déligny, Luiz Decazes and Euénio Leclerc with concessionaires Nicolau Biava and the recognition of the proposed English engineer, Diogo Mason, as director in 1859. By the late nineteenth century, information regarding extraction from the Portuguese pyrite belt began to be documented in mining publications such as those for the Portuguese Director-General of Mines and Geological Services. An example of this would be *Catálogo da Comissão Executiva da Secção de Minas*, which was edited by J.A.C.N. Cabral and twenty other authors, at the time of the Portuguese Industrial Exhibition of 1888. (Although the mining plan for S. Domingos Mine was presented in 1859, open pit and subterranean mineworkers only began to extract ore in 1863. (Gaspar 1998, 406)

From studies of ships visiting and, the trade tonnage at the Port of Vila Real de Santo Antonio, it appears that British trade dominated that of the German and Norwegian from 1860 with Swansea being the British *Copperpolis*. After 1890, there was an increase in German trade but also a shift in the demand for copper with ships from North Africa and America. Germany began to be an emerging industrial power, increasing its industry and navy. By 1908 American copper began to dominate the world market with pyrite treatment centres coming into operation in the USA (Garcia 1998, 293-295). S. Domingos Mine reached its climax at the turn of the century due to the boom of the German chemical industry and declined with World War I (Garcia 1998, 292). However, in the twentieth century it still remained a source of copper with high grade ore (Gaspar 1998, 409). Today the large, open pit where ore was extracted by hand from Roman times, is now still and is filled with water. The open pit is the most striking feature of the S. Domingos Mine site, not only because of its size (the mounds of tailings reflecting only a fraction of the material removed from this man-made hole) but because it is a monument - a testimony to a history of a mine in an age of advancing technological development and man's obsession for wealth and power, and moreover a silent witness to many lost lives who dug the earth for a living over centuries.

In 1866-67, with the downturn in copper prices, open pit mining was advocated as a cheaper means of extracting ore at the site and from 1868, the pit was progressively excavated until a substantial hole, approximately120 m deep, remained (Rego 1966 in Batista 2000, 10). There is evidence of shafts dug into the pit to a depth of 390m and wells and galleries (some begun in the Roman period) dug down to a depth of 420m. Excavation continued until 1966 when the ore deposit was exhausted (Batista 2000,12).

Between 1867 and 1880, 3Mm^3 of rock was extracted from the open pit. In total, an estimated 25 MT of ore for copper concentrate and cupriferous pyrite were mined from its prehistoric beginnings until supplies were depleted in 1966 (Gaspar 1998, 406). Having used up the supply of ore, the mine closed in 1966. From the pit, raw material was crushed in an on-site mill nearby and then transported to Achado do Gamo where a smelter extracted high grades of copper ore and sulphur products (for the developing chemical industry). From there it was sent by rail, 15km south to Pomarão Harbour on the Guadiana river (Batista 2000, 15). Barges then transported the material to ships in the Atlantic harbour at Via Real de Santo Antonio (the Guadiana river having been an ancient trade route for metals in this region). The railway and river were essential to the success of operations. The railway constructed by the mine in 1858 was the second one to be built in Portugal (Batista 2000, 7).

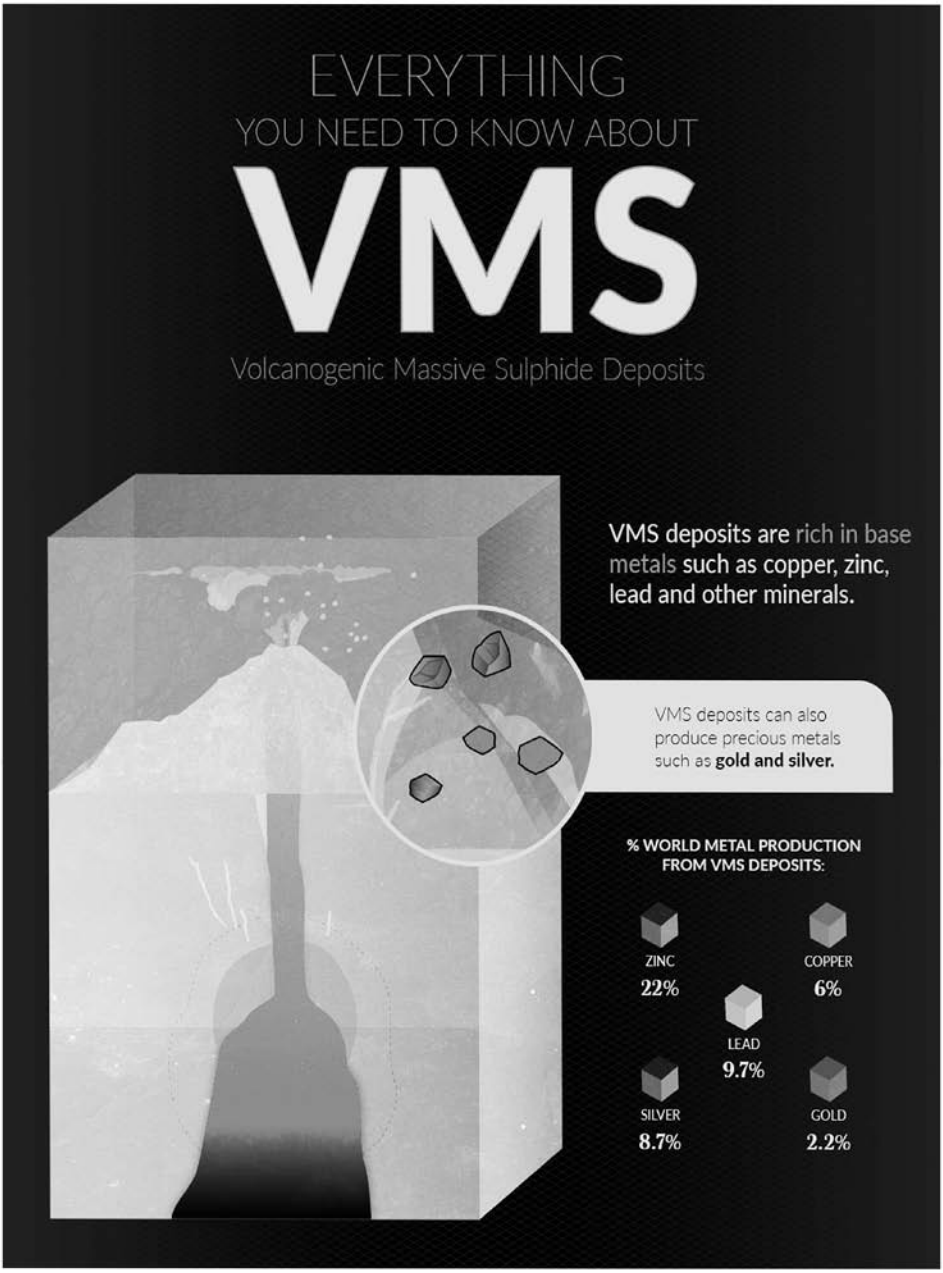
Globally, this Pyrite Belt is an example of environmental destruction due to intensive mining over a period of over 3000 years which has changed the landscape and polluted the water resources in the region (Tornos 2008, 57). Pollution control and reclamation of contaminated sites was not practised in Portugal before 1987 when environmental laws came into effect. Mines whose operations ceased before this date, now remain abandoned contaminated sites. Consideration of reclamation projects for such areas has had to take into account lack of funds, lack of policy and regulation, isolated towns and lack of public transportation (Anawar 2012, 296-297).

Mining at S. Domingos Mine brought about a much wider environmental impact - as is the case with other mines on the Iberian Pyrite Belt (IPB) – involving soils, stream sediments, tailings and surface waters in a total area of 2,963,900 m^2, from the village to the Chumbeiro downstream dam, located 11 km south east. "Along the valley of S. Domingos stream, 767,659 m^2 is the area occupied by industrial landfill + leaching/cementation tanks and 767,737 m^2 of ore + host rock tailings. In mining area, a total of 14,7Mm^3 of mining wastes are estimated, present in mining landfills and tailings with a heterogenous size, changing from 14m near the open pit to no less than 1m in the downstream areas" (Matos et al., 2012, 9). Water filling the pit is extremely acidic, due to pyrite oxidation (Rego 1966 in Batista 2000,14).

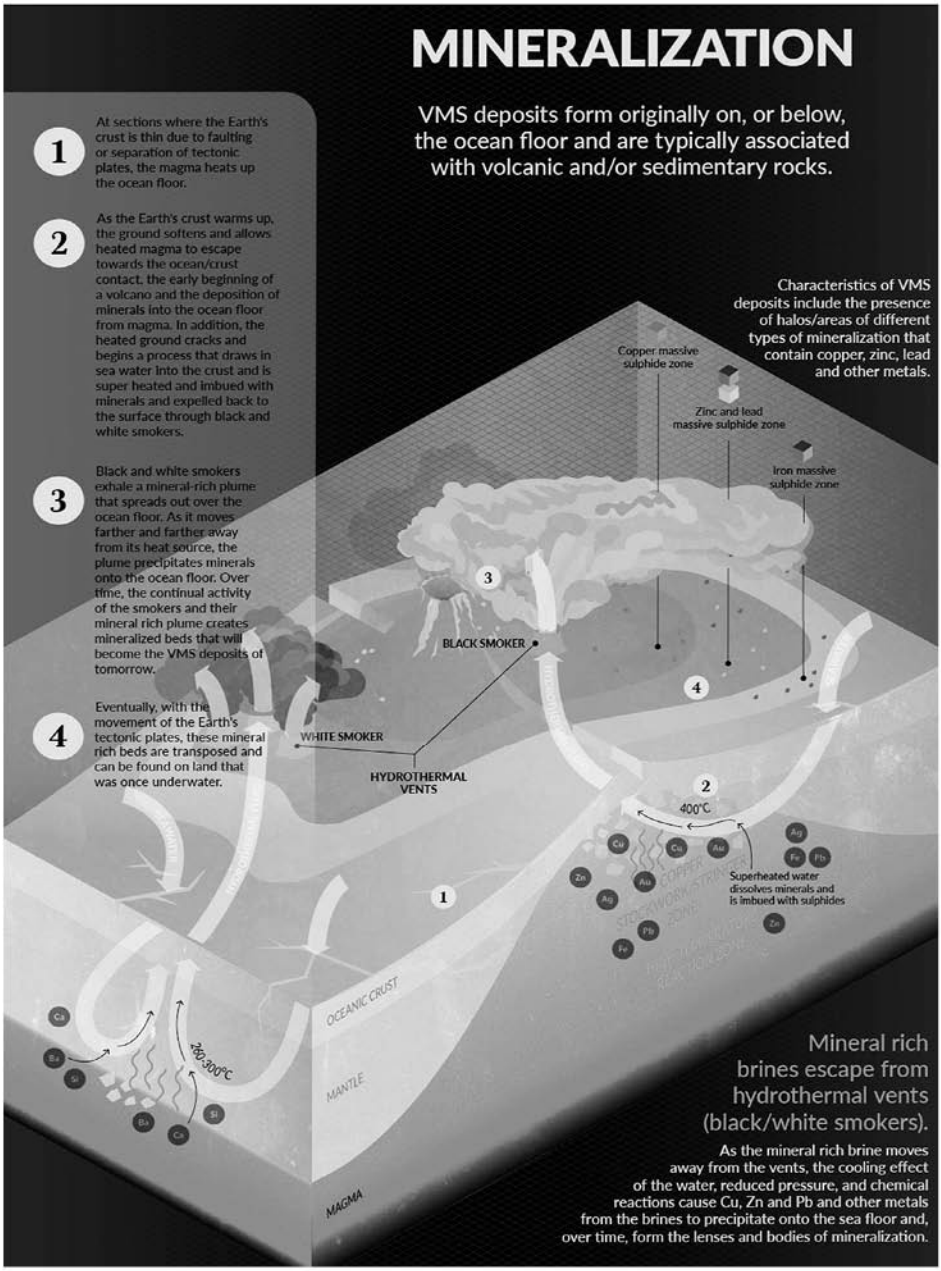
Limiting the fluvial transport of mine waste particles could be possible through solidification of mine soil heaps but a more practical solution has been by phytoremdiation through introducing metal tolerant vegetation in the area (Anawar, H.M. 2012, p.296 and 298). Geologist, Fernando Tornos (2008, 57) however points out that the generation of acid waters from the erosion of massive sulphides and mine waste washing, and the drainage of mine waters on the IBP have brought about different and unique extremophile ecosystems which should now be preserved.

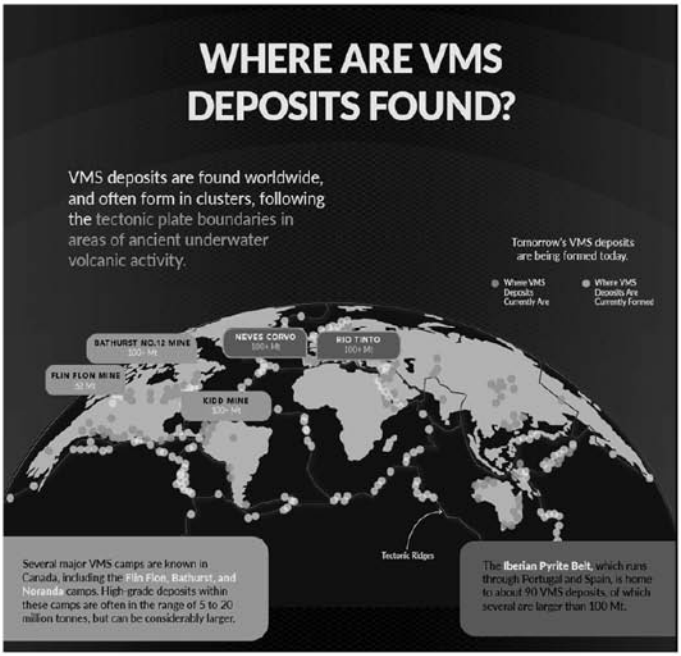
Despite S. Domingos Mine being "a typical exploration of British colonization" (Garcia, J.C., 1998, pp.291-292) as it was British owned and run by British management using British skilled workers and machinery (with labour being resourced locally), it was "one of the main industrial projects located in southern Portugal in the 19th century and until the 1950s "(Matos et. al. 2012, 7). Its closure in 1966 therefore "induced 'desertification' in the area, progressively erasing past industrial events, and revealing the socio-economic changes in the village (Alves 1997 in Batista 2000, 7) and a social and economic decline of the region (Matos et. al. 2012, 8). S. Domingos Mine is a site worth preserving culturally and historically and projects have been developed with this initiative to be realised in the future e.g. "the Moitinha Crushing Plant, the Achada do Gamo industrial facilities, the buildings of the former' Miners' Canteen, the General Workshops, the 'Black' Bridge, the Unloading Quay, the Power Plant, the Weigh-bridge of the Bleaching Plant" (EDM 2001, 144). It was possible to convert the former Railway Terminal, in Pomarão 7 km away into an interpretative centre managed by the Mértola Town Council. Former concessionaires of the mine restored the Mine Manager's house into a hotel (EDM 2001, 144). Urban planning reflects differences between facilities for English personnel and those of Portuguese workers – even in the allocation of two different graveyards – for separate religions (Batista 2000, 8). However, no projects have been put forward for the central and most striking feature of the mine - the pit - despite a wooden walkway having been constructed around it for viewing purposes.

105 Geological map of the Iberian Pyrite Belt (modified for this thesis after Carvalho et al.,1999) showing its various VMS deposits spread throughout Portugal and Spain. The S. Domingos VMS deposit can be seen in the centre situated near the border between Portugal and Spain.

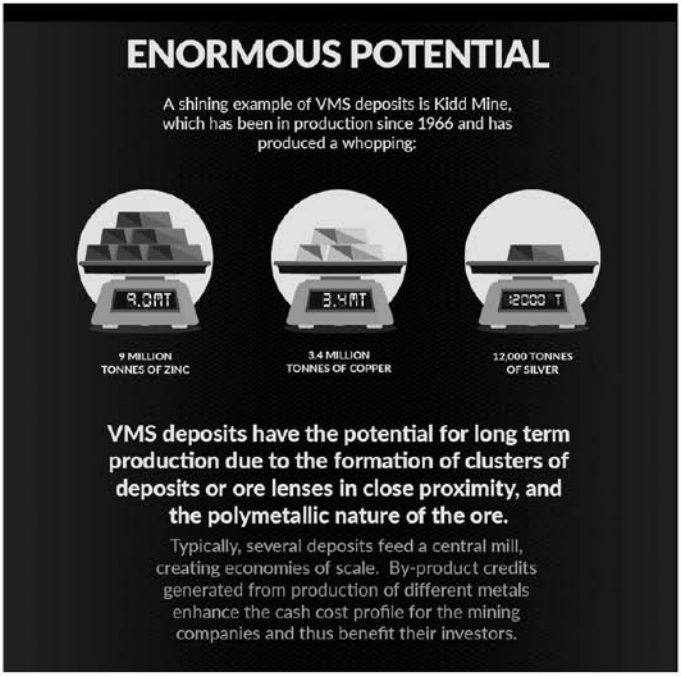


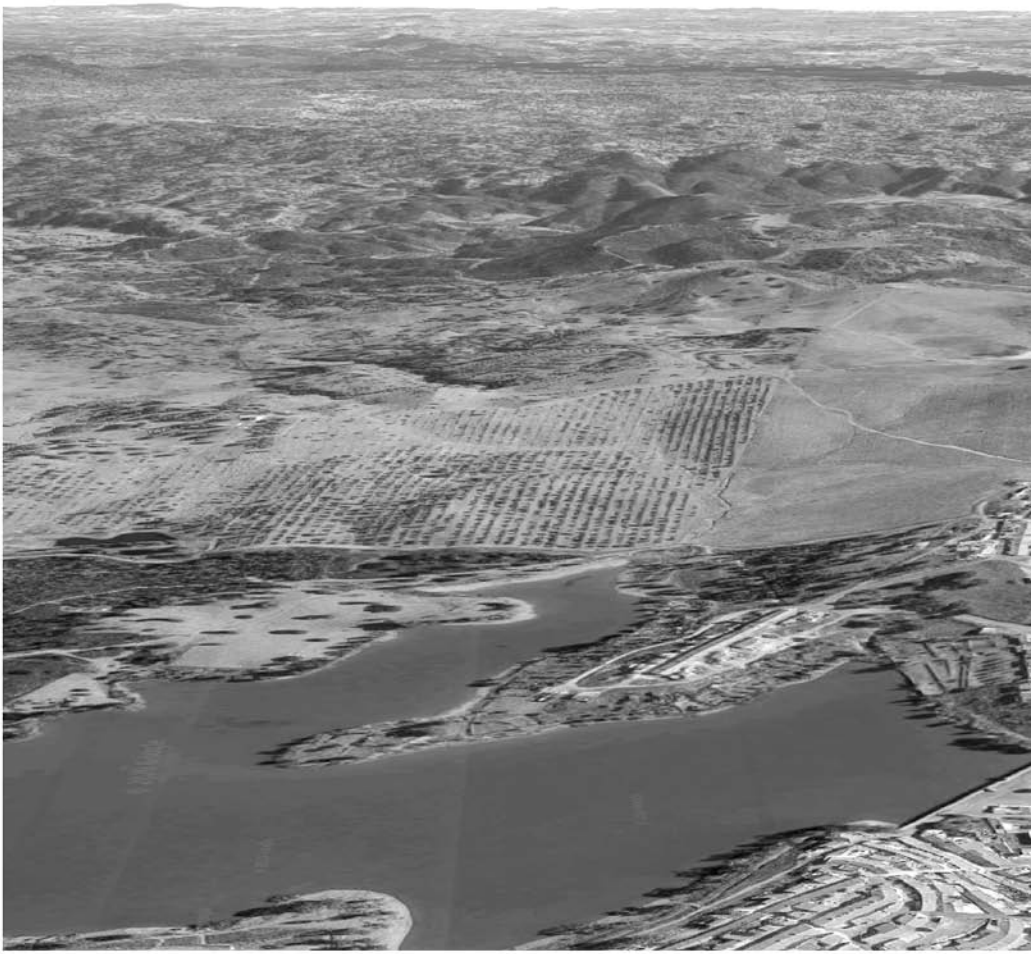
106 Two graphic illustrations of VMS deposits showing: The percentage of different types of metals in VMS deposits and the percentage of world metal production from them (left); the typical formation of a VMS deposit (right).


MINERALIZATION
VMS deposits form originally on, or below, the ocean floor and are typically associated with volcanic and/or sedimentary rocks.
1
At sections where the Earth's crust is thin due to faulting or separation of tectonic plates, the magma heats up the ocean floor.
2
As the Earth's crust warms up, the ground softens and allows heated magma to escape towards the ocean/crust contact. the early beginning of a volcano and the deposition of minerals into the ocean floor from magma. In addition, the heated ground cracks and begins a process that draws in sea water into the crust and is super heated and imbued with minerals and expelled back to the surface through black and white smokers.
3
Black and white smokers exhale a mineral-rich plume that spreads out over the ocean floor. As it moves farther and farther away from its heat source, the plume precipitates minerals onto the ocean floor. Over time, the continual activity of the smokers and their mineral rich plume creates mineralized beds that will become the VMS deposits of tomorrow.
4
Eventually, with the movement of the Earth's tectonic plates, these mineral rich beds are transposed and can be found on land that was once underwater.
Characteristics of VMS deposits include the presence of halos/areas of different types of mineralization that contain copper, zinc, lead and other metals.
Copper massive sulphide zone
Zinc and lead massive sulphide zone
Iron massive sulphide zone
BLACK SMOKER
WHITE SMOKER
HYDROTHERMAL VENTS
400°C
Superheated water dissolves minerals and is imbued with sulphides
200-300°C
OCEANIC CRUST
MANTLE
MAGMA
Mineral rich brines escape from hydrothermal vents (black/white smokers).
As the mineral rich brine moves away from the vents, the cooling effect of the water, reduced pressure, and chemical reactions cause Cu, Zn and Pb and other metals from the brines to precipitate onto the sea floor and, over time, form the lenses and bodies of mineralization.

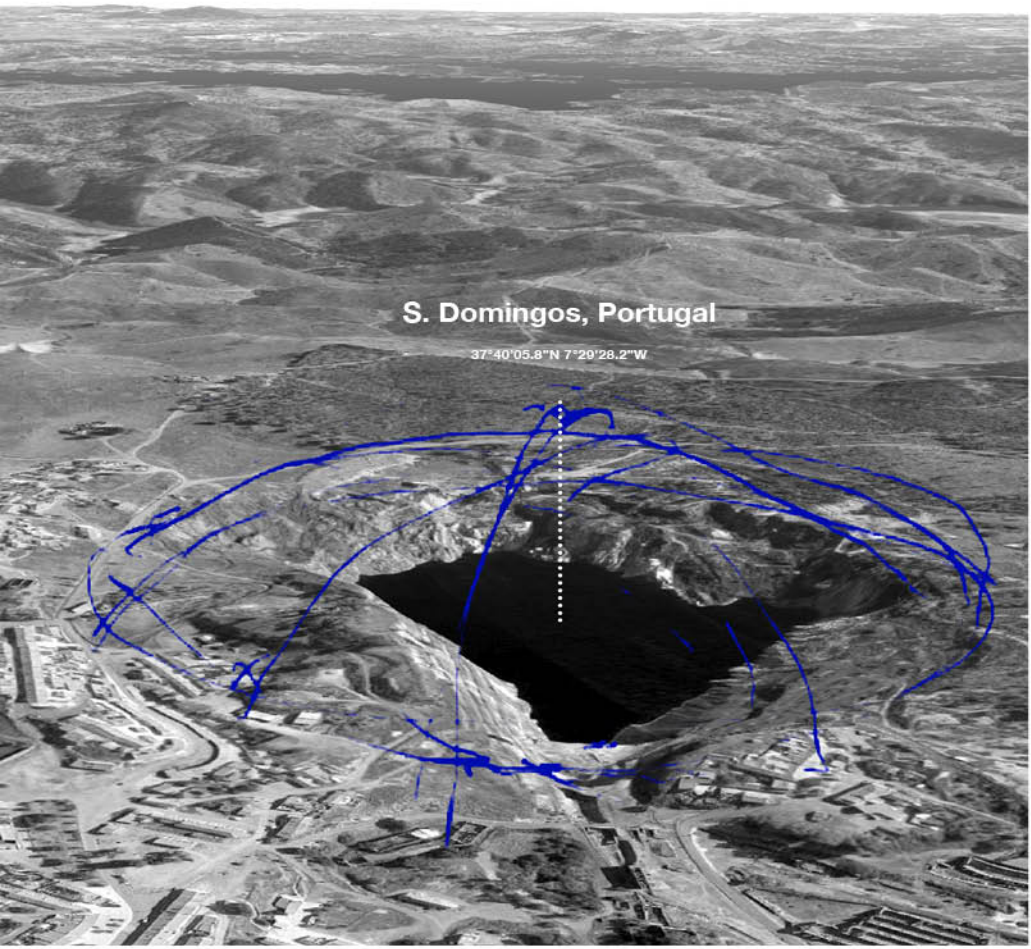


107 Two Graphic illustrations showing: a conceptual map of where VMS deposits can be found globally (left); a compelling example of Kidd Mine thus underlining the enormous potential these VMS deposits have (right).


ENORMOUS POTENTIAL
A shining example of VMS deposits is Kidd Mine, which has been in production since 1966 and has produced a whopping:
9.0MT
3.4MT
9 MILLION TONNES OF ZINC
3.4 MILLION TONNES OF COPPER
12,000 TONNES OF SILVER
VMS deposits have the potential for long term production due to the formation of clusters of deposits or ore lenses in close proximity, and the polymetallic nature of the ore.
Typically, several deposits feed a central mill, creating economies of scale. By-product credits generated from production of different metals enhance the cash cost profile for the mining companies and thus benefit their investors.



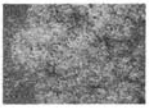
108 Conceptual sketch (in blue) of the previous VMS deposit at S. Domingos Mine, Portugal placed over an aerial view of the open pit at the site. To the left of the photograph, we can see the part of the mining village of S. Domingos and one of the dams (Tapada Pequena) created by the establishment of the mine and, to the right, the entrance to the mine from the town. The sketch illustrates the original hill that was formed by the VMS deposit and which disappeared as a result of the opencast mining that took place there.


S. Domingos, Portugal
37°40'05.8"N 7°29'28.2"W

109 Composition of six illustrations taken from the book *De re metallica*, 1556 by Georgius Agricola. The illustration (top left) shows what appears to be a VMS deposit and the remainder of illustrations show suggested methods or techniques for the extraction and processing of metal at the time.

Copper in history

THE MAIN INVENTIONS THAT INCREASED DEMAND



3500 BC
Copper smelting: increased the supply of metal, Asia Minor.

2500 BC
Bronze: allowed the production of weapons, tools and cast objects.

100 BC
Brass: use expanded to decorative and practical items for the home, Roman Empire.

850
Gunpowder: used only for fireworks in China.
The bronze cannon was invented in Europe in the 14th century.

1510
Pocket watch: brass case and gears, Germany.

1550
Screws and nuts: mainly of brass, copper and bronze, France.

1698
Steam pump: made possible the drainage of water from mines and increased usable copper reserves.

1710
Piano with bronze strings.

1752
Lightning rod: made of copper wire, American colonies.

1795
Corkscrew: made of brass, England.

4000 BC | 3000 BC | 2000 BC | 1000 BC | 0 | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 | 1600 | 1700 | 1800

1500 BC
Bells, gongs: bronze came into use as a source of sound, Asia.

700 BC
Coins: the use of bronze as a means of payment became widespread, Asia Minor, Lydia.

1400
Astronomy: brass navigation instruments invented, Europe.

1447
Printing press: use of bronze and brass to cast lead type; engraved copper plates, Germany.

1608
Optical telescope: made of brass, Holland.

1656
Pendulum clock: gears and pendulum made of brass.

1670
Table utensils: initially made of brass and bronze, Italy.

1795
Steam engine: revolutionized the industrial world and, as a result, boosted copper consumption, England.

110 A conceptual time line taken from Alexander Leibbrandt's "Civilization and Copper" entitled "Copper in History - The main inventions that increased demand" (The Coldeco Collection 2001). Through time, we can see man's increasing usage of copper to create commodities and their parts, and therefore copper's historical importance in the development of the technology and the progress of mankind.

1821
Harmonica: made of brass, Germany.

1830
Ship propeller: made of bronze, England.

1841
Saxophone: made of brass, Belgium.

1854
Brass shell (bullet), USA.

1851
First underwater telegraph cable from Dover to Calais.

1837
Electric telegraph: transmission along copper cables, USA.

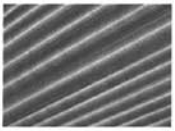
1879
Electric train engine, Germany.

1881
Light bulb: fed by electric current carried by copper wires, USA.

1909
Electric toaster: requires electrical power.

1917
Electric drill: powered by a small electric motor.

1920
Floatation process: made it possible to extract low-grade ores.



1985
Ultrasonic washing machine, Japan.

1998
Copper chip: processing speed increased.

1825 1850 1875 1900 1925 1950 2000

1866
Electric dynamo: with copper wire coil, Germany.

1876
Telephone: voice transmission along copper wires, USA.

1878
Electric generator and transmission along copper wires.

1882
First alternating current electric generator, USA.

1884
Steam turbine: reduced electric generating costs, England.

1885
Motor car: components and parts made of copper, bronze and brass, Germany.

1886
Washing machine: with an electric motor, USA.

1901
Washer with electric motor, USA.

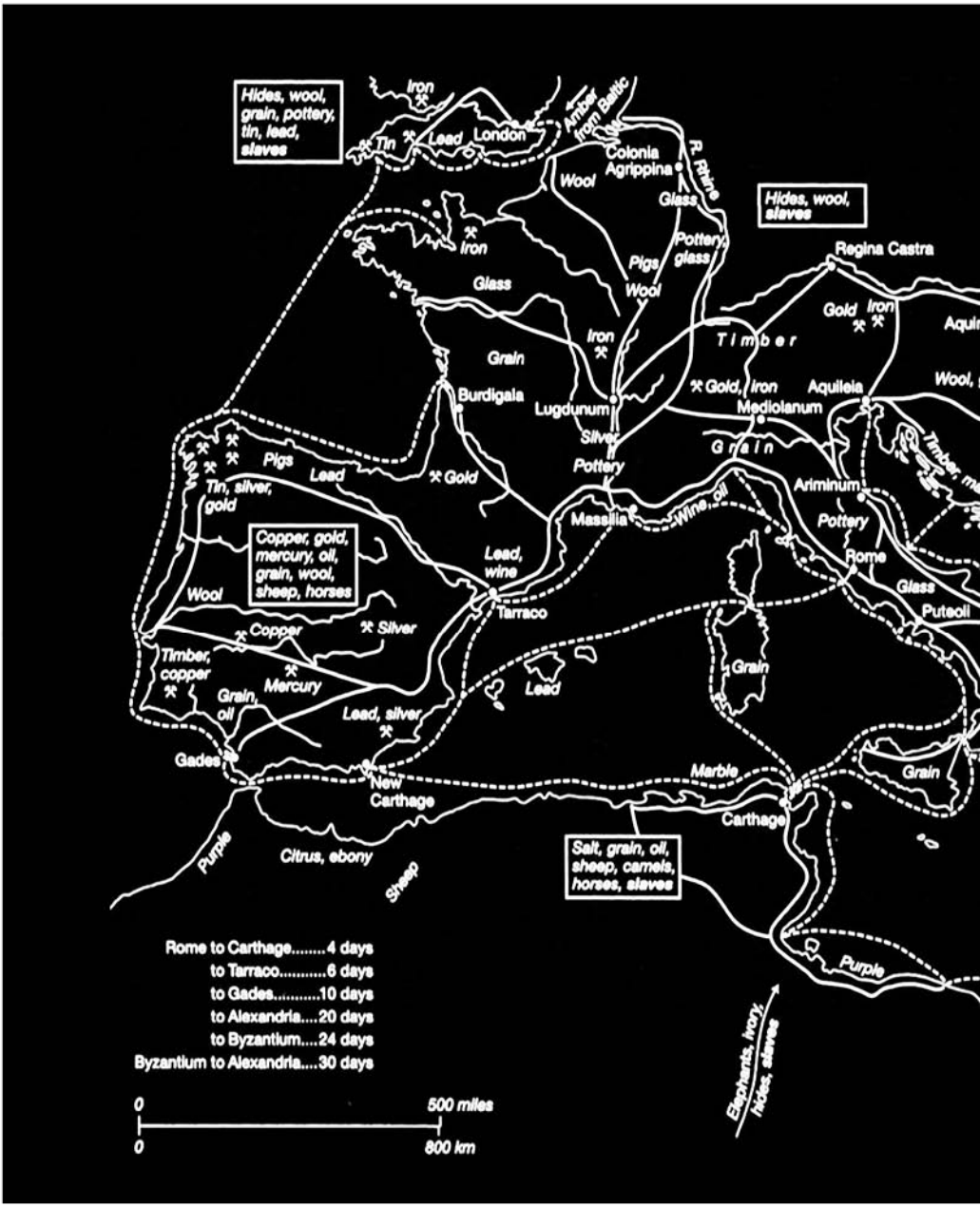
1906
Radio: powered by electricity.

1931
Television: powered by electricity.

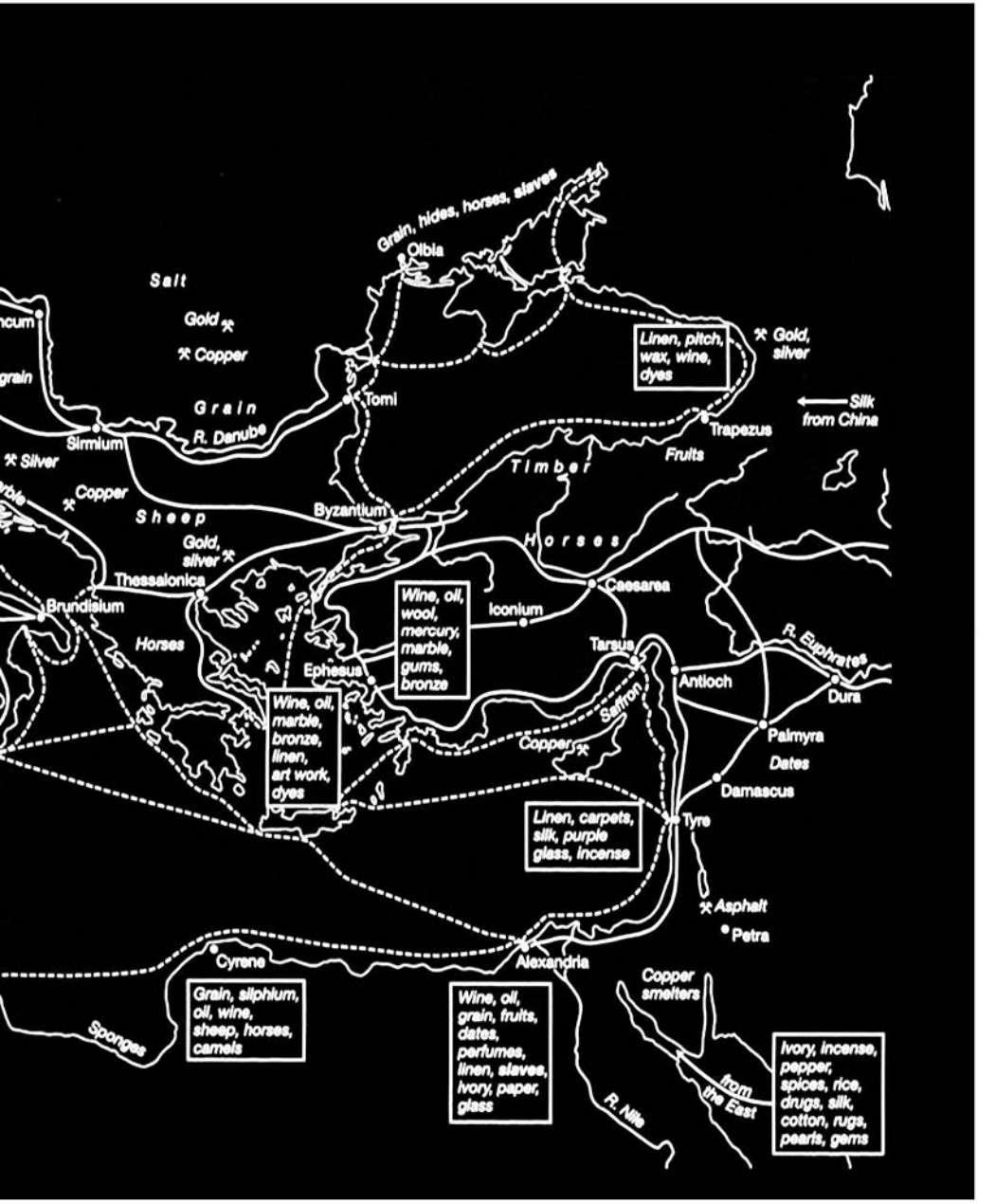
1945
Microwave oven: powered by electricity.

1954
Solar cells: convert sunlight into electric energy.

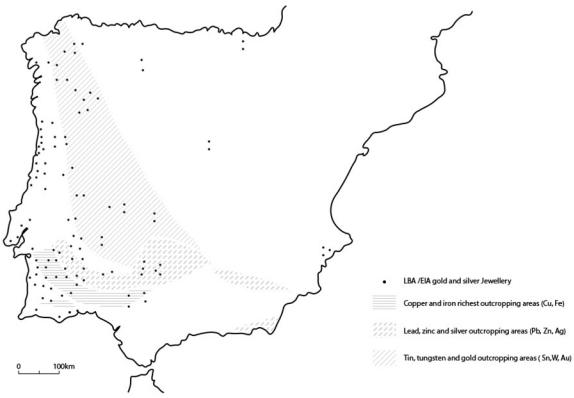
2000
Third generation of copper chips.



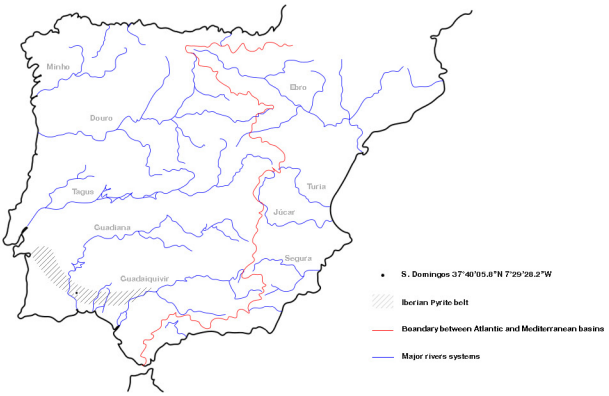
111 "Trade Routes and Commerce of the Roman Empire" From Charles Alexander Robinson, Jr., *Ancient History: From Prehistoric Times to the Death of Justinian* (New York: Macmillan Co., 1951) p. 565. On the left, we can sea the maritime trade route from the Straits of Gibraltar to the western side of the Iberian Peninsula as well as the Roman copper mines situated in what is today the southern part of Portugal on the east of the Guadiana River. These sea and river routes were of strategic importance in the acquisition of metal.


Grain, hides, horses, slaves
Olbia
Salt
Gold
Copper
Grain
R. Danube
Tomi
Linen, pitch, wax, wine, dyes
Gold, silver
Silk from China
Trapezus
Fruits
Timber
Horses
Silver
Copper
Sheep
Gold, silver
Sirmium
Byzantium
Thessalonica
Brundisium
Horses
Wine, oil, wool, mercury, marble, gums, bronze
Iconium
Caesarea
Tarsus
R. Euphrates
Antioch
Dura
Ephesus
Wine, oil, marble, bronze, linen, art work, dyes
Saffron
Copper
Palmyra
Dates
Damascus
Linen, carpets, silk, purple glass, incense
Tyre
Asphalt
Petra
Cyrene
Alexandria
Copper smelters
Grain, silphium, oil, wine, sheep, horses, camels
Wine, oil, grain, fruits, dates, perfumes, linen, slaves, ivory, paper, glass
Sponges
R. Nile
from the East
Ivory, incense, pepper, spices, rice, drugs, silk, cotton, rugs, pearls, gems

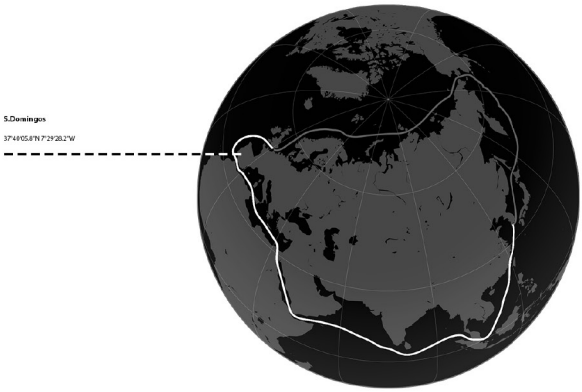
268 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W



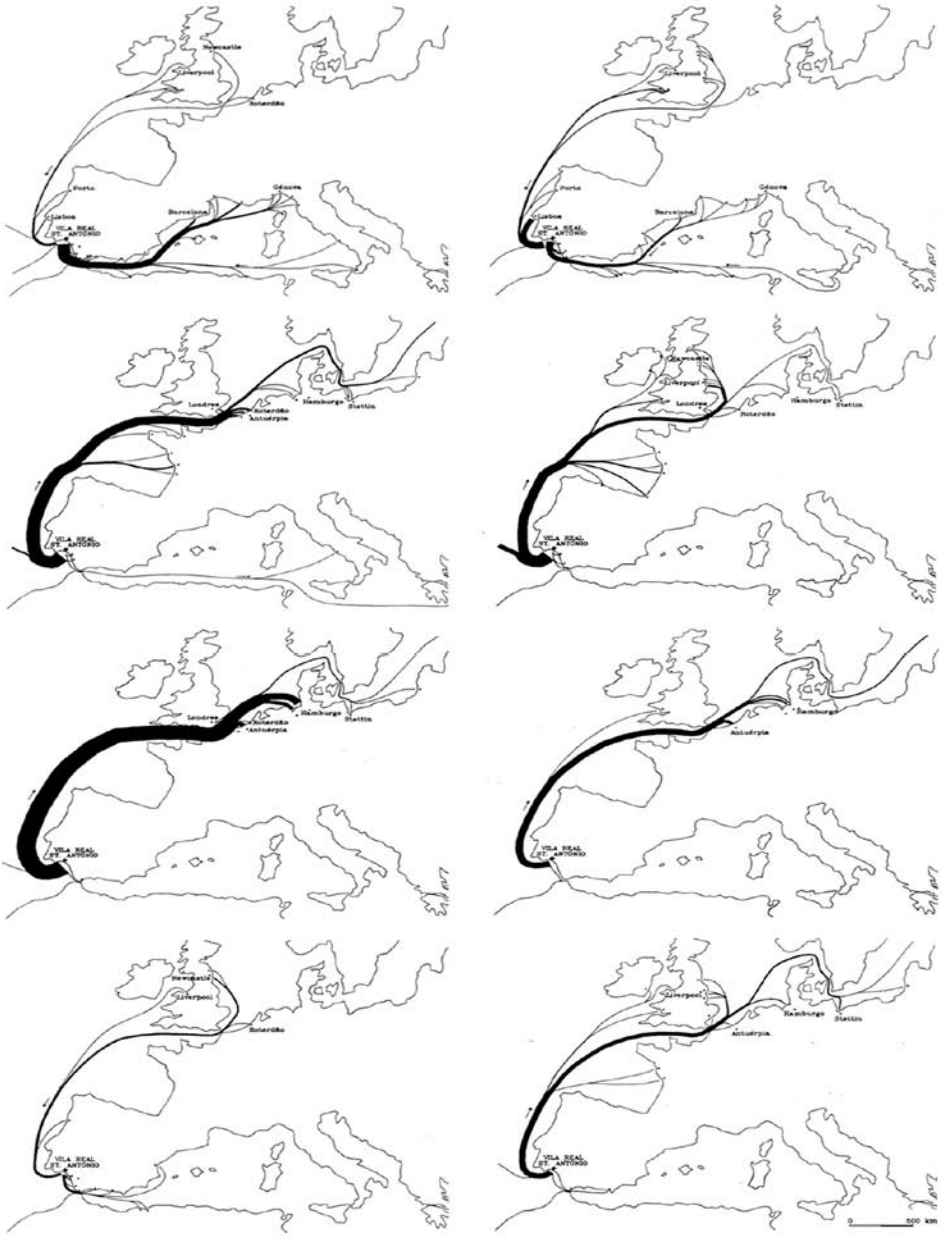
112 "A comparison of the distribution of metal ores and prehistoric gold jewelry in the Iberian Peninsula" from Gamito, Teresa Júdice (2005) *The Celts in Portugal*, e-Keltoi: Journal of Interdisciplinary Celtic Studies: Vol. 6 , Article 11.



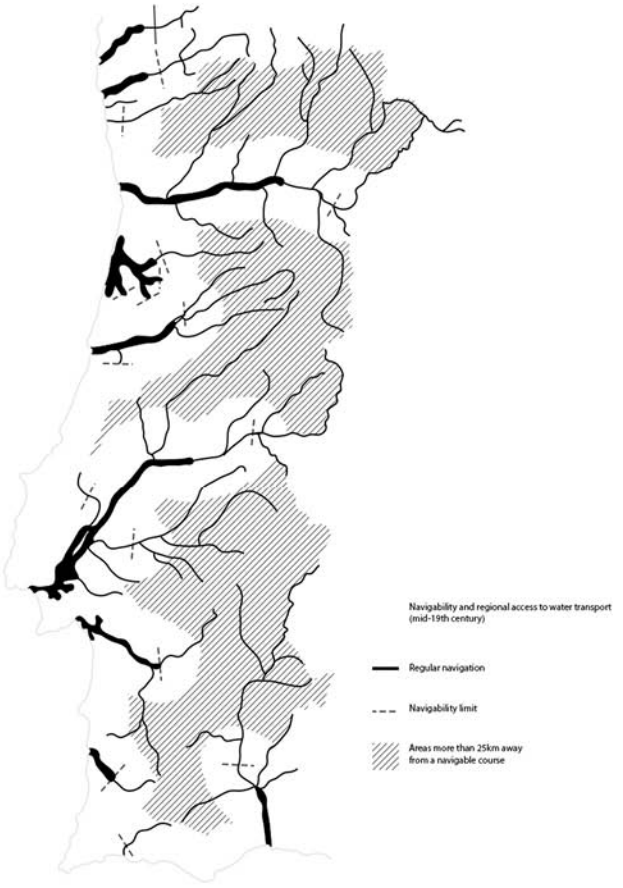
113 Map showing the Iberian Pyrite Belt with major river systems and boundary between the Atlantic and Mediterranean basins. Here we can see the intersection of the Iberian Pyrite Belt with the Guadiana river and the geographical location of the S. Domingos VMS deposit. This map is based on the anterior maps of "A comparison of the distribution of metal ores and prehistoric gold jewellery in the Iberian Peninsula" from Gamito, Teresa Júdice (2005) *The Celts in Portugal*, e-Keltoi: Journal of Interdisciplinary Celtic Studies: Vol. 6 , Article 11. Overlapping information of Iberian boundaries and river systems (from an online atlas) have been added.



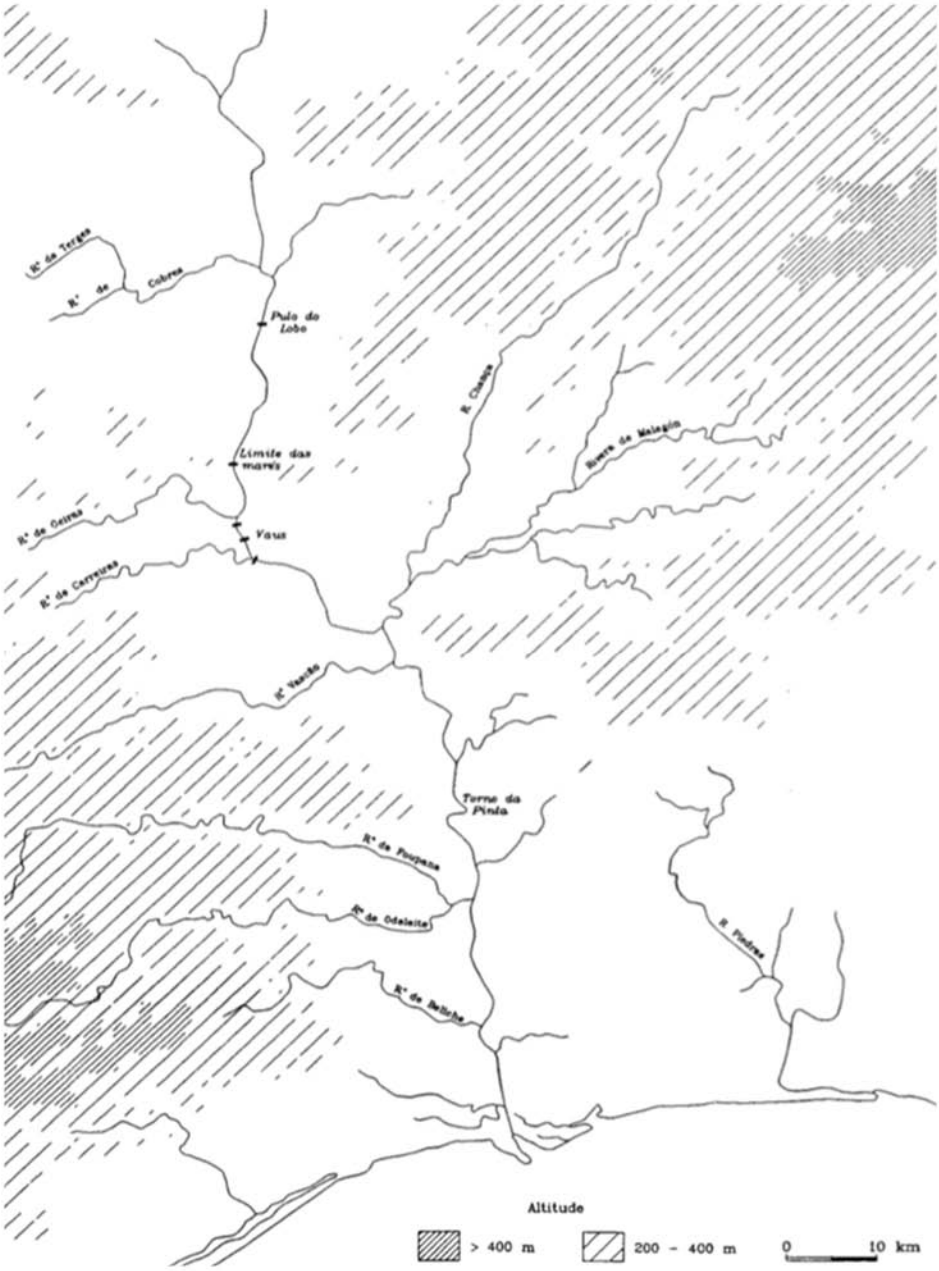
114 Adaptation showing the location of S. Domingos VMS deposit in comparison to the Northeast Passage (white) and an alternative route through the Suez Canal (black).



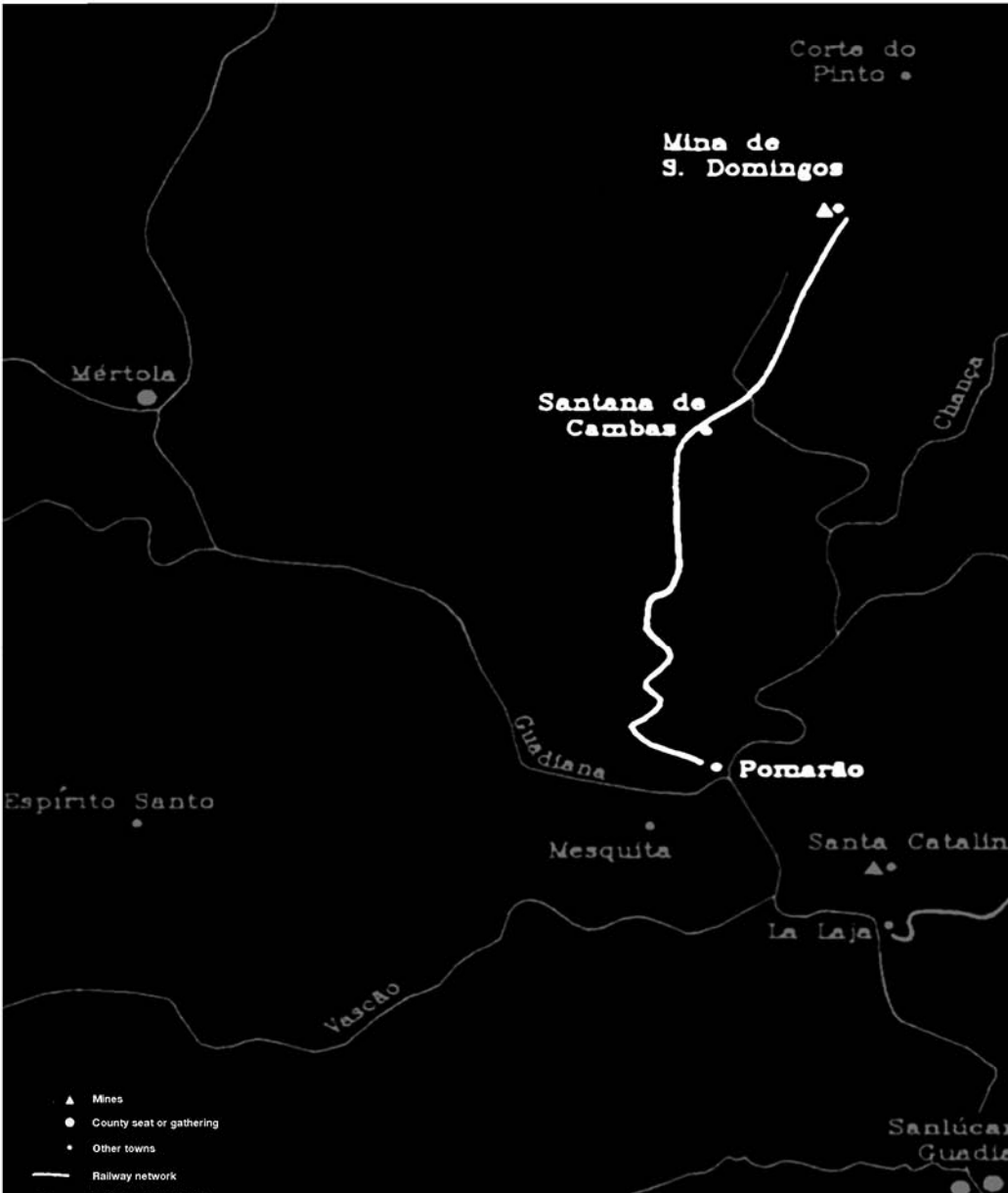
115 Compilation of images showing the frequency of trade and interaction of the port of Vila Real de St Antonio, Portugal, in relation to the navigation of ships in the lower Guadiana River during the period of mining at S. Domingos (1857-1917).



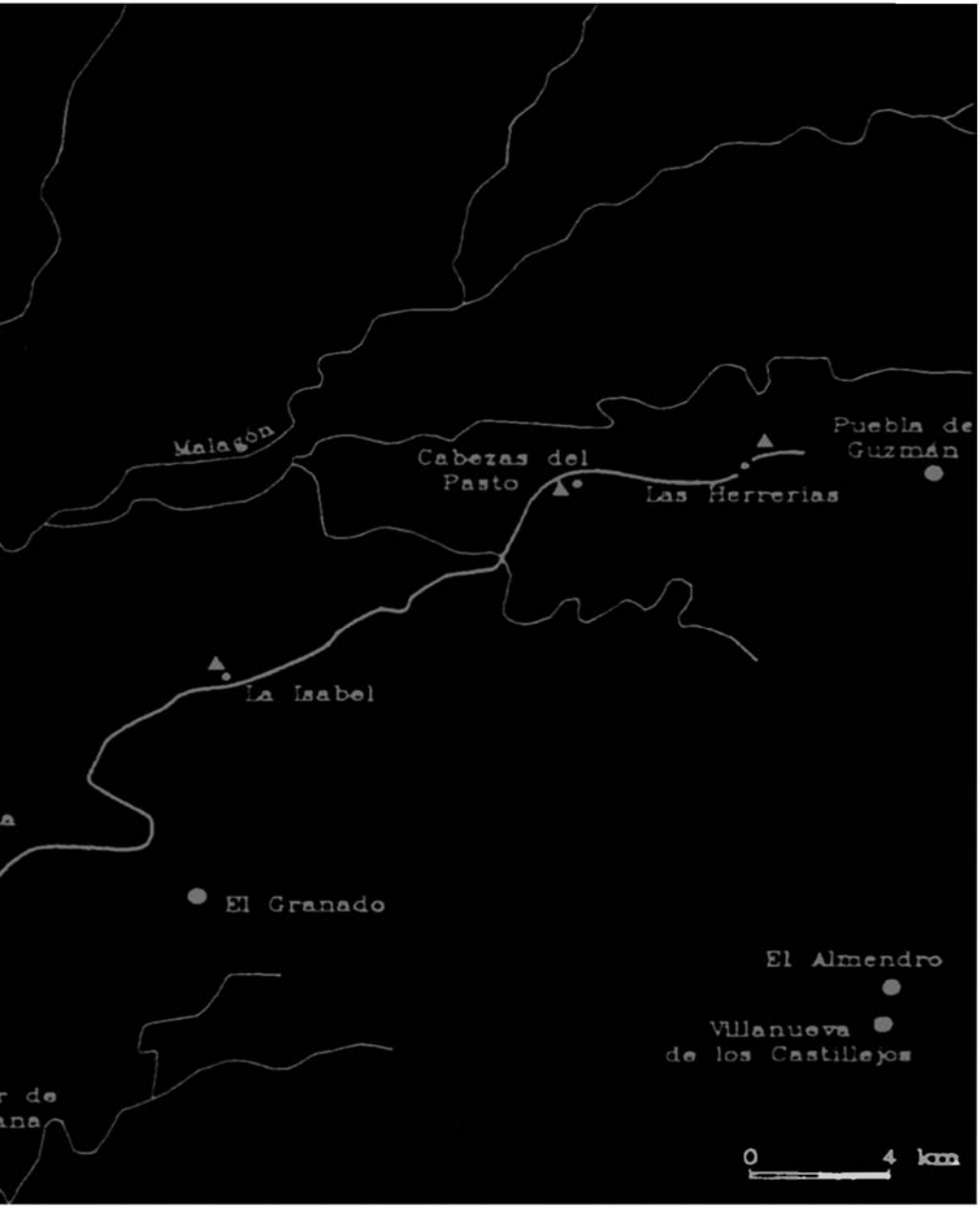
116 Map showing navigability and regional access through major river systems in the territory of Portugal during the mid 19th century (taken from -Garcia, J.C. "Portuguese copper and these trade in the Western Mediterranean from 1895 to 1909""" in Revista da Faculdade de Letras - Geografia 1 Serie, Vol IV. Porto, 1988. 291-297.) In the 19th century and before, some of these rivers major river systems were navigable for longer stretches than is possible today as the construction of large hydroelectric dams only started in Portugal in the mid 20th century. The location of the S. Domingos VMS deposit was strategic in that it coincidentally was close to the Guadiana River making it possible for transport to transport ore down the river to ships on the north east trading passage.

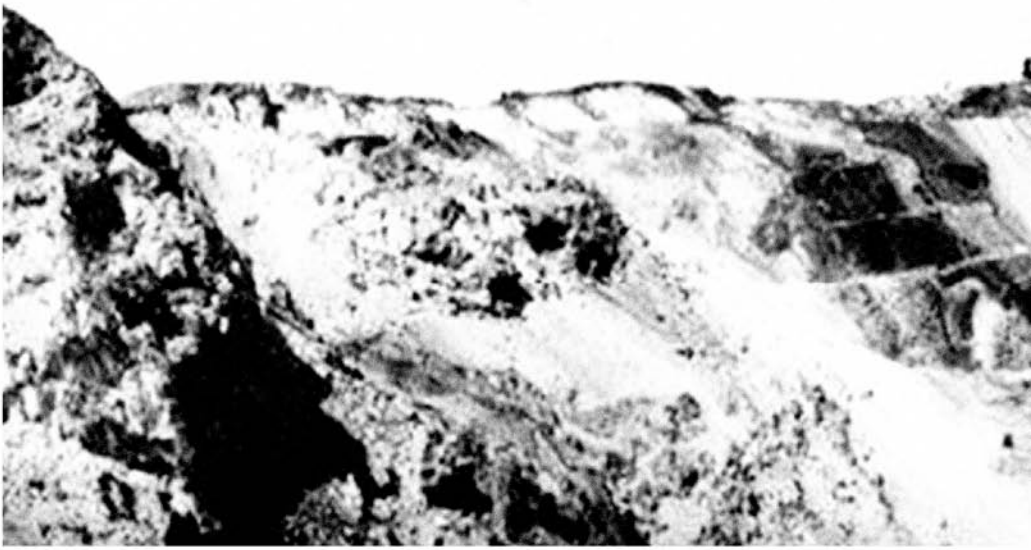


117 Conceptual altimetric map showing the lower part of the Guadiana River between Portugal (left) and Spain (right). Taken from: Garcia, J.C. "Portuguese copper and these trade in the Western Mediterranean from 1895 to 1909"" in Revista da Faculdade de Letras - Geografia 1 Serie, Vol IV. Porto, 1988.

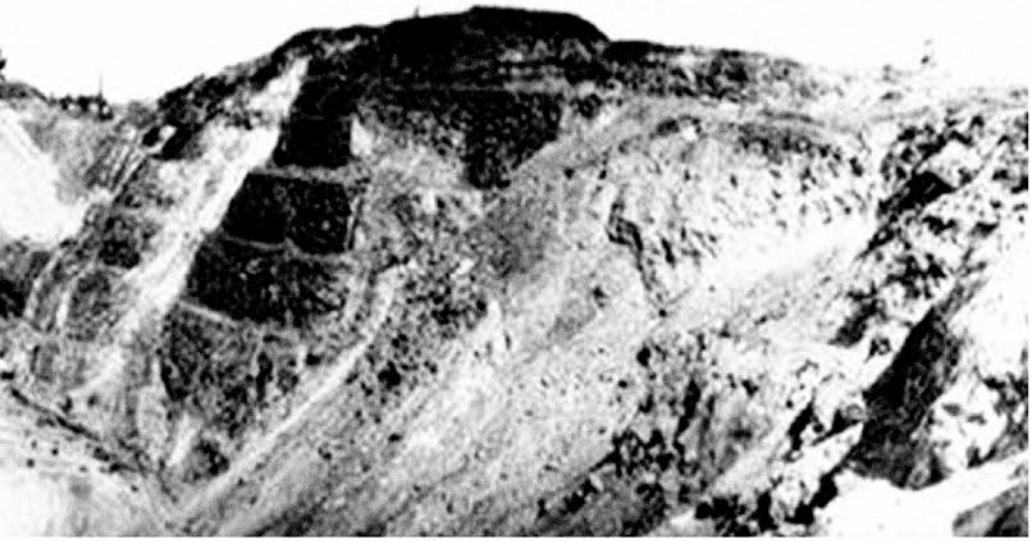


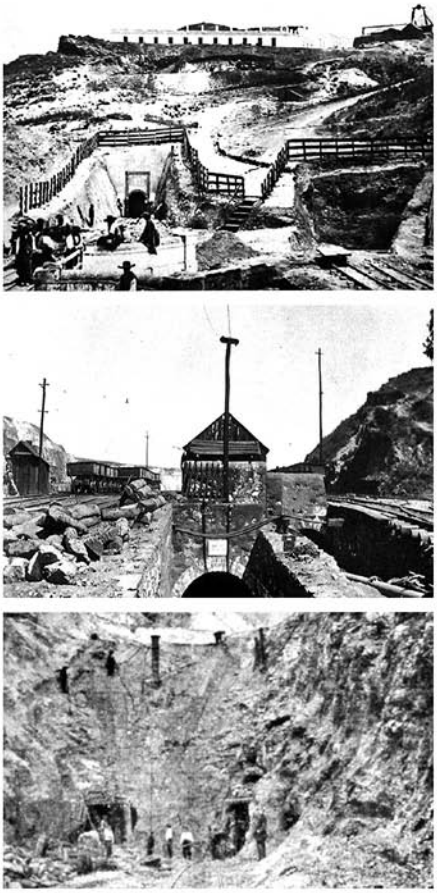
118 Map (modified for this thesis) from Garcia, J.C. "Portuguese copper and these trade in the Western Mediterranean from 1895 to 1909""" in Revista da Faculdade de Letras - Geografia 1 Serie, Vol IV. Porto, 1988. This map shows the hydrographic network of the Guadiana River between Portugal and Spain (spanning from Mértola to Puebla de Guzman), during the mid 19th century. We can see the major mines at the time as well as their railway networks, which connect them and the Guadiana River, for the transportation of ore. At the Pomatão on the Guadiana River, the ore was offloaded onto ships heading for major processing industries in Europe. (See trade network. p.271) Here we focus special attention to the S. Domingos mining railway network which passes through the Santana de Cambas en route to the destination of the Portuguese port of Pomarão on the Guadiana River.


Malagón
Cabezas del
Pasto
Las Herrerias
Puebla de
Guzmán
La Isabel
El Granado
El Almendro
Villanueva
de los Castillejos
0
4 km

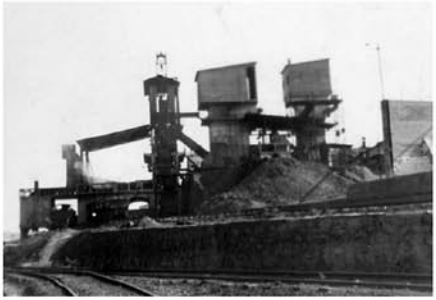


119 1960? View to the west of the open pit of S. Domingos Mine. Some of the terraces remain but there has been considerable disintegration of them through landslides within the open pit.

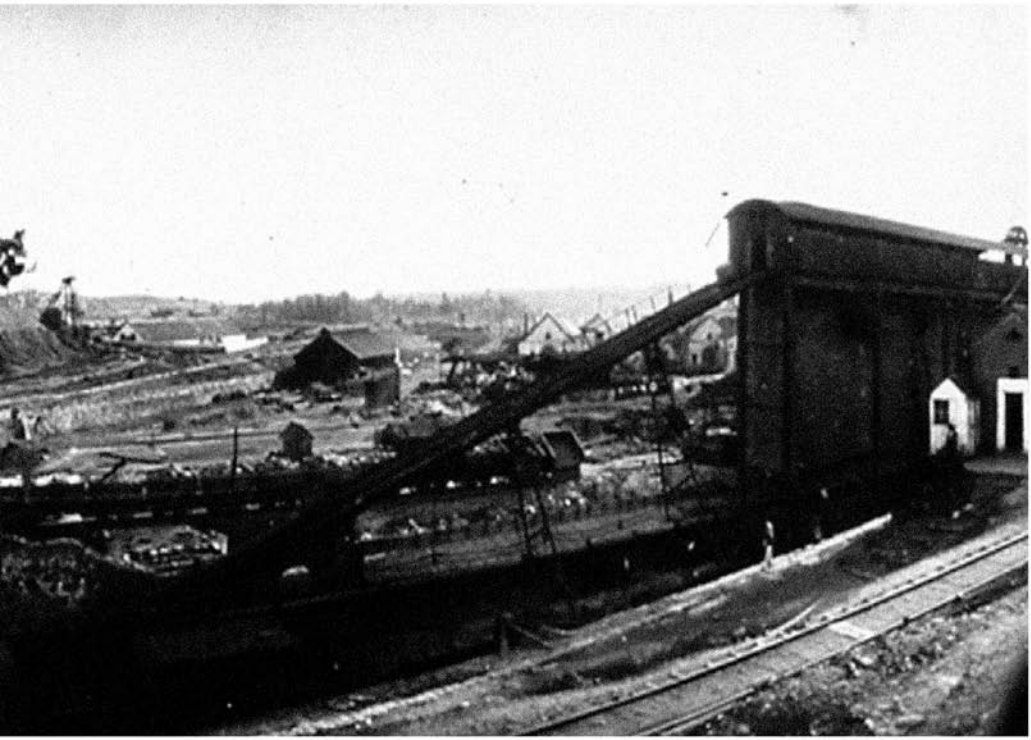




120 Composition of six images relating to the S. Domingos open pit and the transportation of ore to the harbour of Pomarão on the bank of the Guadiana River. (Antoine Claudet? 1864). Top Left: This shows the entry to the S. Domingos underground tunnels. The hill of the S. Domingos orebody can be observed. Left Middle: 1945, entry to the S. Domingos underground tunnels. It can be observed that the hill (in the top left of the image) does not exist anymore. Left Bottom: Carlos Mascarenhas photograph within the open pit ,1903. Right Top:1945? Photograph at the opening of the S. Domingos open pit showing wagons filled with ore on the railway. Right Middle: John Higgins 1955 image showing the sulphur factories at Achada do Gamo and the railway passing by them. Right Bottom: 1955? Railway and ships at the port of Pomarão on the Guadiana River.



121 1945? Panoramic Photograph showing the 0m mining level. To the left are the railways and the wagons to the entrance of the open pit and to the right the entrance to the mine and the railway workshops can be seen.



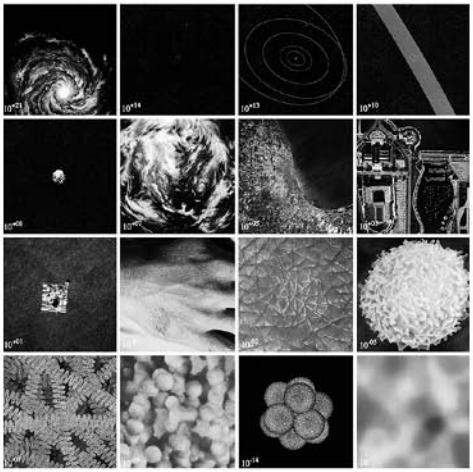
122 Aerial photograph of 2013 by Duarte Fernandes Pinto showing the terrils at the area of Achada do Gamo. The artificial hills, a result of years of continuous dumping of slag, create an artificial awe-inspiring landscape - not only due to their scale within the S. Domingos mining ravine but also to due to their contrast to the surrounding landscape and vegetation.

123 Panoramic view, facing east within the S. Domingos open pit. To the right of the photograph, the wooden path way, built for the visitor to view the open pit, lies on top of consolidated mining waste. The still surface of the acid mine drainage within the mining pit (to the left) reflects the sky and the surrounding landscape and acts as a mirror of gigantic proportion.

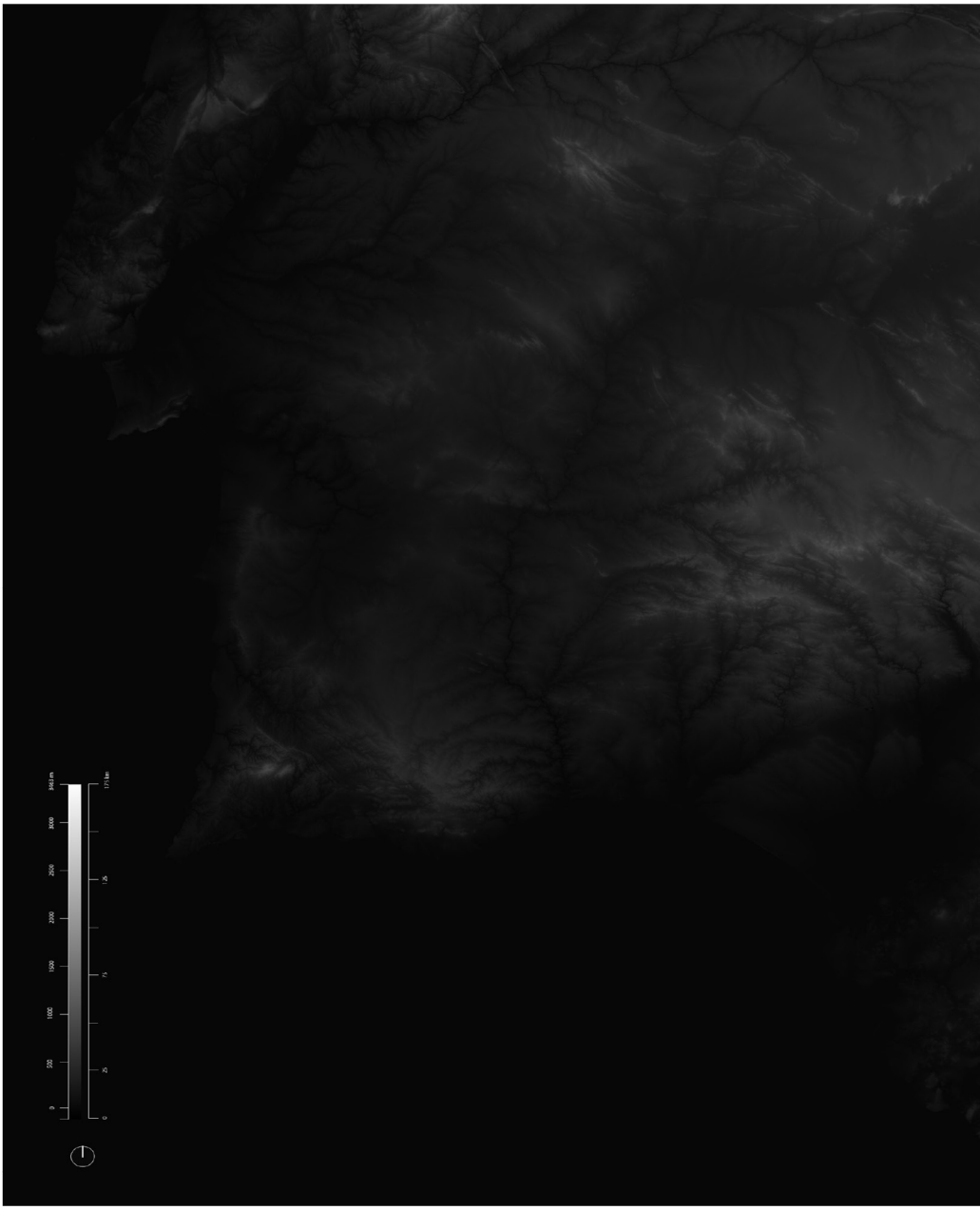
Cartographic analysis and documentation

Charles and Ray Eames documentary *Powers of Ten* (1977) explores "continuity and change" of the universe through scale. A location is given a dimension, a perspective, a relationship. Exponential powers are used to explain the significance of scale[83].

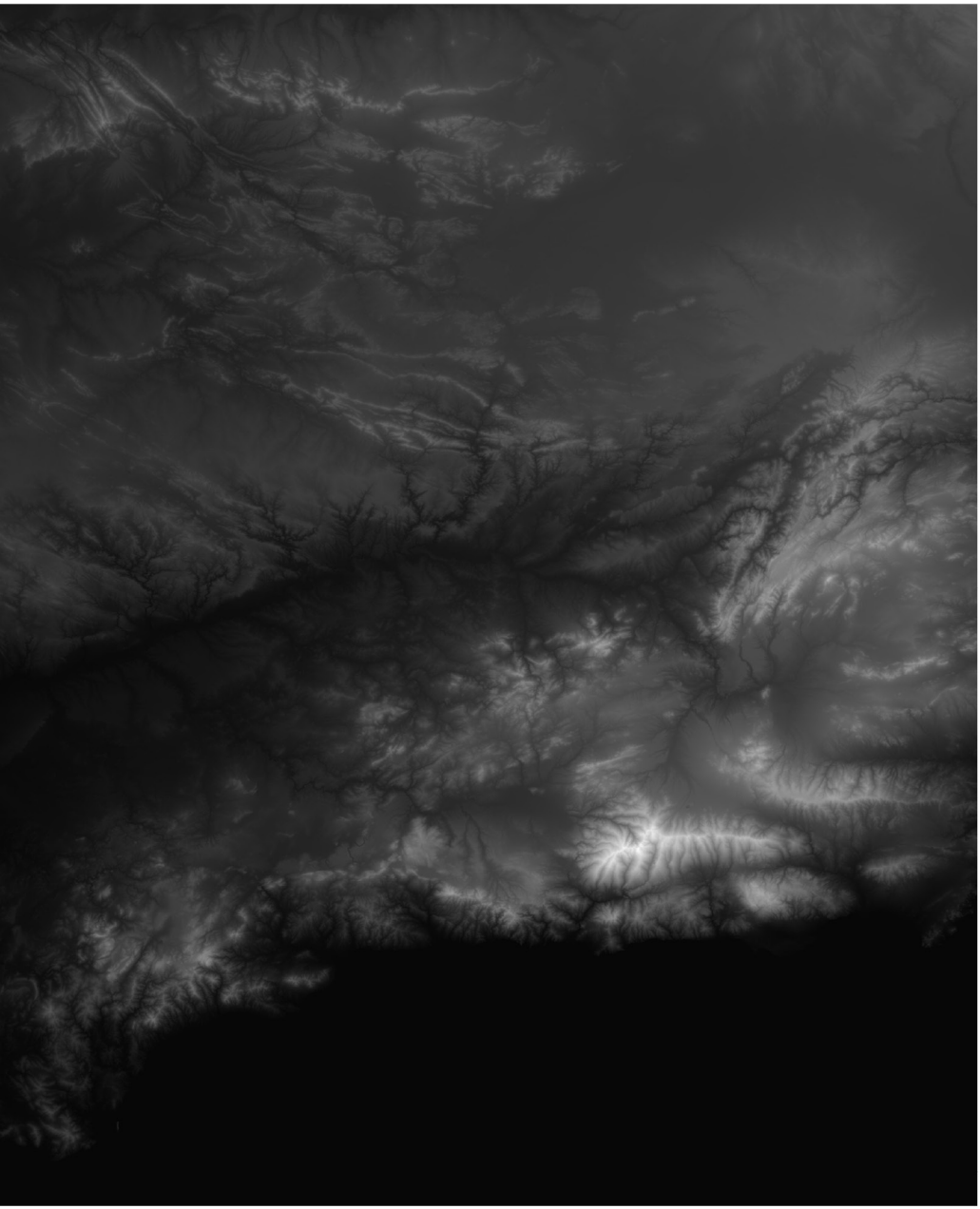
In a similar way, in this project, an attempt has been made to investigate S. Domingos in terms of scale such as that generated by cartography from the SRTM Worldwide Elevation Data which through NASA has digitally mapped Earth through elevation[84]. Planimetric axometric cartography and sections have been used to reveal the mining site of S. Domingos as a unique landscape and its relationship to the landscape of which it is part: the Iberian Pyrite Belt; Guadiana water system; 130m contour line above sea level; S. Domingos railway to the harbour at Pomerão; the mounds of toxic waste produced through years of mining in the landscape; the open pit at S.Domingos. The interconnectedness of all of these is revealed through the order of cartographic imagery of various scales of their analysis. On different scales they tell us the narrative of the S. Domingos open pit in relation to its surroundings.

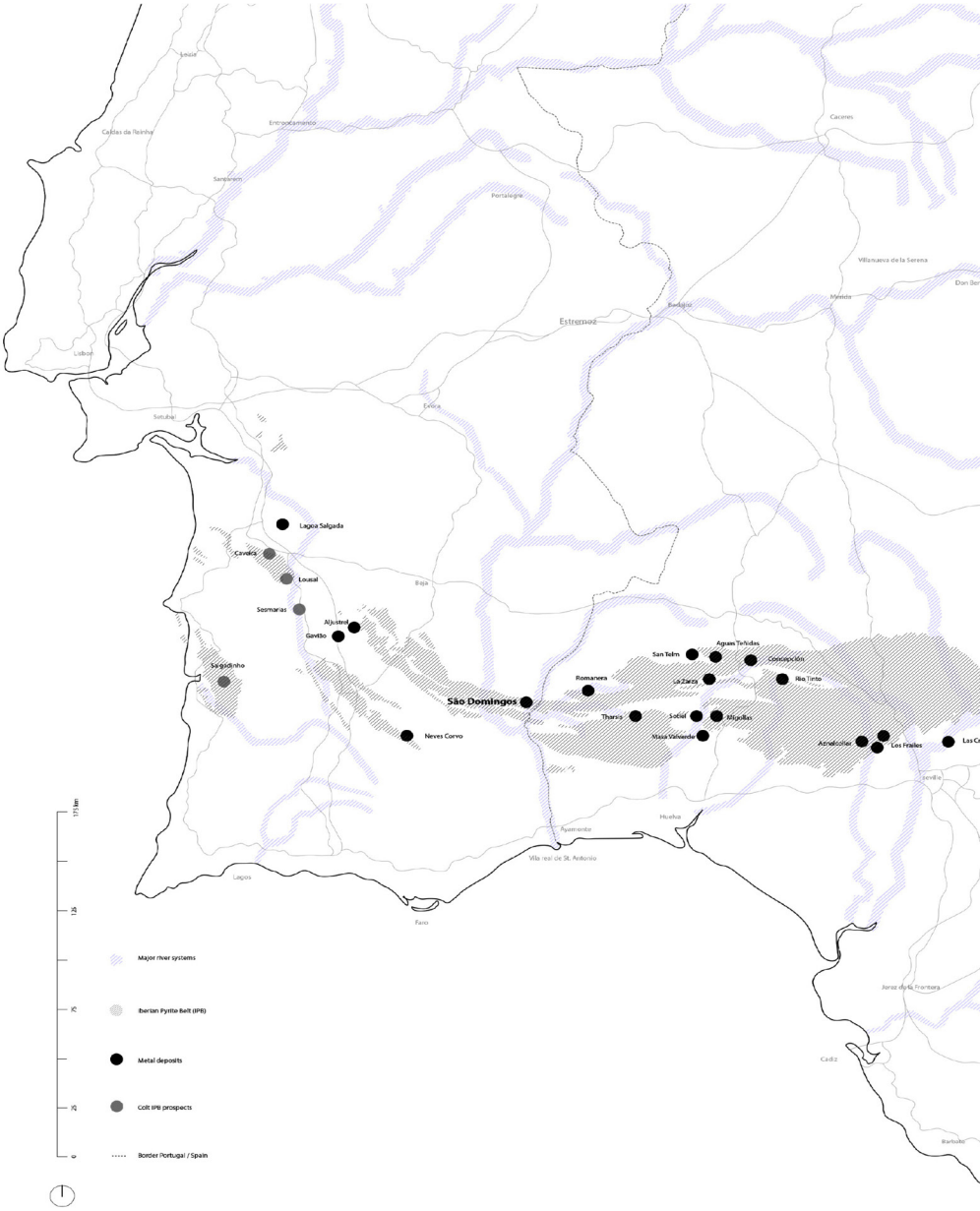


124 Composition of 16 still images from the short documentary film "Powers of Ten" directed by Charles and Ray Eames and distributed by IBM. 1977.



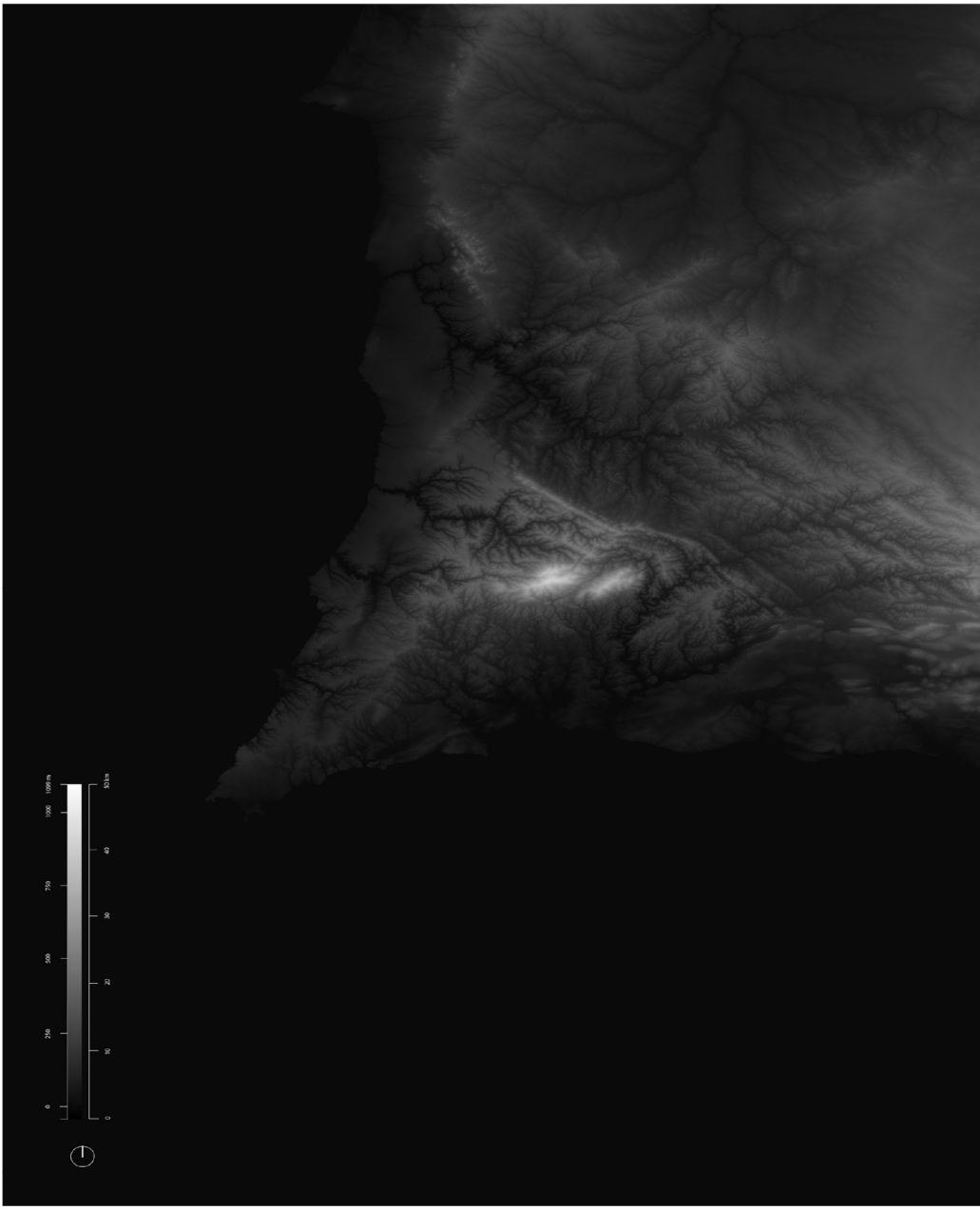
125 Hypsometric map generated by cartography from the SRTM Worldwide Elevation Data showing the southwestern region of the Iberian Peninsula. This cartography is to be viewed along with the following map on pages 288 and 289 to identify the location of S.Domingos Mine on the Iberian Pyrite belt and, other geographical references. © Jared Miguel Fantasia. 2018



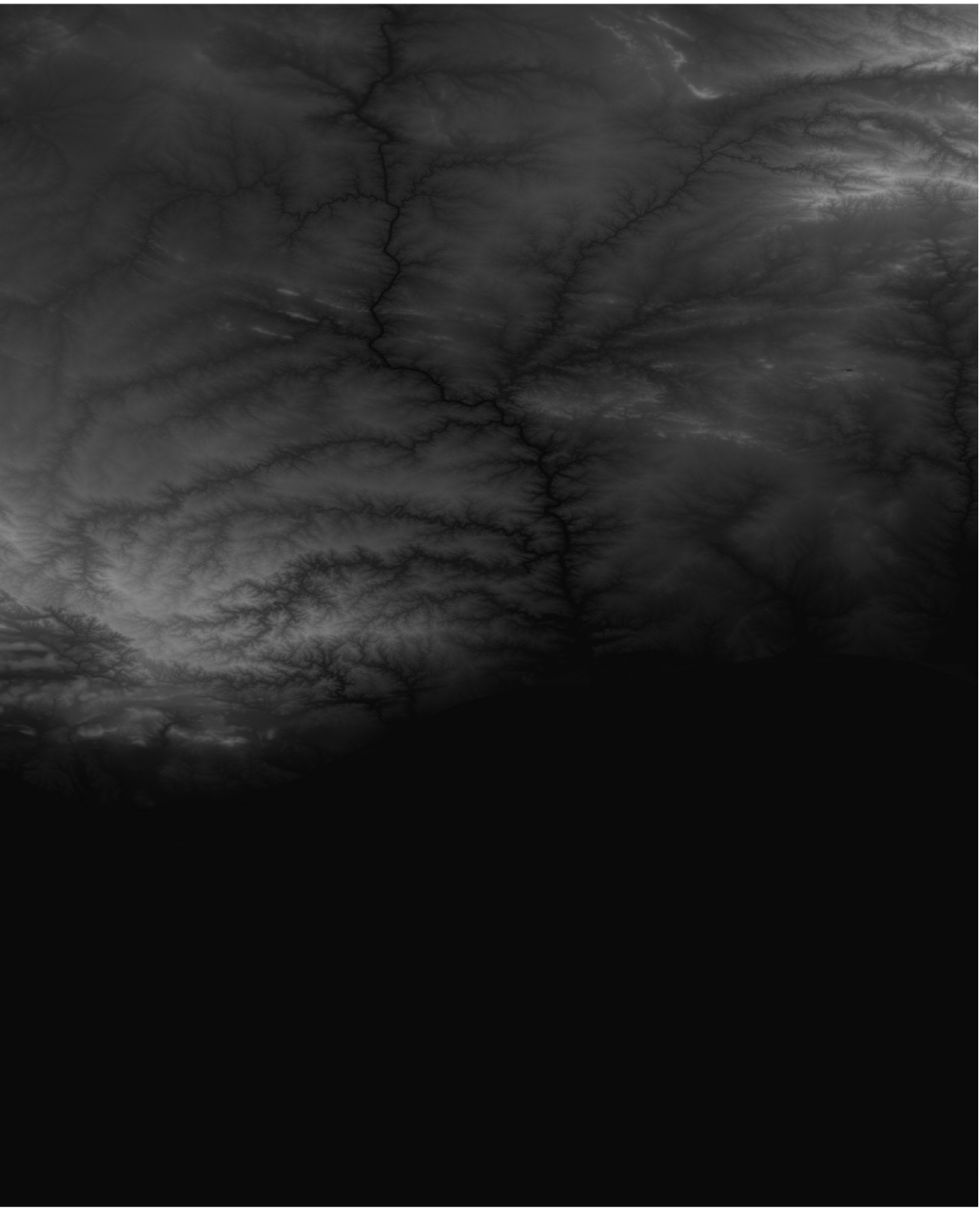


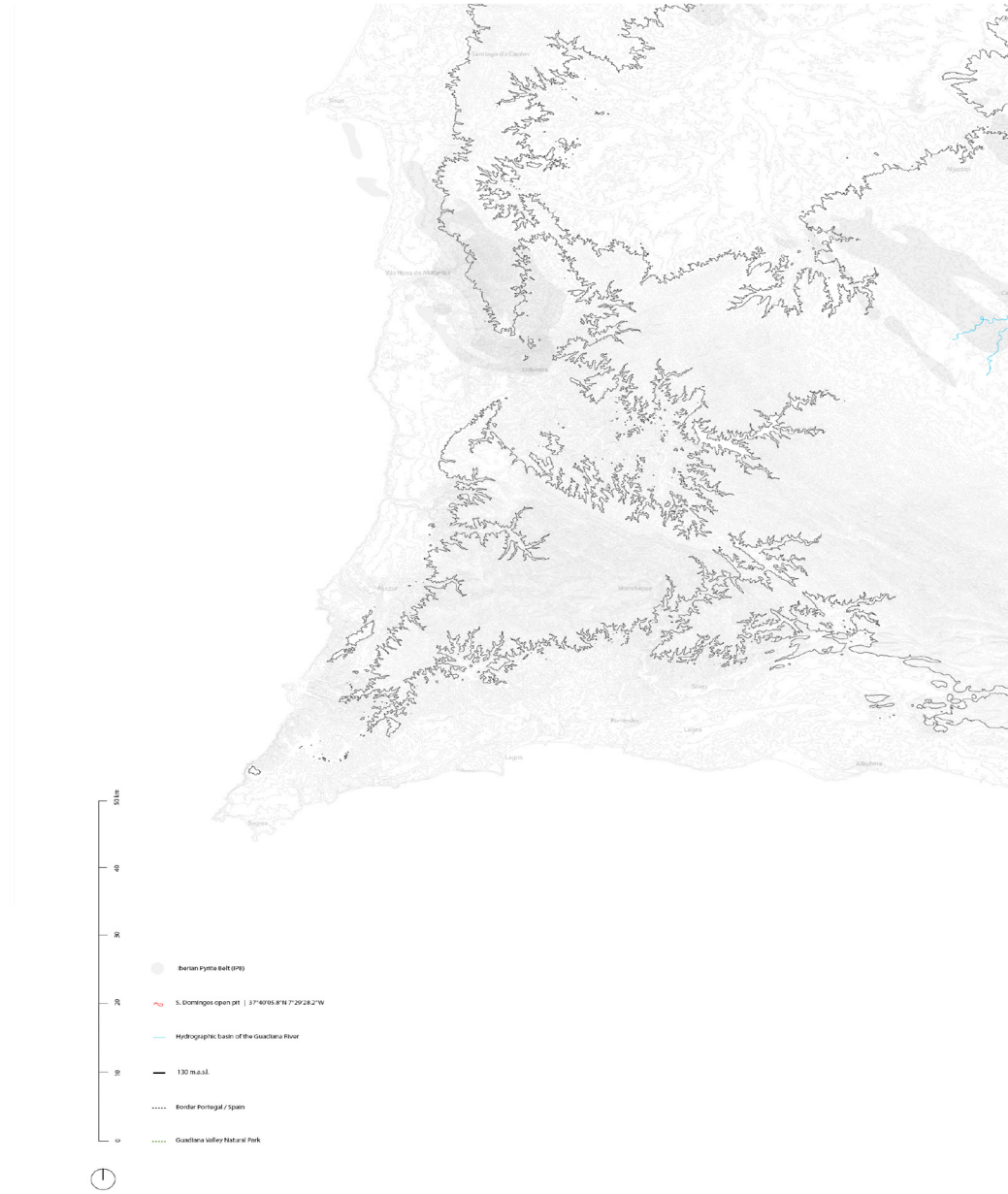
126 Map showing the southwestern region of the Iberian Peninsula with: major river systems,; Iberian Pyrite Belt; metal deposits; colt IPB prospects; border between Portugal/Spain. The S. Domingos Mine is situated where the Guadiana River and the Portuguese border intersects the Iberian Pyrite Belt. © Jared Miguel Fantasia. 2018


Toledo
Alcazar de San Juan
Campo de Criptana
Tomelloso
Villarrobledo
Ciudad Real
Valdepeñas
Puertollano
Almagro
Linares
Jaen
Cordoba
Sevilla
Lucena
Baza
Guadix
Granada
Osuna
Loja
Almeria
Motril
Adra
El Ejido
Malaga
Marbella
Gibraltar

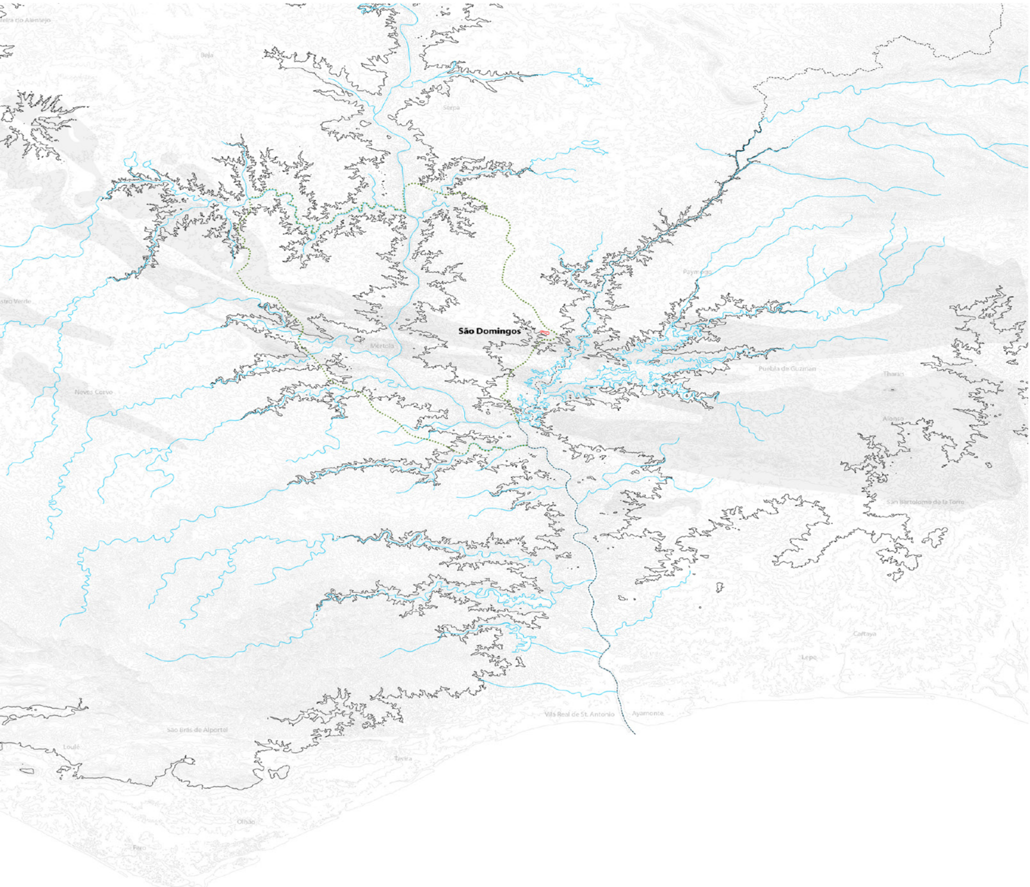


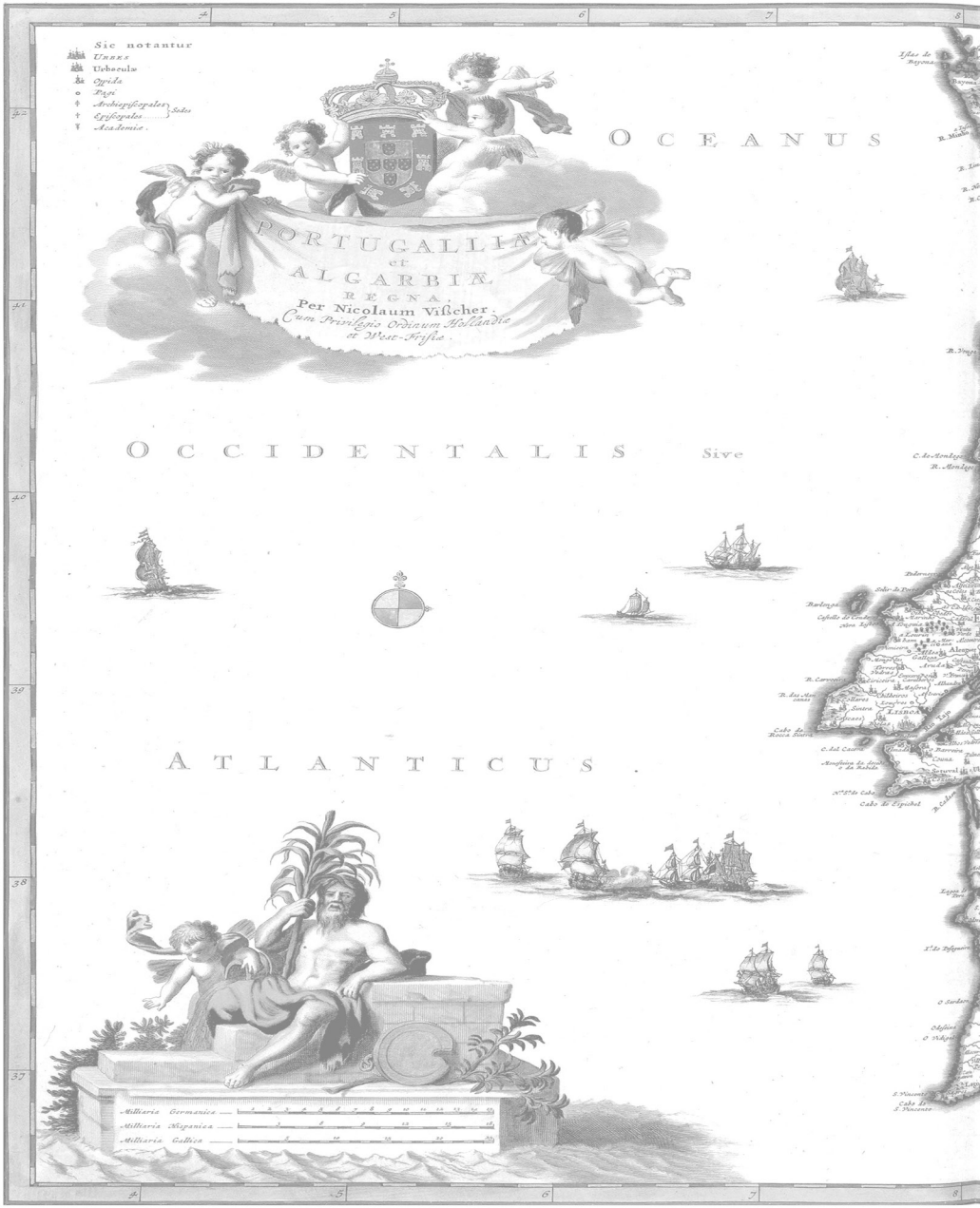
127 Hypsometric map showing the region of the Algarve generated by cartography from the SRTM Worldwide Elevation Data showing the southwestern region of the Iberian peninsula. The curving ridges of the Iberian Pyrite Belt, ranging from east to west, can be clearly seen. This cartography is to be viewed along with the following map on pages 292 and 293 to identify the location of S.Domingos Mine on the Iberian Pyrite belt and, other geographical references. © Jared Miguel Fantasia. 2018





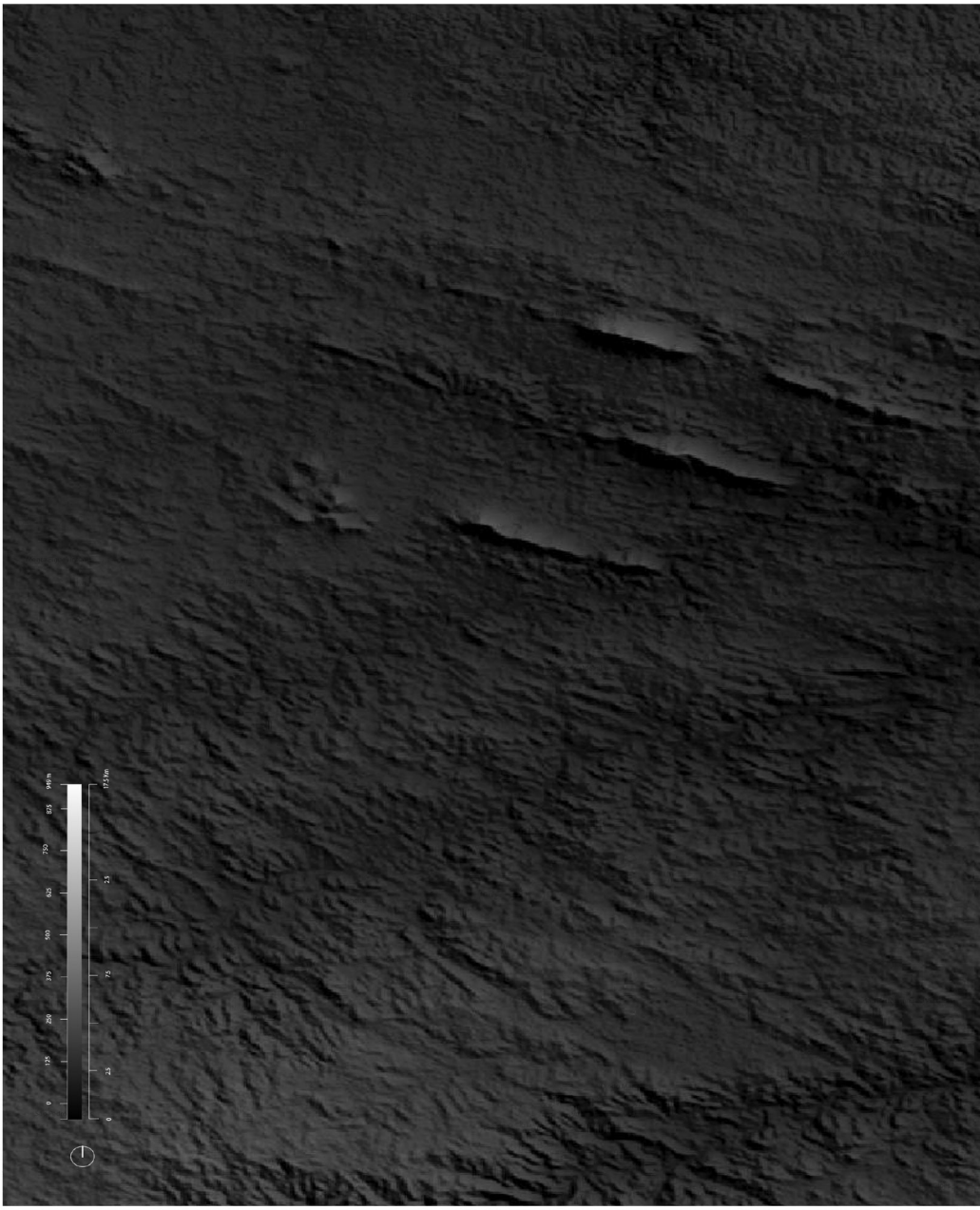
128 Map showing the region of the Algarve generated by cartography from the SRTM Worldwide Elevation Data showing the south western region of the Iberian Peninsula. Here we can see: the Iberian Pyrite Belt; the S. Domingos open pit framed by the 130 m above sea level contour; the hydrographic basin of the Guadiana river; the border between Portugal and Spain; the Guadiana Valley Natural Park.© Jared Miguel Fantasia. 2018


Beja
Serpa
São Domingos
Mértola
Neves Corvo
Puebla de Guzman
Alosno
San Bartolomé de la Torre
Cartaya
Lepe
Vila Real de St. Antonio
Ayamonte
São Brás de Alportel
Tavira
Olhão
Faro

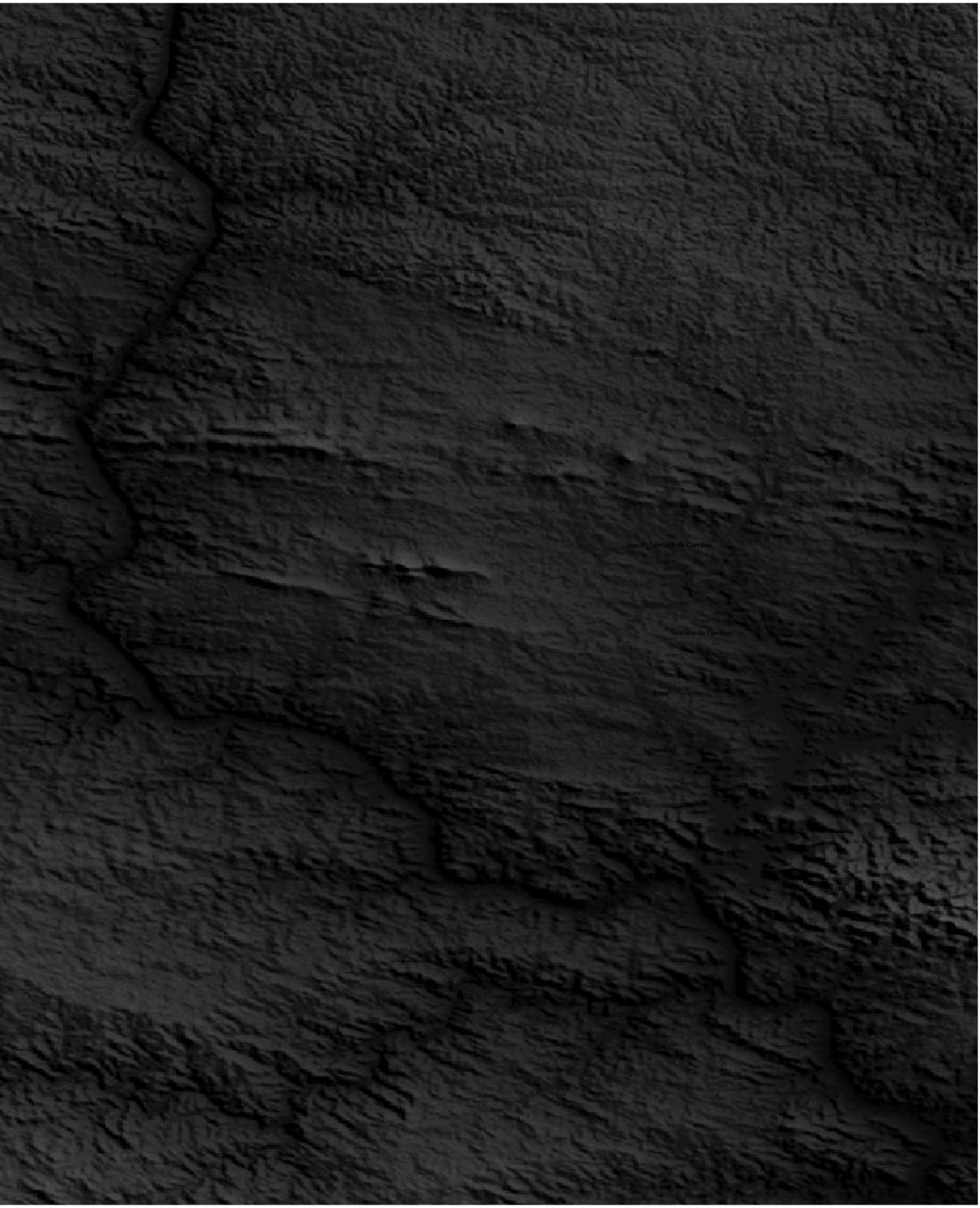


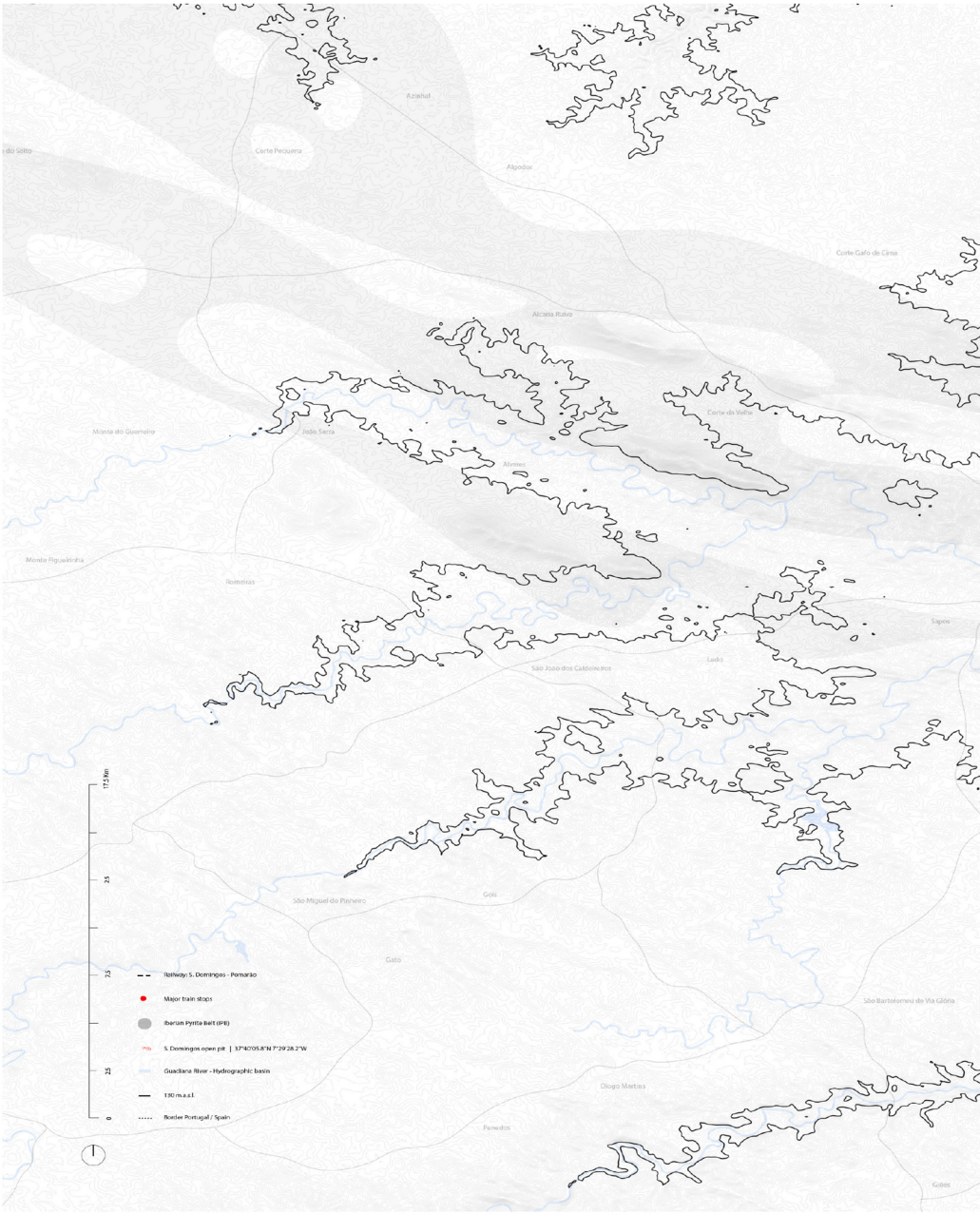
129 Map of Portugal published by Nicolaes Visscher II (1649-1702) in the second half the 17th century. The map is probably based on a map of the cartographer Pedro Texeira Albernaz (deceased 1662) who published a general map of Portugal in 1662. Here we can see the town of Corte do Pinto and the river line of the S. Domingos drainage basin that flows to the Chança River from the present S. Domingos open pit - once known as *Serra de S. Domingos*. (This water line can be observed on pages 298 to 299). At the time of the making of this map, the pre-existing Roman workings (at the current S. Domingos site) were unknown and therefore not demarcated.


GALLIÆCIÆ REGNUM
LEGIONIS
REGNUM.
CASTELLÆ VETERIS REGNUM
ESTRE
NOVÆ
MA
CASTELLÆ
REGNUM
DURA.
VANDALITIÆ
REGNUM.
GADITANUM MARE.
Corte do Pinto
Entre Minho e Douro
Tra los Montes
PORTUGALLIÆ
Beira
Stremadura
Alentejo
o Entre Tejo e Guadiana
ALGARBIÆ REGN.
El Condado
Braganca
Salamanca
Guarda
Viseu
Alcantara
Badajos
Elvas
Merada
Medellin
Truxillo
Plazencia
Coria
Ciudad Rodrigo
Valladolid
Avila
Sevilla
Cordua
Ecija
Cadiz
Malaga
Antequera
R. Douro
R. Tajo
R. Guadiana
R. Guadalquivir

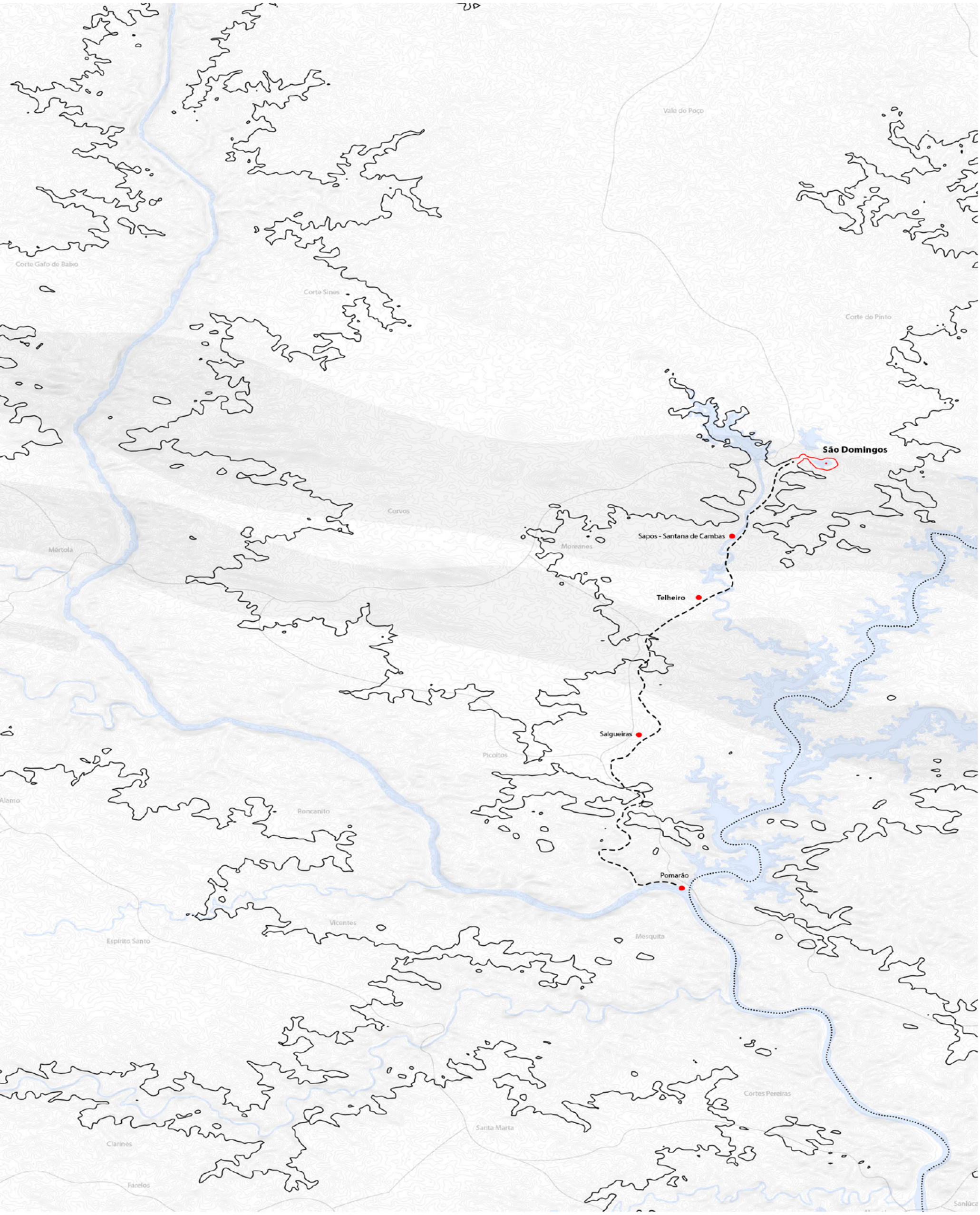


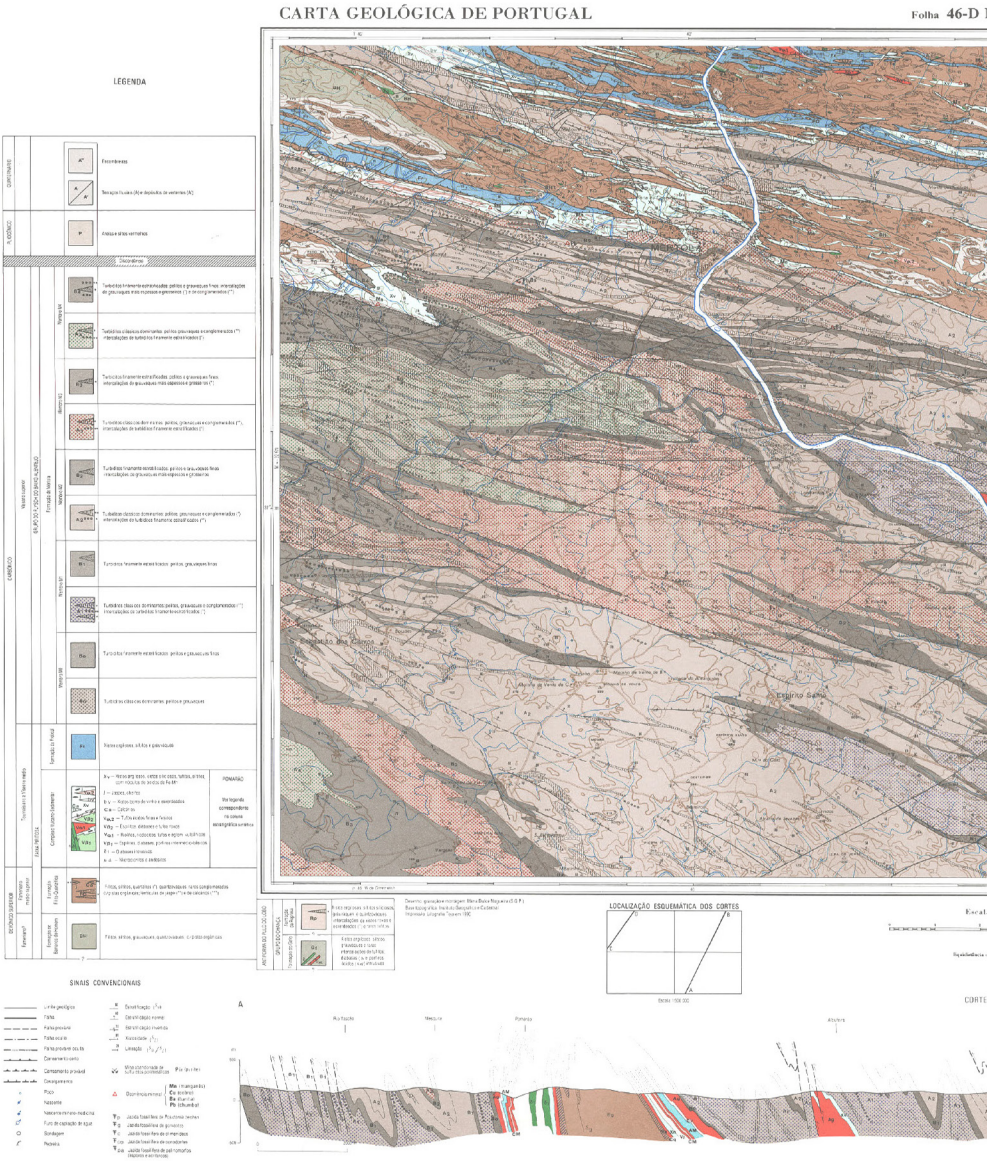
130 Hypsometric map, generated by cartography from the SRTM Worldwide Elevation Data, showing the region of the intersection of the Iberian Pyrite Belt with the Guadiana River. This cartography is to be viewed along with the following map on pages 298 and 299 to identify the location of S.Domingos Mine, Iberian Pyrite belt and, other geographical references. © Jared Miguel Fantasia. 2018


Sapos - Santana de Cambas
Santana de Cambas
Bens
Salgueiras

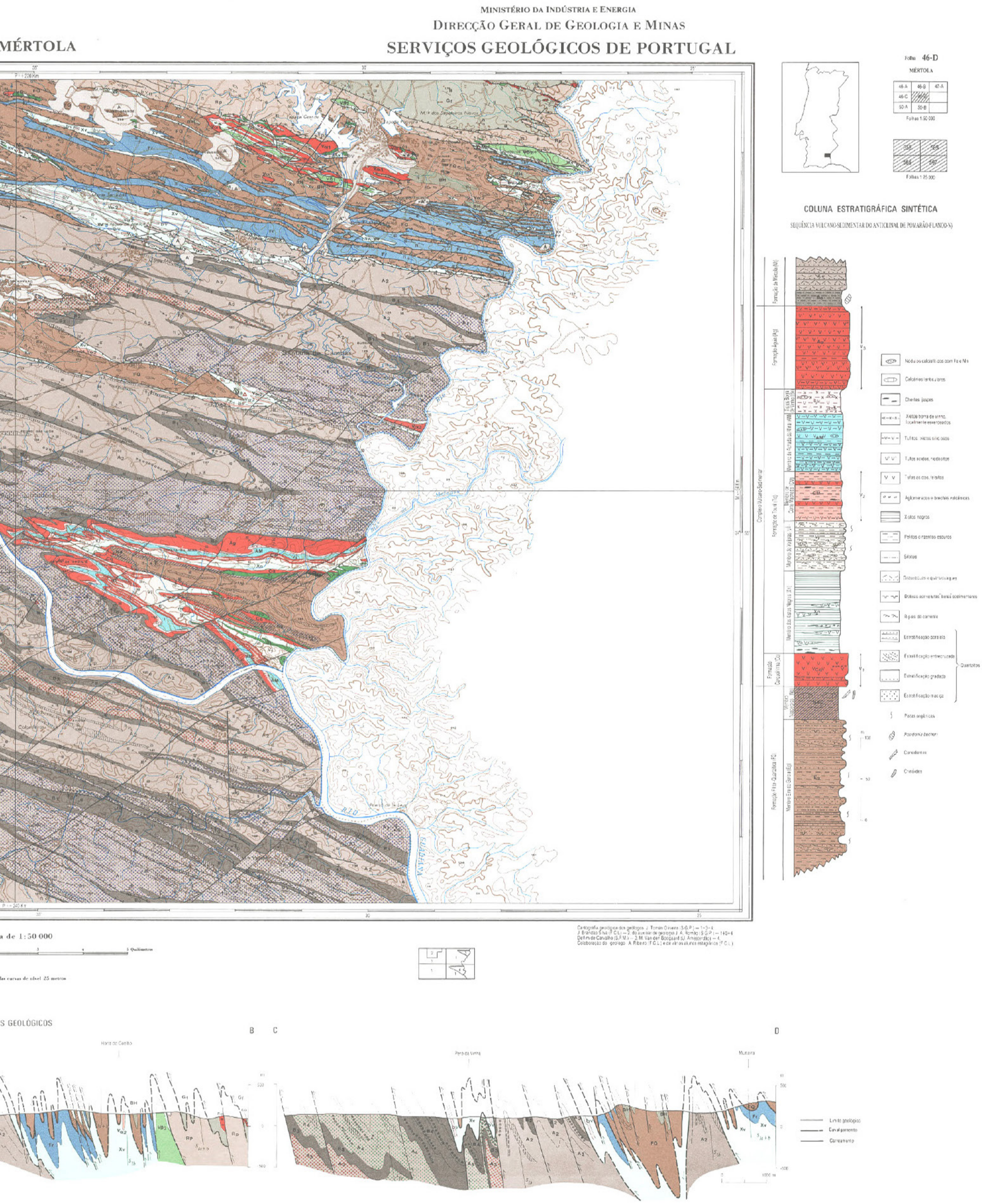


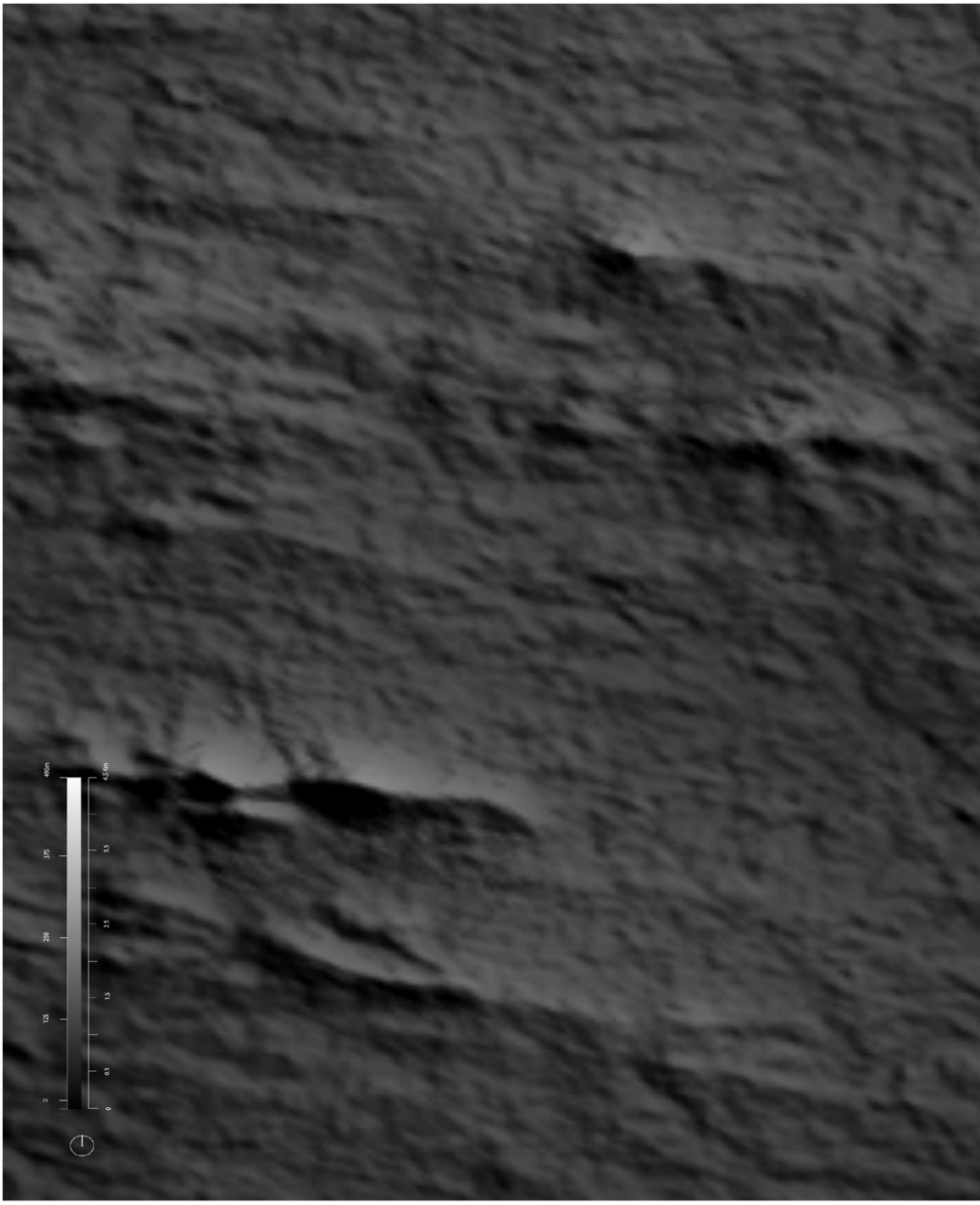
131 Map, generated by cartography from the SRTM Worldwide Elevation Data, showing the region of the intersection of the Iberian Pyrite Belt with the hydrographic basin of the Guadiana River. Here we can see the S. Domingos open pit and the railway from the open pit to the Guadiana port of Pomarão on the Portuguese - Spanish border. The 130m above sea level contour delimits the open pit. © Jared Miguel Fantasia. 2018


São Domingos
Sapos - Santana de Cambas
Telheiro
Salgueiras
Pomarão
Corvos
Mértola

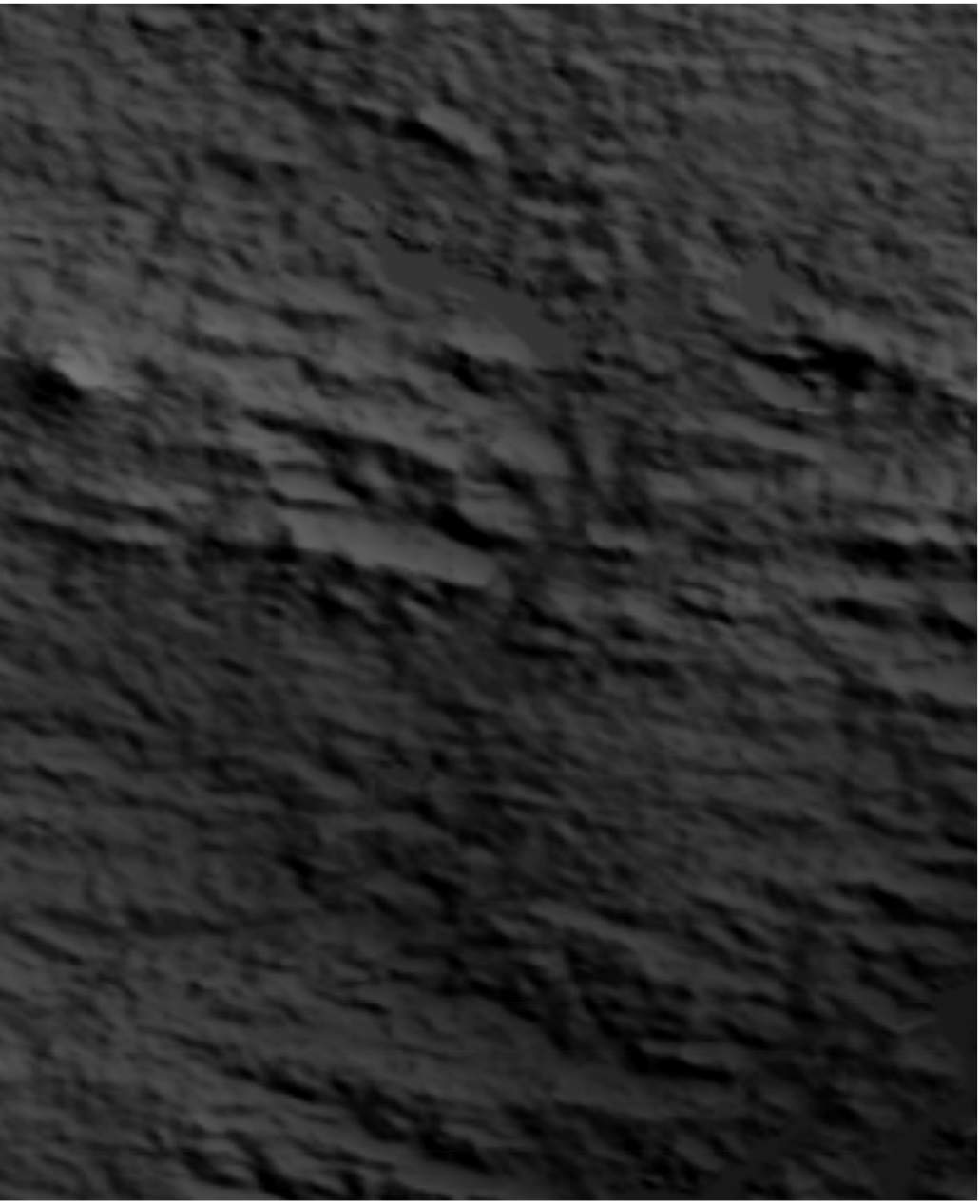


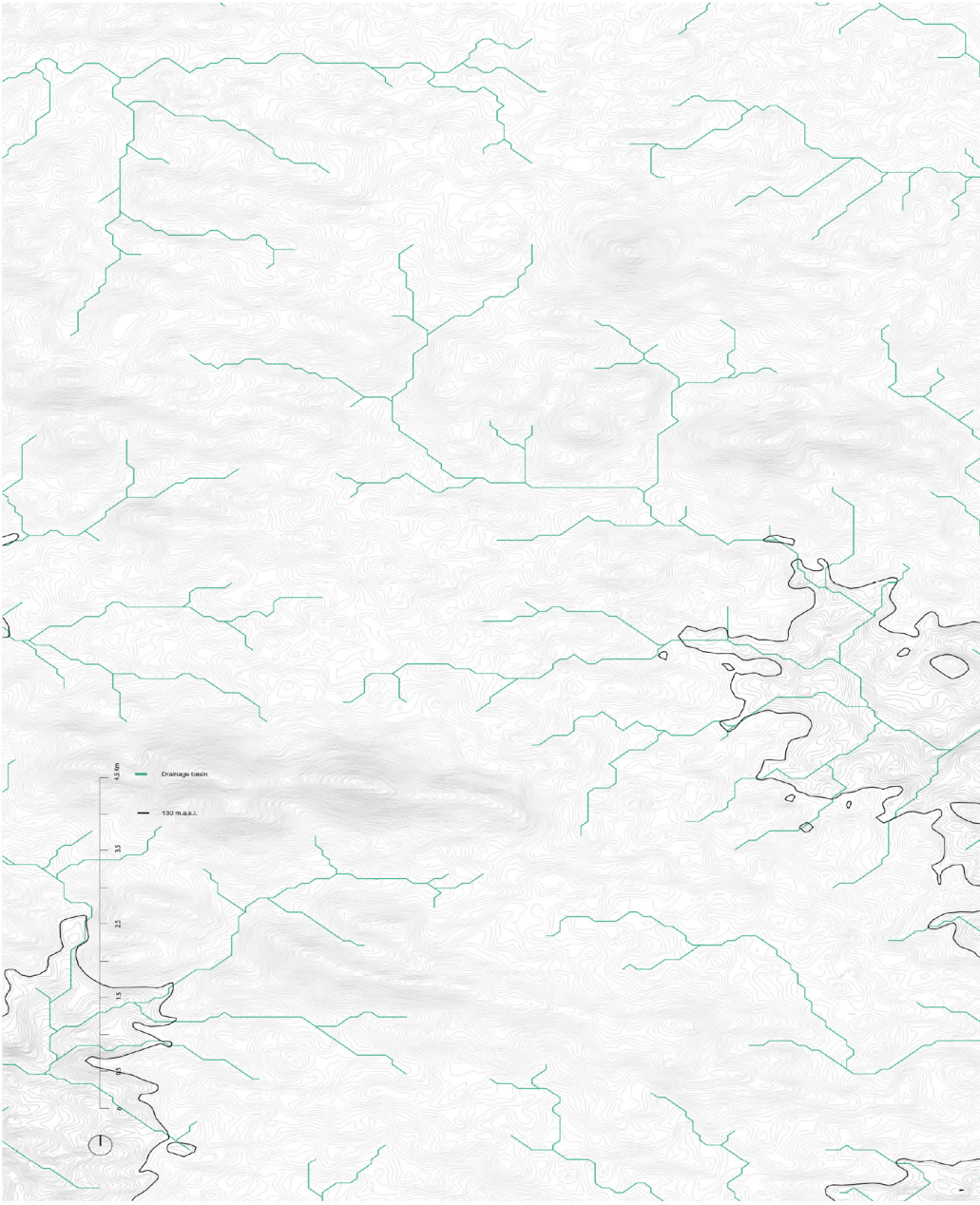
132 Geological map, sheet 46-D Mértola scale 1:50000 (Oliveira & Silva & colaborators, 1990). The Iberian Pyrite Belt and Volcanic Sedimentary Complex (VSC), passing through the S. Domingos Mining Area, can be observed as well as the geological boundaries running in a south-east direction in parallel with the Iberian Pyrite Belt. Thus we can understand that this is a territory marked by invisible lines running east-west.


MINISTÉRIO DA INDÚSTRIA E ENERGIA
DIRECÇÃO GERAL DE GEOLOGIA E MINAS
MÉRTOLA
SERVIÇOS GEOLÓGICOS DE PORTUGAL
Folha 46-D
MÉRTOLA
COLUNA ESTRATIGRÁFICA SINTÉTICA
a de 1:50 000
S GEOLÓGICOS
B
C
D

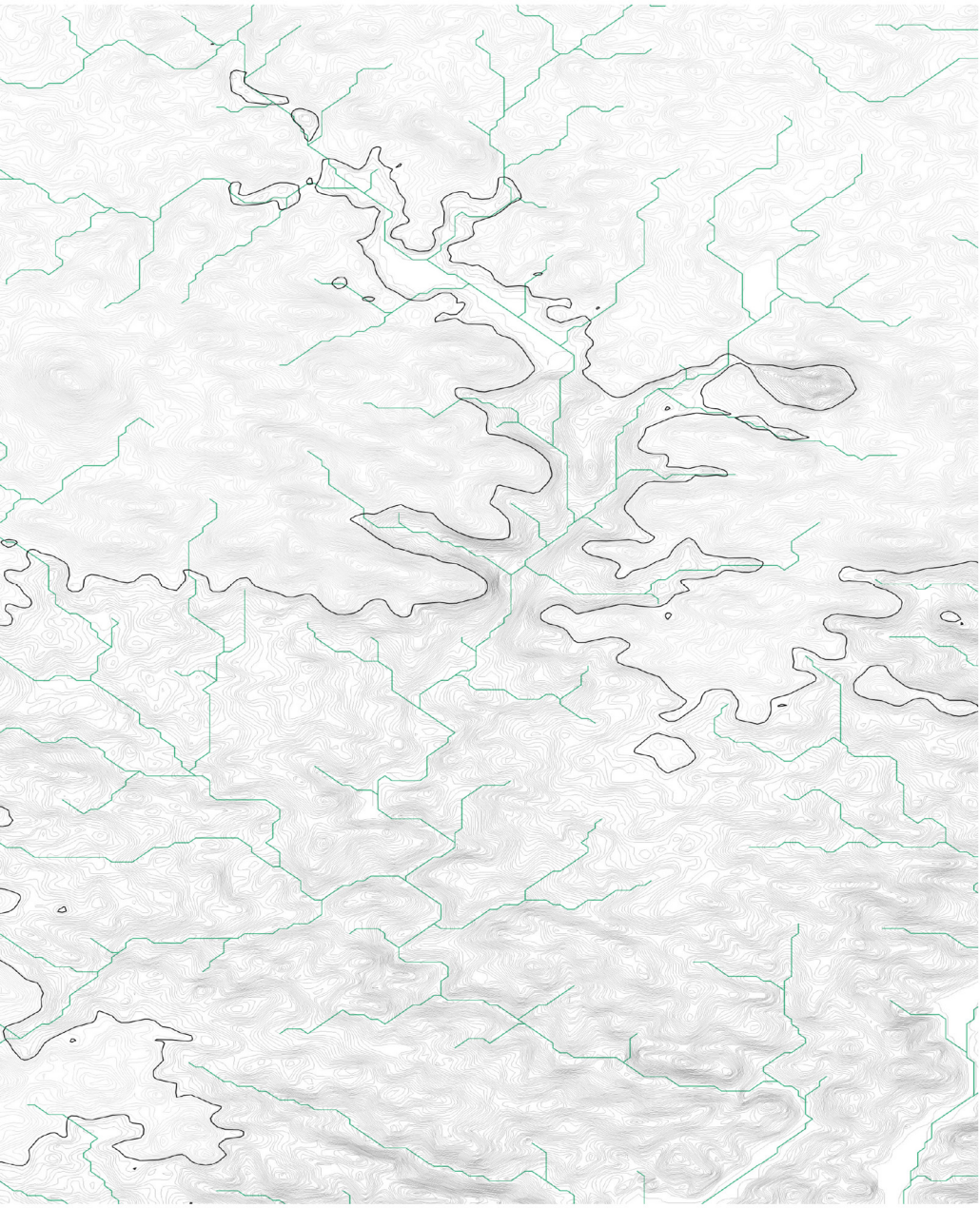


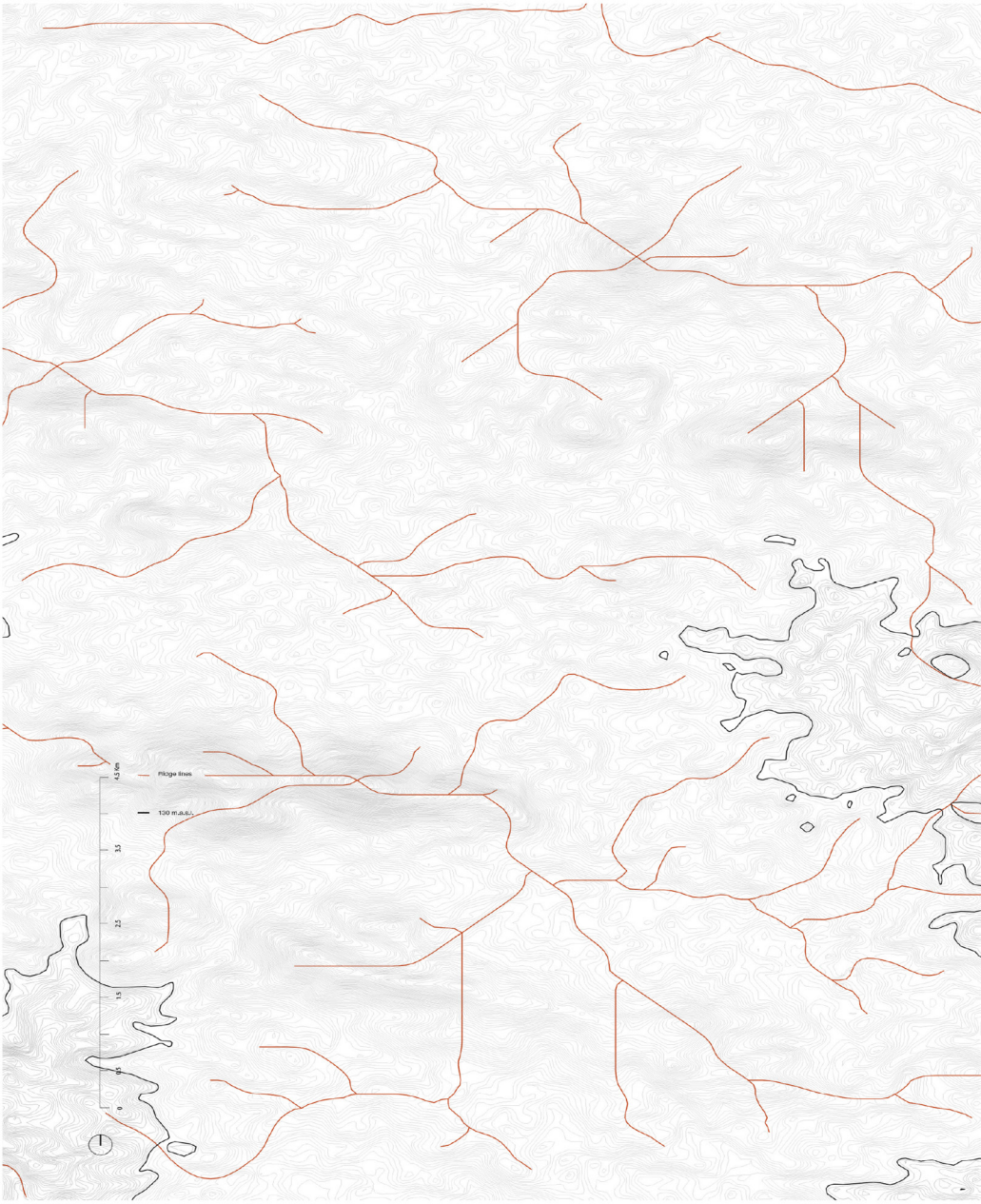
133 Hypsometric map, generated by cartography from the SRTM Worldwide Elevation Data, showing the region of the intersection of the Iberian Pyrite Belt with the S. Domingos mining area and its open pit. This cartography is to be viewed along with the following maps from pages 304 and 309 to identify the location of S.Domingos open pit, drainage basin, ridge lines and other geographical information and references. © Jared Miguel Fantasia. 2018



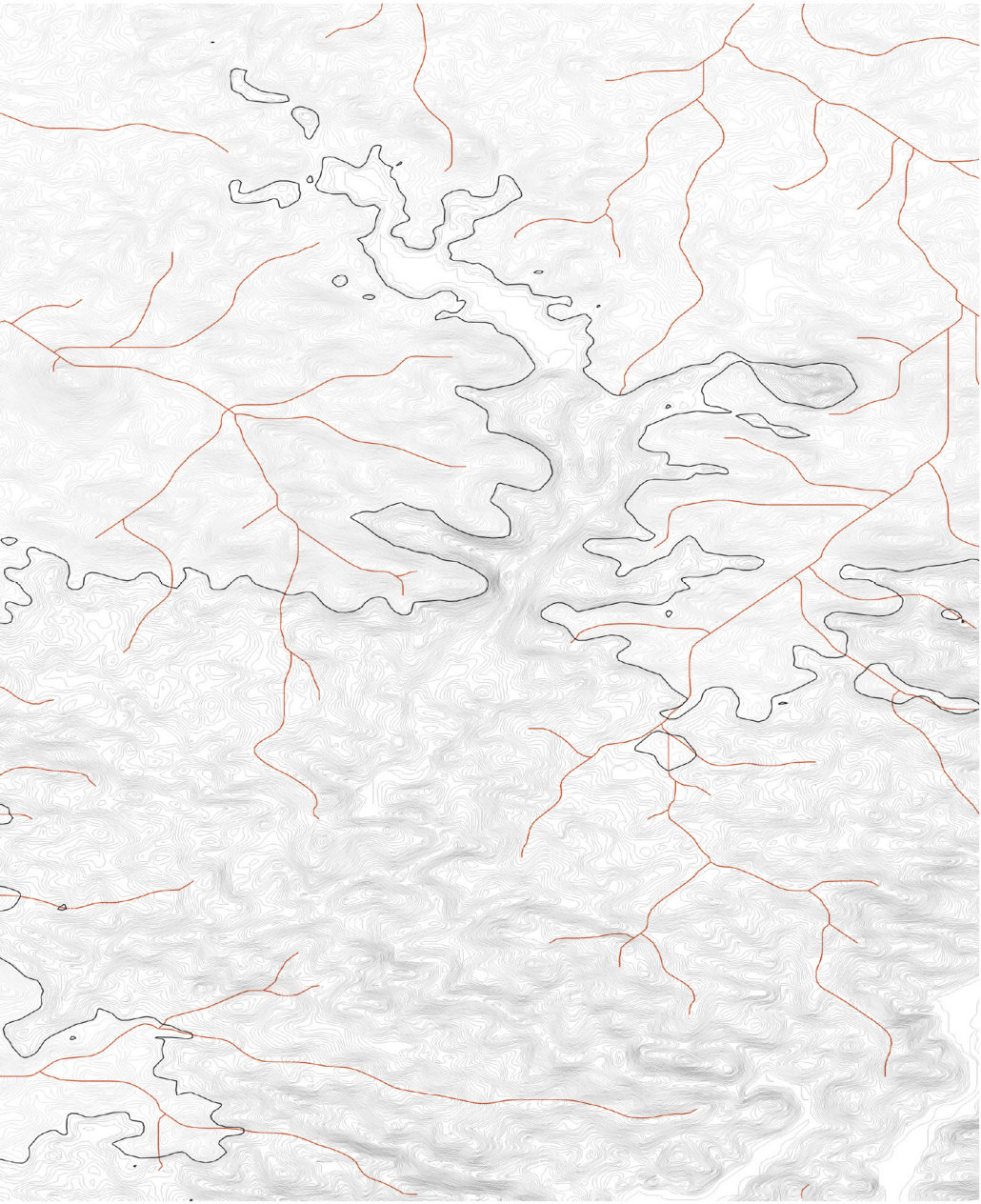


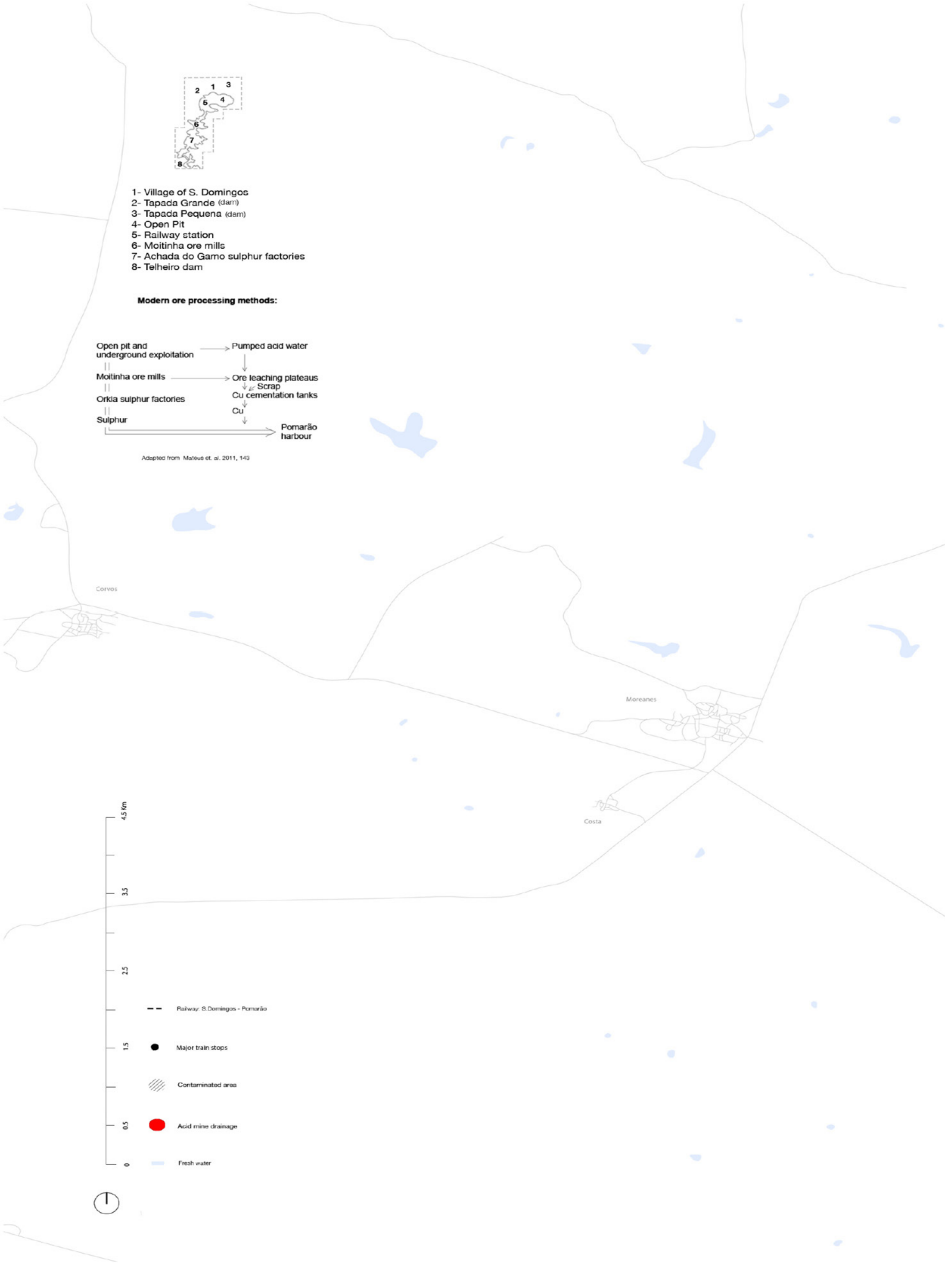
134 Map, generated by cartography from the SRTM Worldwide Elevation Data, showing the drainage basin of the mining area of S. Domingos and the 130m above sea level contour. © Jared Miguel Fantasia. 2018



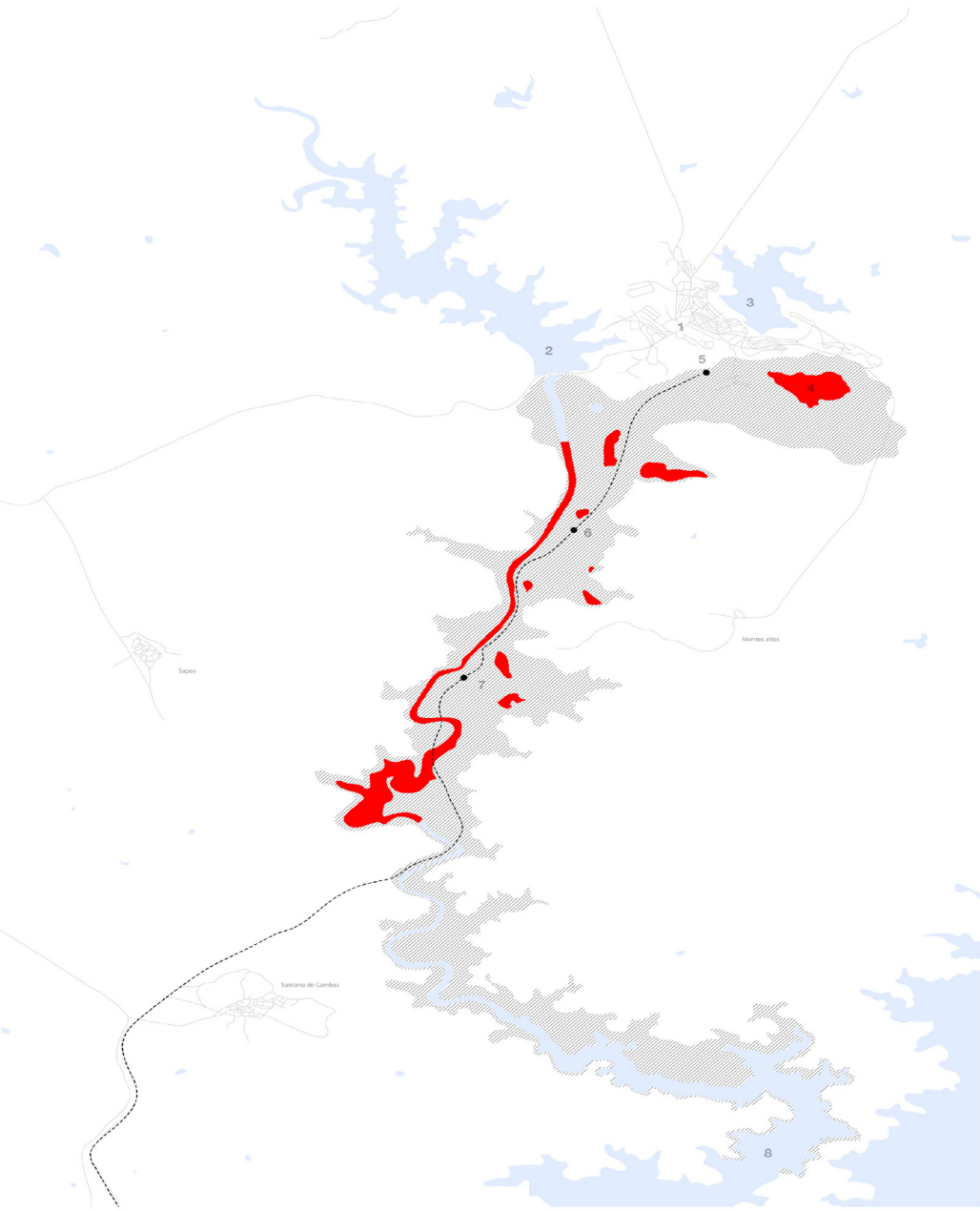


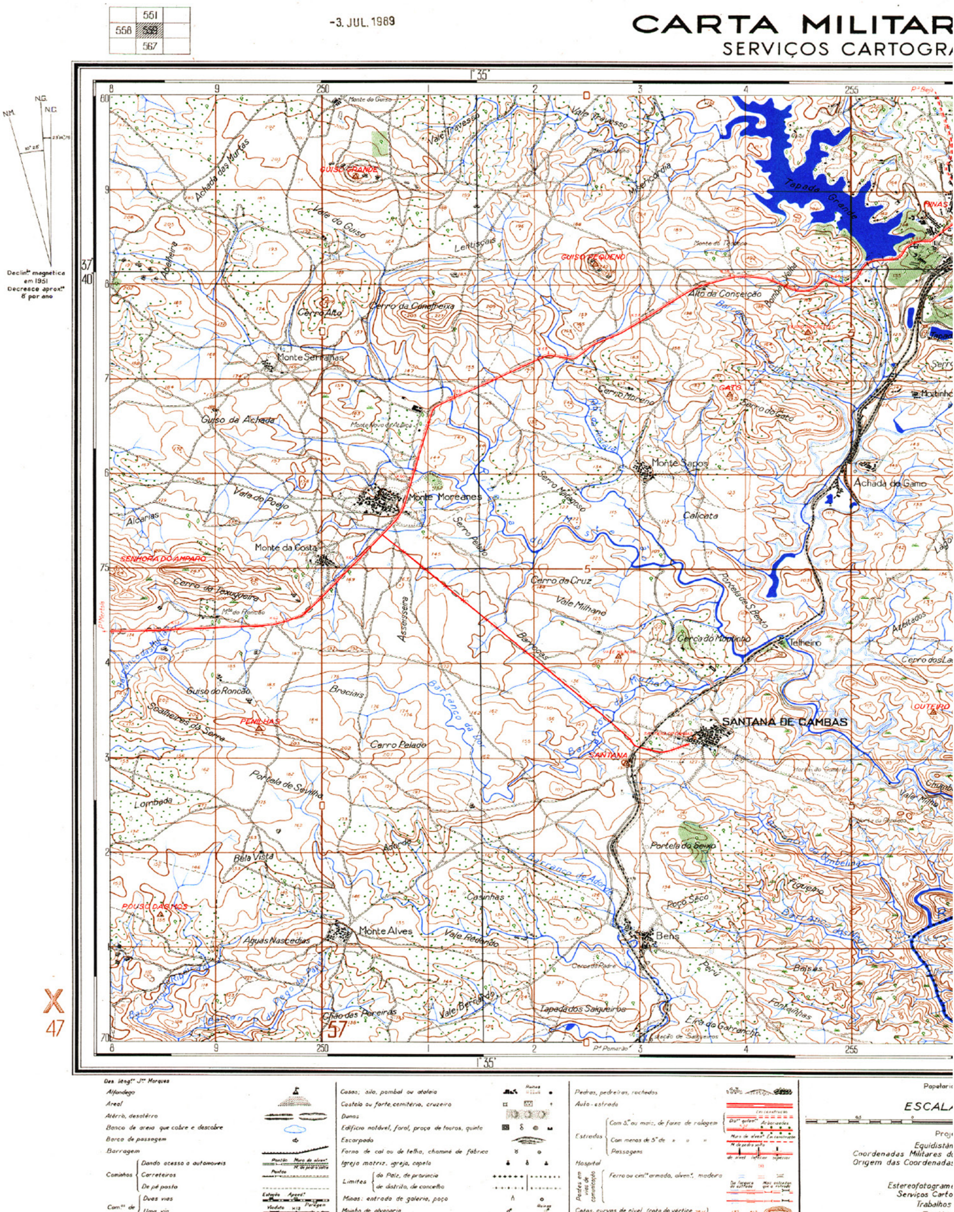
135 Map, generated by cartography from the SRTM Worldwide Elevation Data, showing the ridge lines around the S. Domingos mining area and the 130m above sea level contour. © Jared Miguel Fantasia. 2018



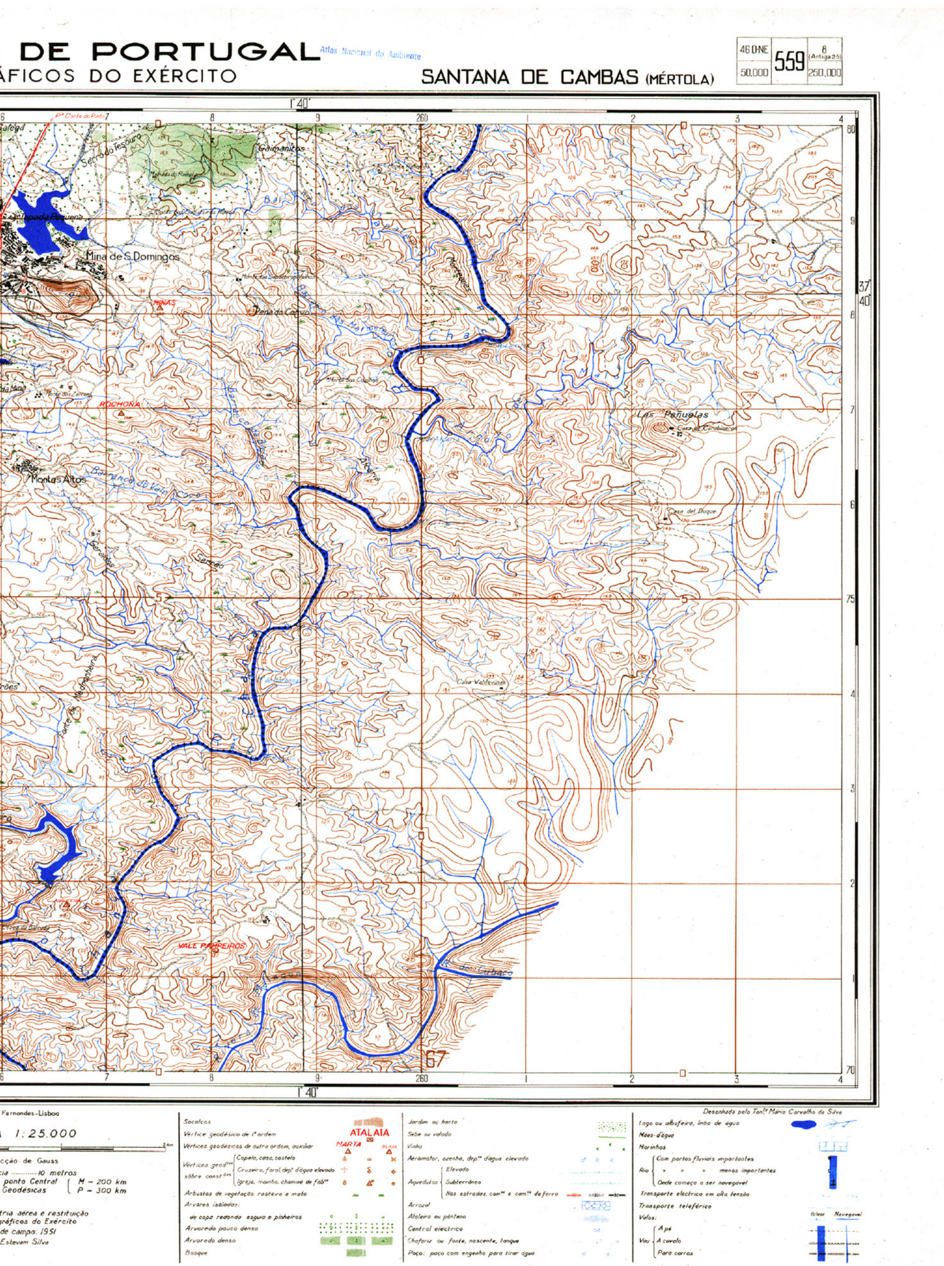


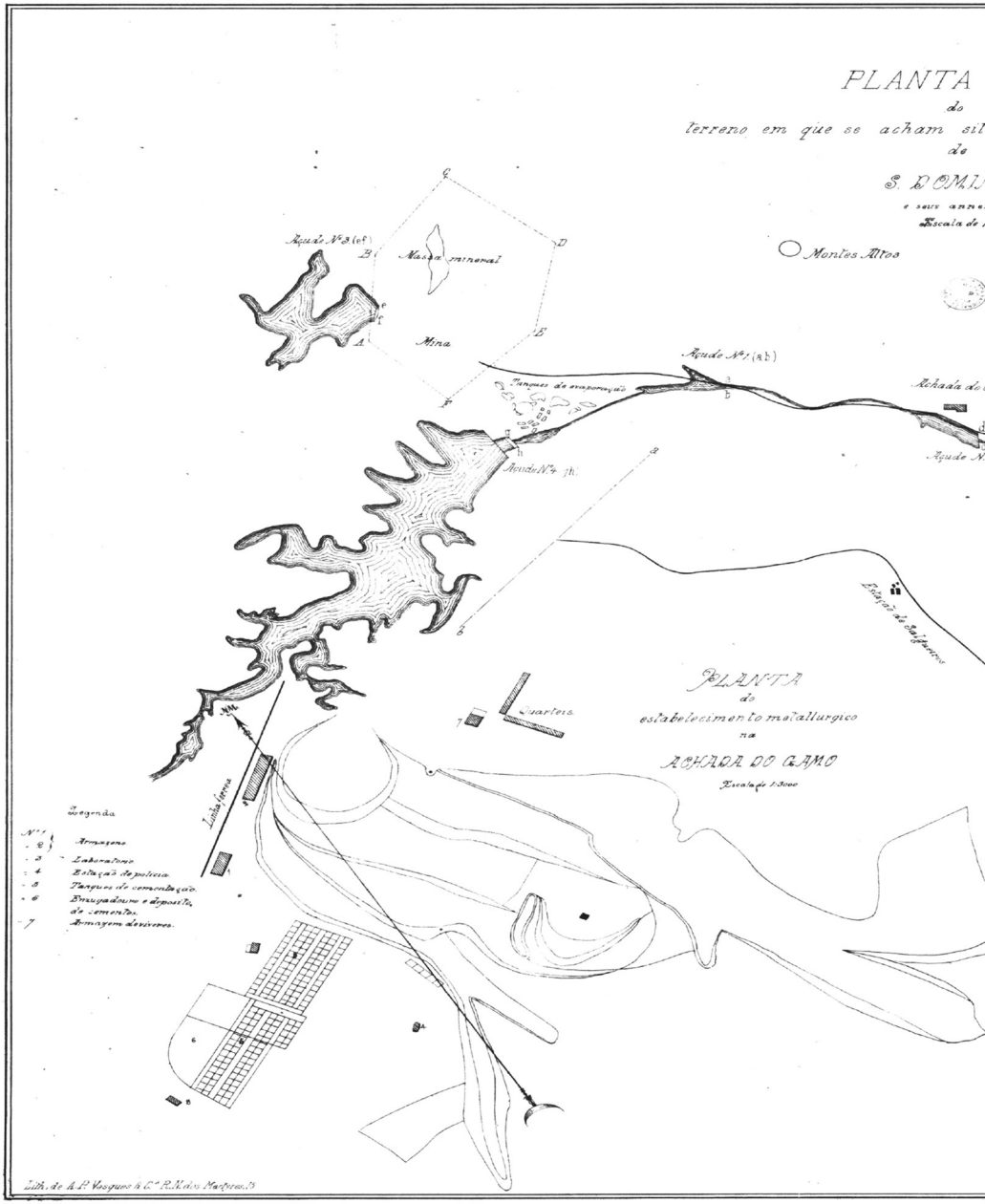
136 Map and diagram showing modern ore processing methods and map of the S. Domingos mining area showing contamination, acid mine drainage, fresh water, the S. Domingos mining railway and the major train stops. © Jared Miguel Fantasia. 2018


1
2
3
4
5
6
7
8
Montes altos
Sapos
Santana de Cambas

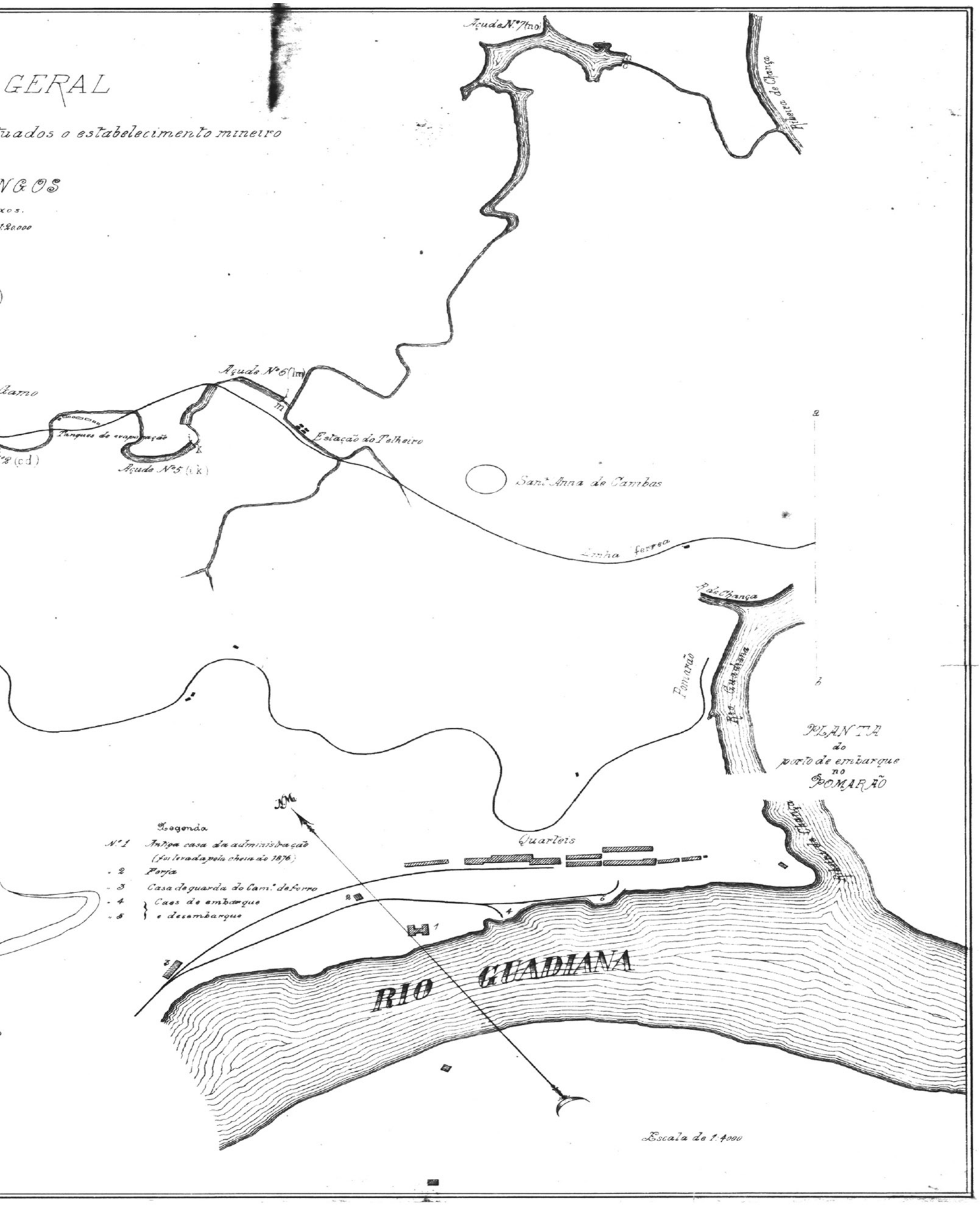


137 Portuguese Military map of Santana de Cambas (Mértola),1951 (page 551) showing the mining area of S. Domingos and its open pit, the mining village and surrounding fresh water dams at the time when the mine was still operational. We can observe the S. Domingos water basin running from the open pit to the Chança River. This map was made before the construction of the Chança Dam in 1979.

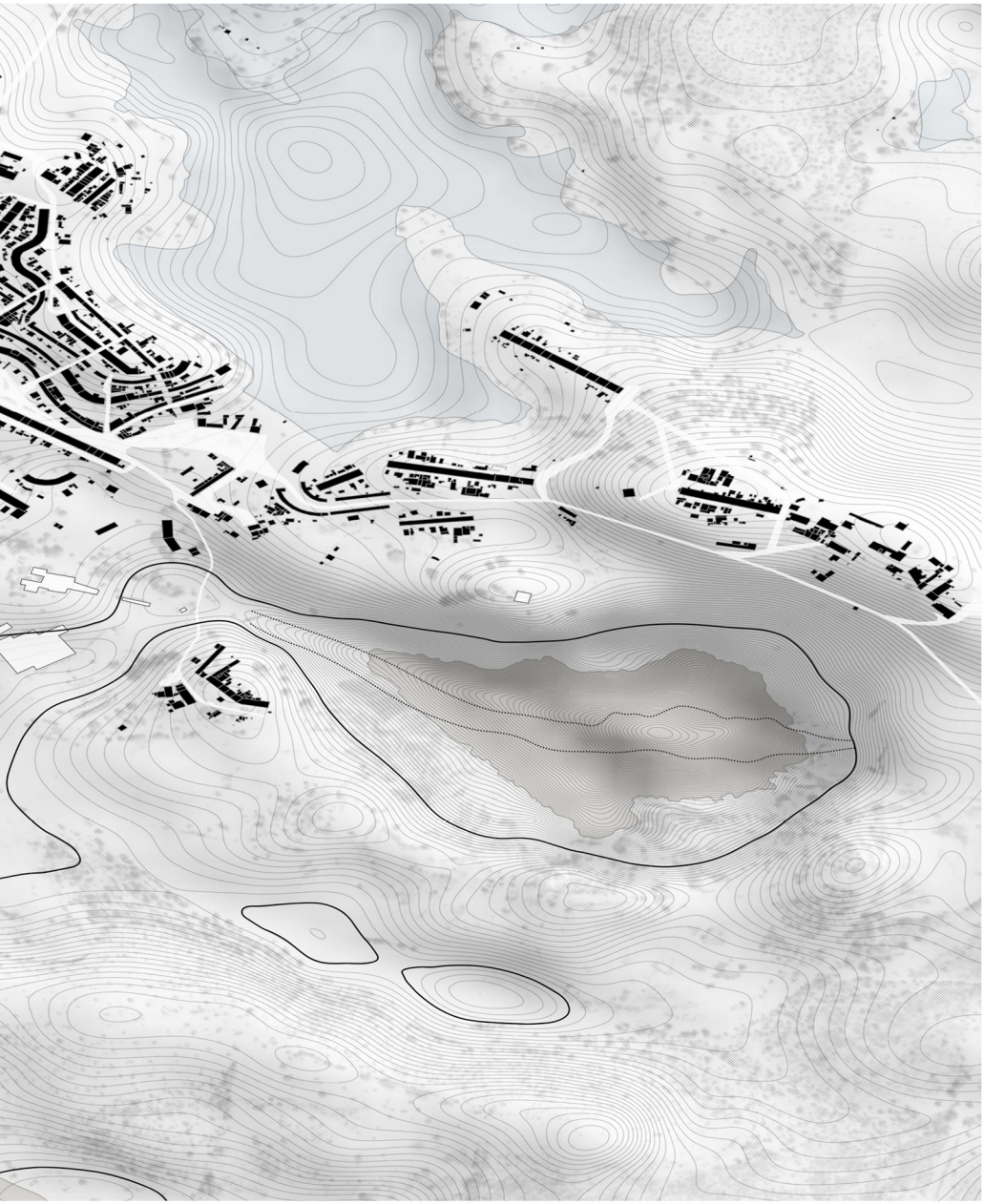

DE PORTUGAL
ÁFICOS DO EXÉRCITO
Atlas Nacional do Ambiente
SANTANA DE CAMBAS (MÉRTOLA)
46 D-NE
559
8 (Antiga 25)
50.000
250.000
Mina de S. Domingos
MINAS
Pena do Corvo
ROCHONA
Montes Altos
Las Peñuelas
Casa del Duque
Casa Valdevinas
VALE PAMPEIROS
Desenhada pelo Ten.te Mário Carvalho da Silva
1:25.000
ATALAIA
MARTA

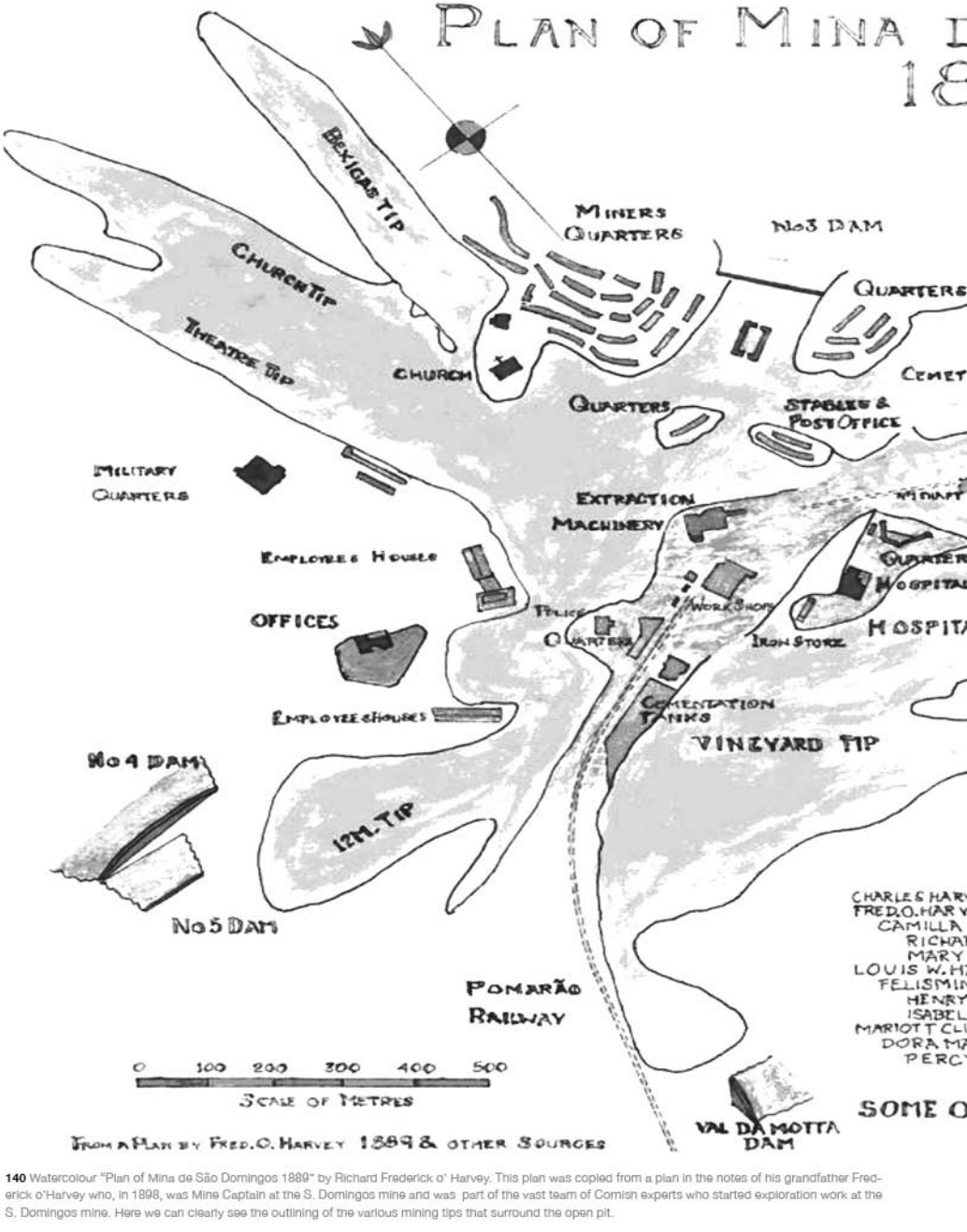


138 Plan showing the S. Domingos mining railway to the port of Pomarão on the Guadiana River by Sequeira, Pedro Victor da Costa, 1883. Here we can see on the left, the outline of the mineral mass, the two man-made dams (*Tapada Grande* and *Tapada Pequena*) and the water stream running from these in the direction of the Chança River.


GERAL
uados o estabelecimento mineiro
NGOS
Açude Nº 7 (no)
Ribeira de Chança
Açude Nº 6 (lm)
Tanques de evaporação
Açude Nº 5 (i k)
Estação do Telheiro
Sant. Anna de Cambas
Linha ferrea
Rª de Chança
Rio Guadiana
Pomarão
PLANTA
do
porto de embarque
no
POMARÃO
Legenda
Nº 1 Antiga casa da administração
(foi levada pela cheia de 1876)
2 Forja
3 Casa de guarda do Camº de ferro
4 Caes de embarque
5 e desembarque
Quarteis
RIO GUADIANA
Escala de 1:4000

139 Map, generated by cartography from the SRTM Worldwide Elevation Data, showing the mining town of S. Domingos and its open pit. Here we can see the 130m above sea level contour that encompasses the open pit, the orebody and the two freshwater dams. © Jared Miguel Fantasia. 2018



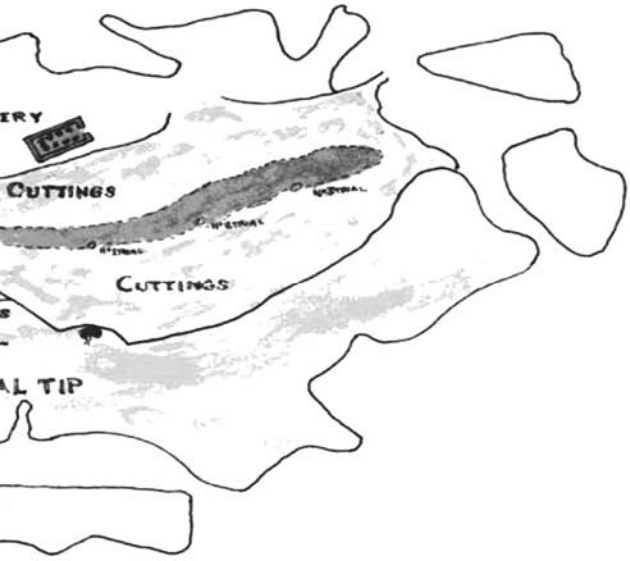


140 Watercolour "Plan of Mina de São Domingos 1889" by Richard Frederick o' Harvey. This plan was copied from a plan in the notes of his grandfather Frederick o'Harvey who, in 1898, was Mine Captain at the S. Domingos mine and was part of the vast team of Cornish experts who started exploration work at the S. Domingos mine. Here we can clearly see the outlining of the various mining tips that surround the open pit.

DE SÃO DOMINGOS
889

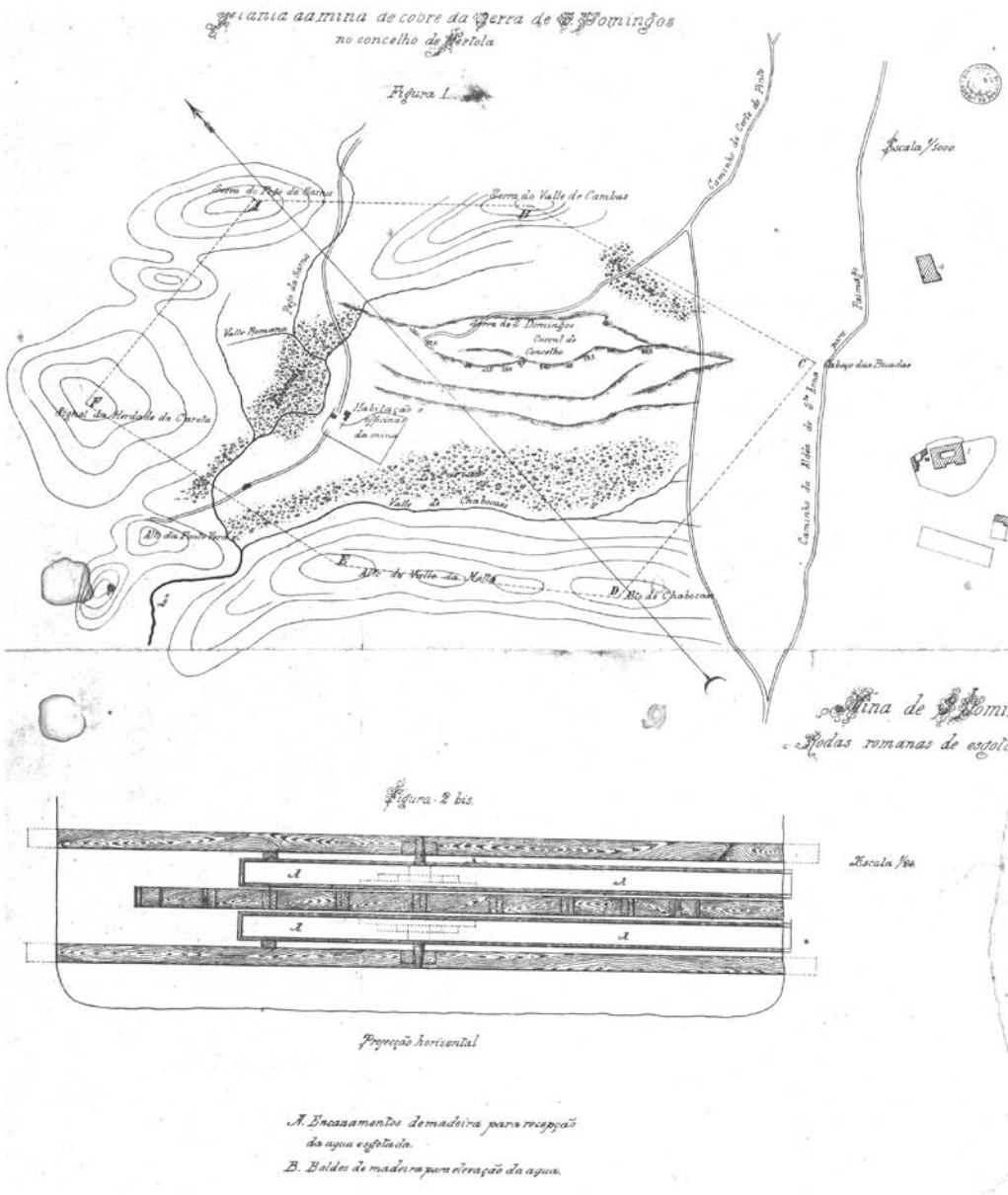
IN THE CEMETERY ARE MEMORIALS TO THOSE WHO DIED BEFORE 1890 AT THE MINE.
DAVID AITKEN DIED VILA REAL DE STA ANTONIO 24th AUG 1876 AGE 42
HIS WIFE ISOBEL DUNCAN WHO DIED AT THE MINE OF SÃO DOMINGOS
29th OF THE SAME MONTH AND YEAR AGE 34 R.I.P.
JOHN VENNER DIED 5th FEBRUARY 1867. AGE 39
WILLIAM ANDREW LAMPLOUGH & HIS MOTHER MIRIAM OCT 30th 1880

LA SUBINAS HOUSE

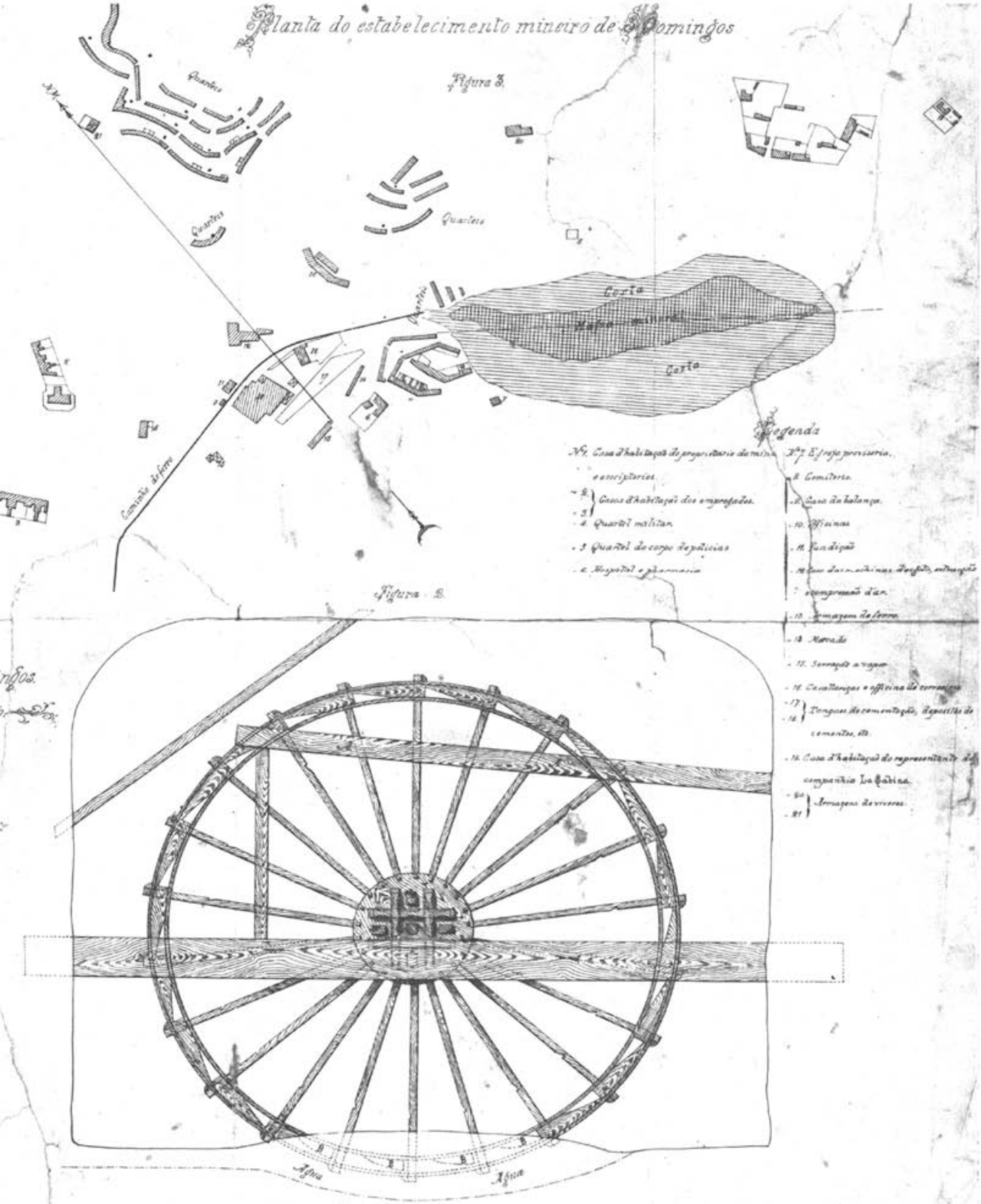


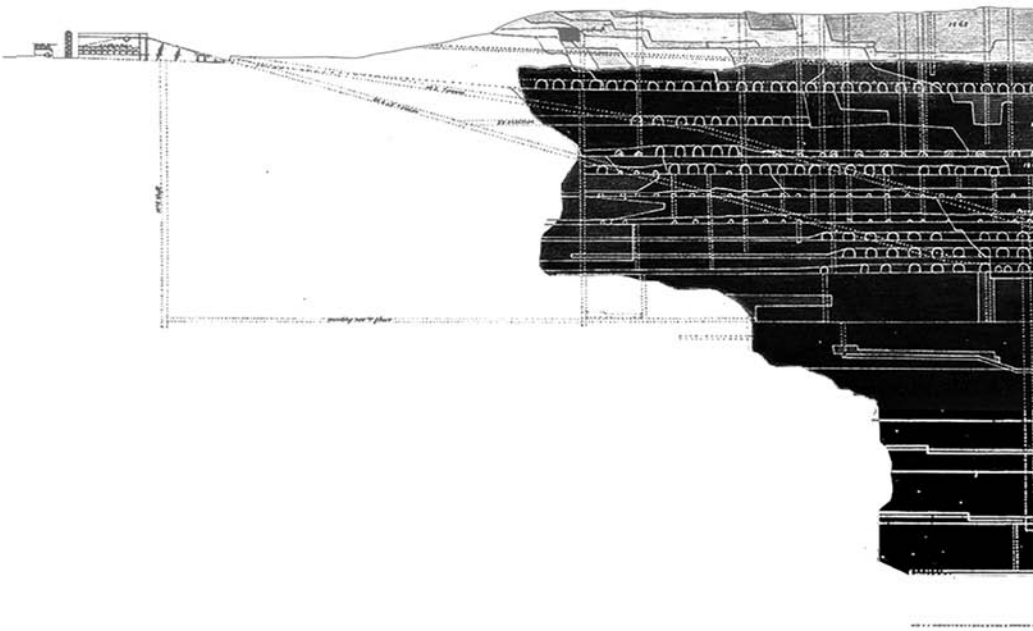
VEY	MINE MANAGER	ANDREW LAMPLOUGH		JOHN OSBORNE	
TEY	MINE MANAGER	MIRIAM	WIFE	ELIZA ANN	WIFE
	WIFE	SARAH ANN	DAUGHTER	JOHN.H.	SON
RD	SON	ARTHUR	SON	FRANCIS CHARLES	SON
	DAUGHTER	WILLIAM ANDREW	SON	DAVID AITKEN	ENGINEER
ARVEY	MECHANIC	WILLIAM LUCAS		ISABELLA	WIFE
NA	WIFE	MARTHA	WIFE	EMILY	DAUGHTER
	SON	WILLIAM	SON	ANNA	DAUGHTER
	DAUGHTER	JOEL LUCAS		JAMES	SON
NCH	ASST. MANAGER	JANE	WIFE	ANNIE GIBSON	DAUGHTER
AUD	WIFE	TRYPHENA	DAUGHTER	JOHN VENNER	
Y	SON			CHARLES HORNE	ENGINEER
				A.D. CHEESEMAN	

OF THE STAFF AND THEIR FAMILIES AT THE MINE BEFORE 1890

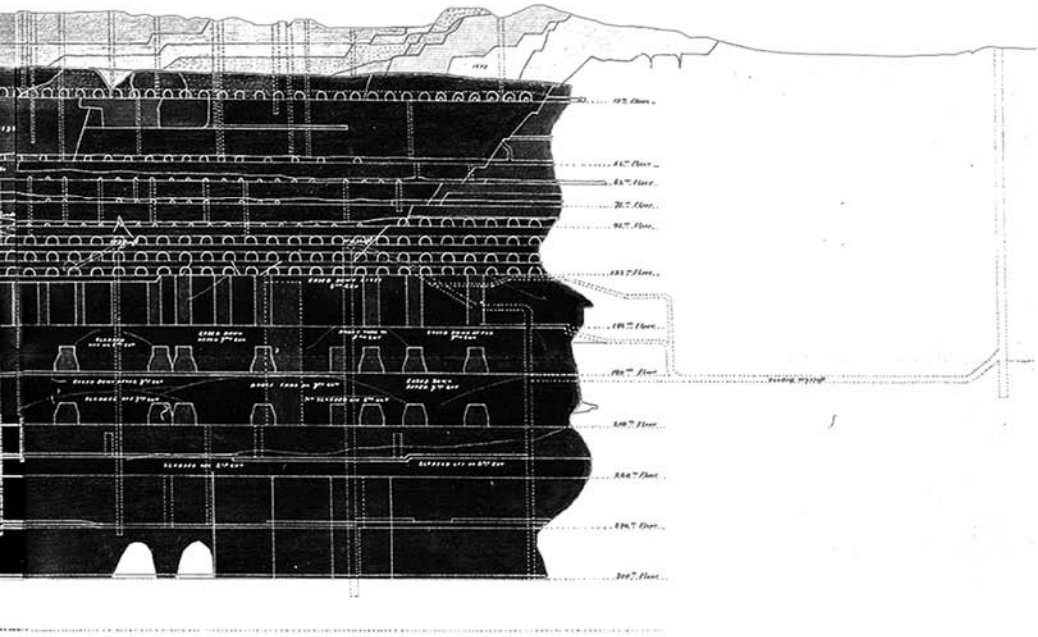


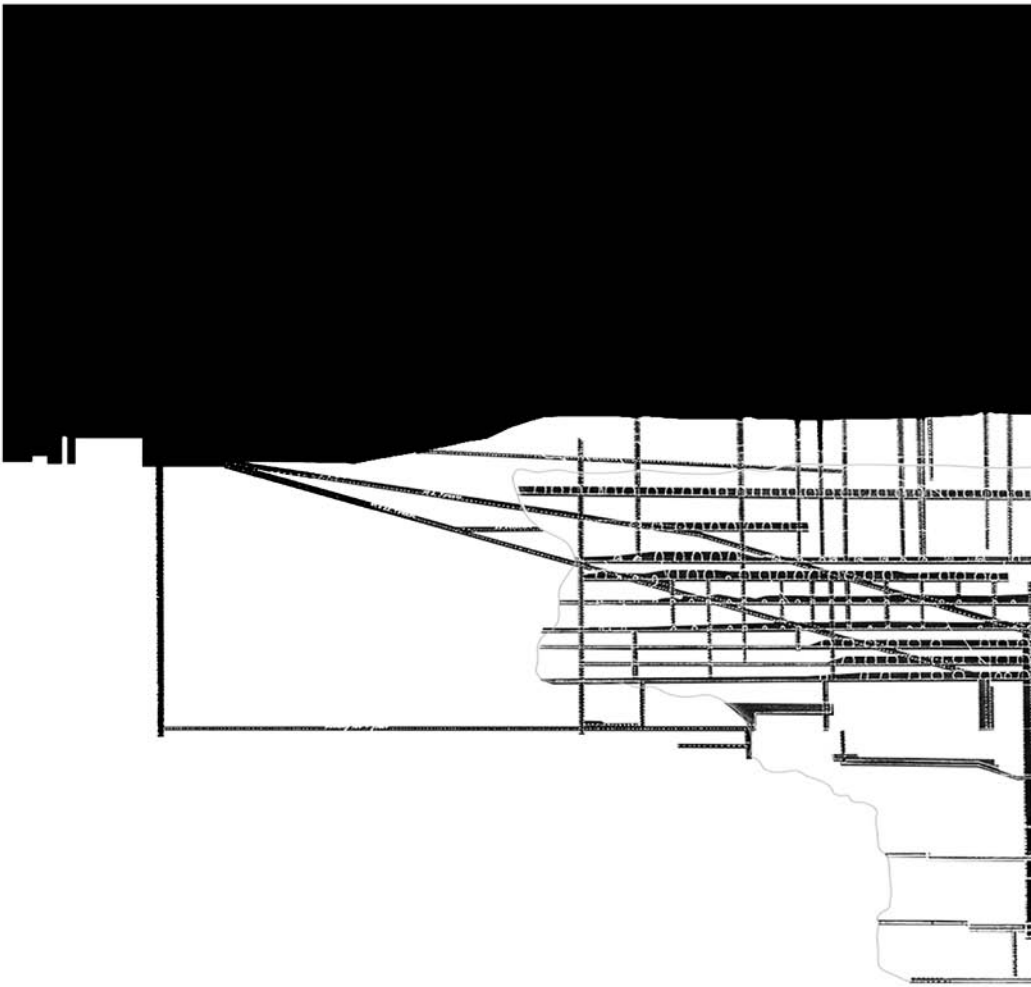
141 Plans of the S.Domingos orebody before nineteenth century mining operations (left) showing Serra de S. Domingos with Roman slag tips, a water stream leading to the Chança River and after (right) the establishment of the S.Domingos Mine with its mining village and vulva-shaped mineral ore outline as depicted by Sequeira, Pedro Victor da Costa,1883. Below can be observed the Roman reverse overshot drainage water-wheel and horizontal cross section (below left) and vertical view (below right) which were found during open cast mining operations in 1883.


Planta do estabelecimento mineiro de S. Domingos
Figura 3.
Quarteis
Quarteis
Quarteis
Corta
Massa mineral
Corta
Caminho de ferro
Legenda
Nº1. Casa d'habitação do proprietario da mina e escriptorios.
2. 3. Casas d'habitação dos empregados.
4. Quartel militar.
5 Quartel do corpo de policias
6. Hospital e pharmacia
Nº7 Egreja provisoria.
8 Cemiterio.
9. Casa da balança.
10. Officinas
11. Fundição
12. Casa das machinas d'esgoto, extracção e compressão d'ar.
13. Armazem de ferro.
14. Mercado
15. Serração a vapor.
16. Cavallariças e officina de correeiro
17. 18. Tanques de cementação, depositos de cementos, etc.
19. Casa d'habitação do representante da companhia La Sabina.
20. 21. Armazens de viveres.
Figura 2.
Agua
Agua

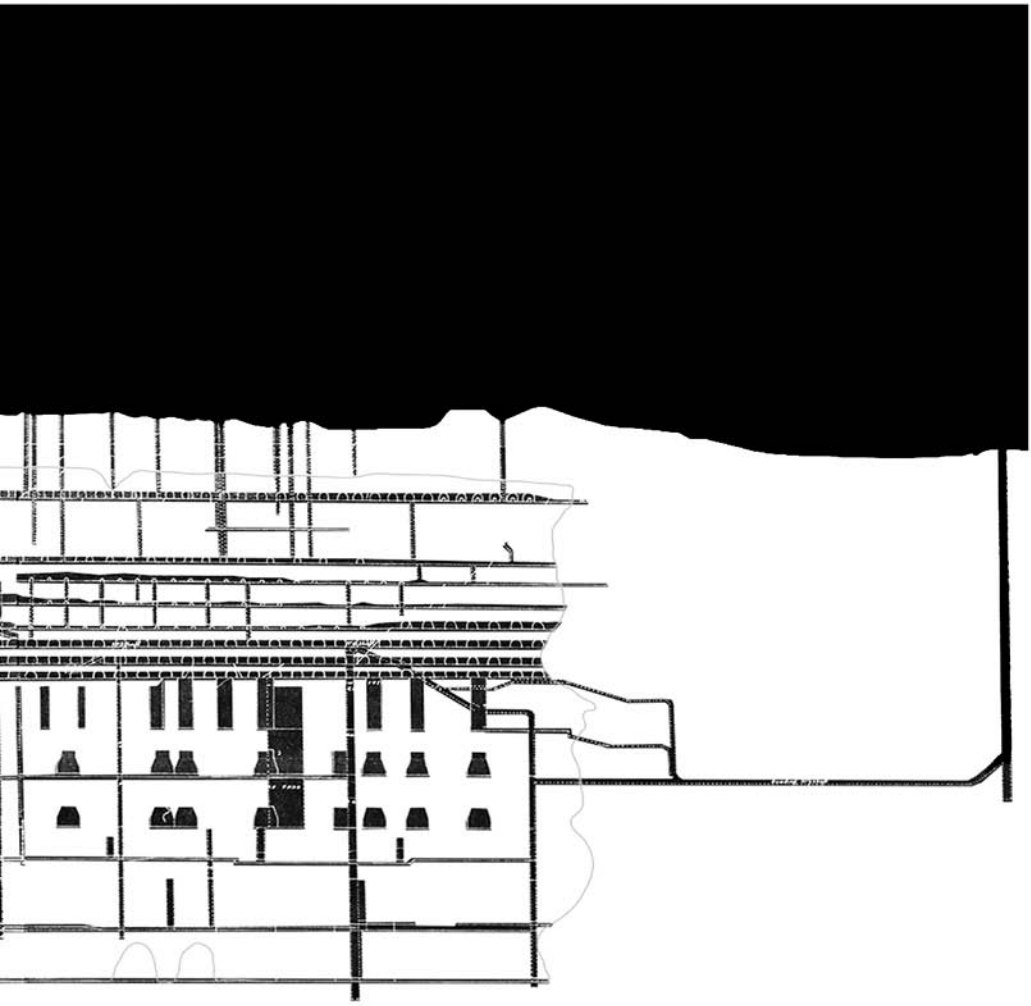


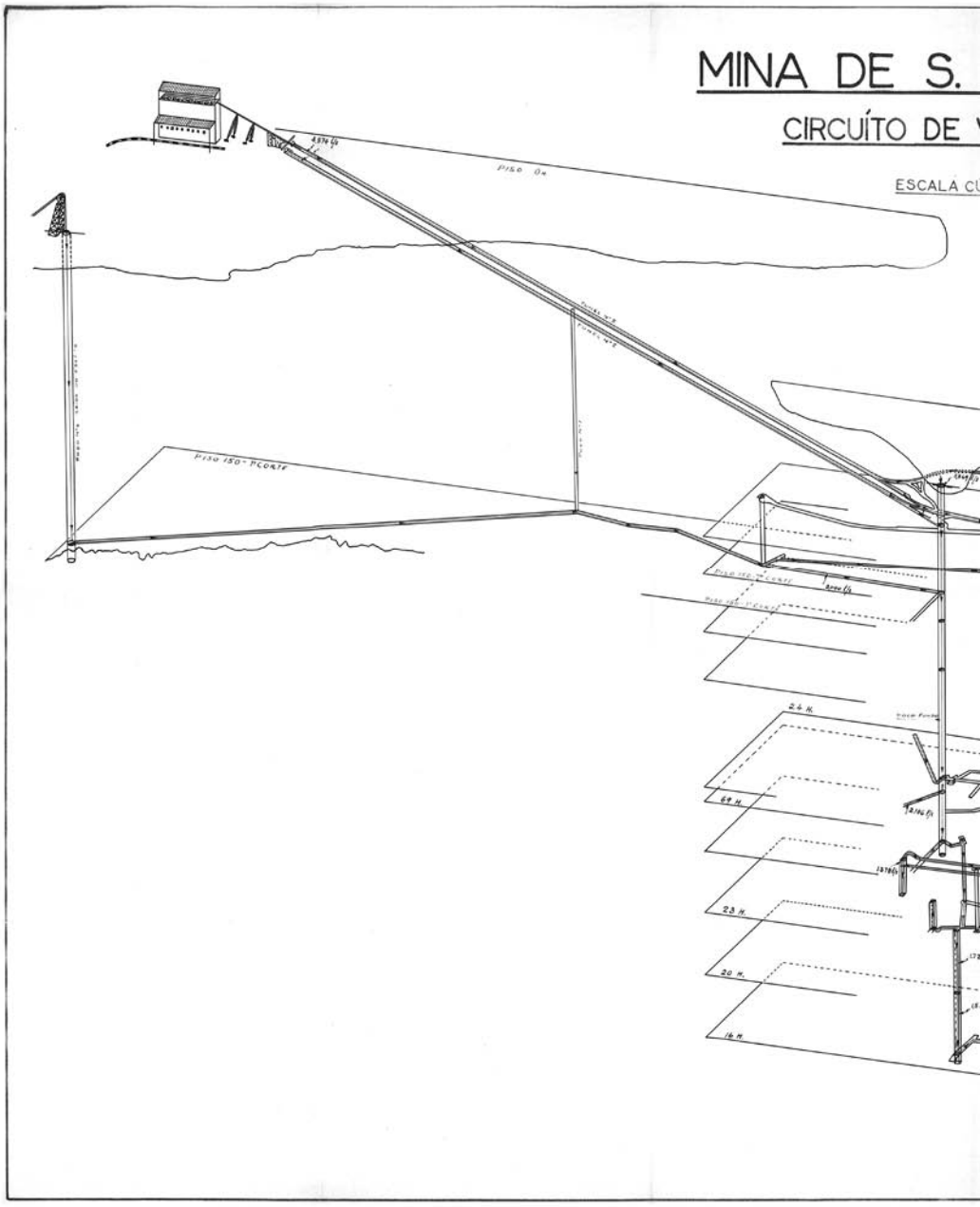
142 Adaptation of the longitudinal section of the S. Domingos orebody and mining exploitation drawn in 1945. The black fill represents the full pyrite mass before the open air extraction which resulted in the open pit. © Jared Miguel Fantasia. 2018



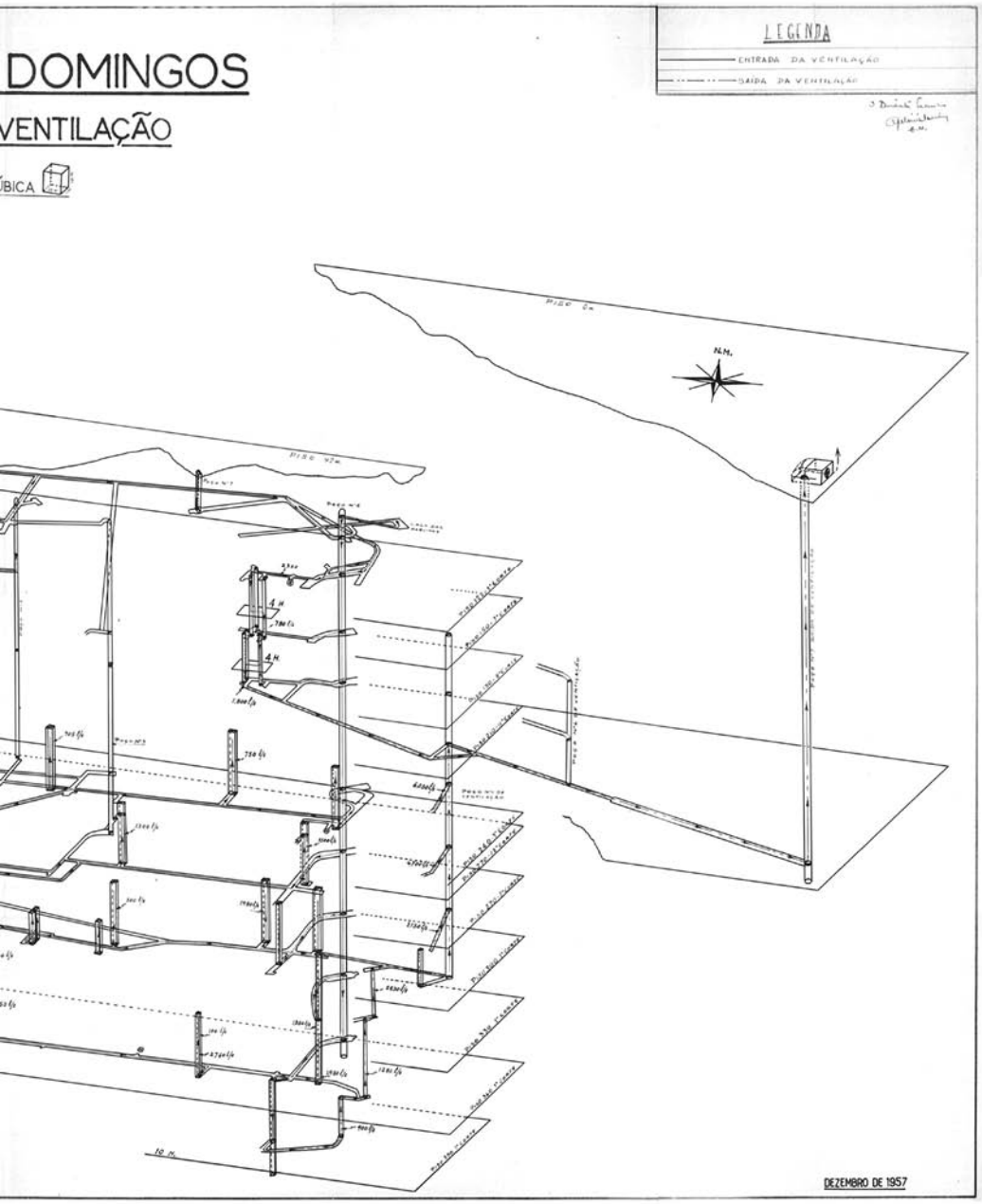


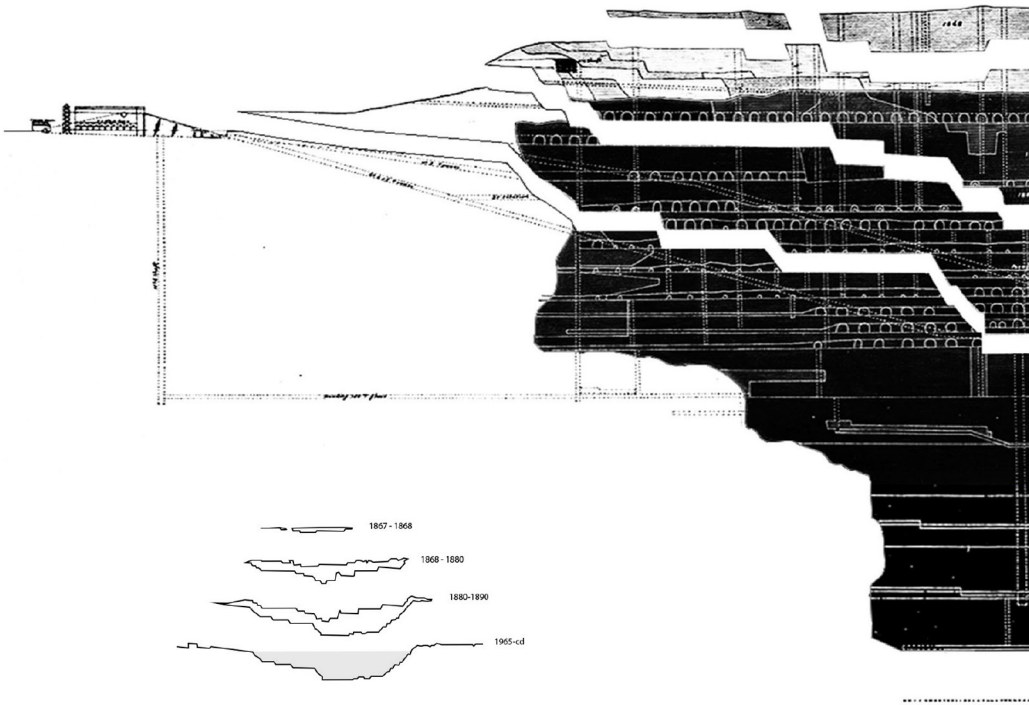
143 Adaptation of the longitudinal section of the S. Domingos orebody and mining exploitation drawn in 1945. The black fill represents the negative space thus highlighting and showing the survey of the underground network of extraction. © Jared Miguel Fantasia. 2018



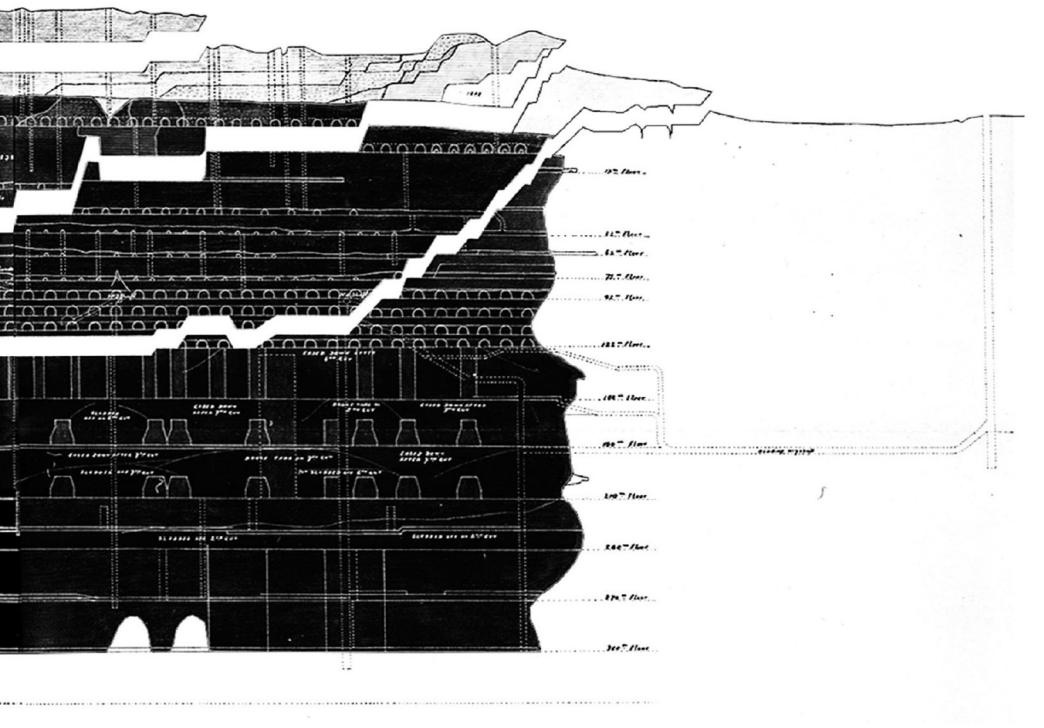


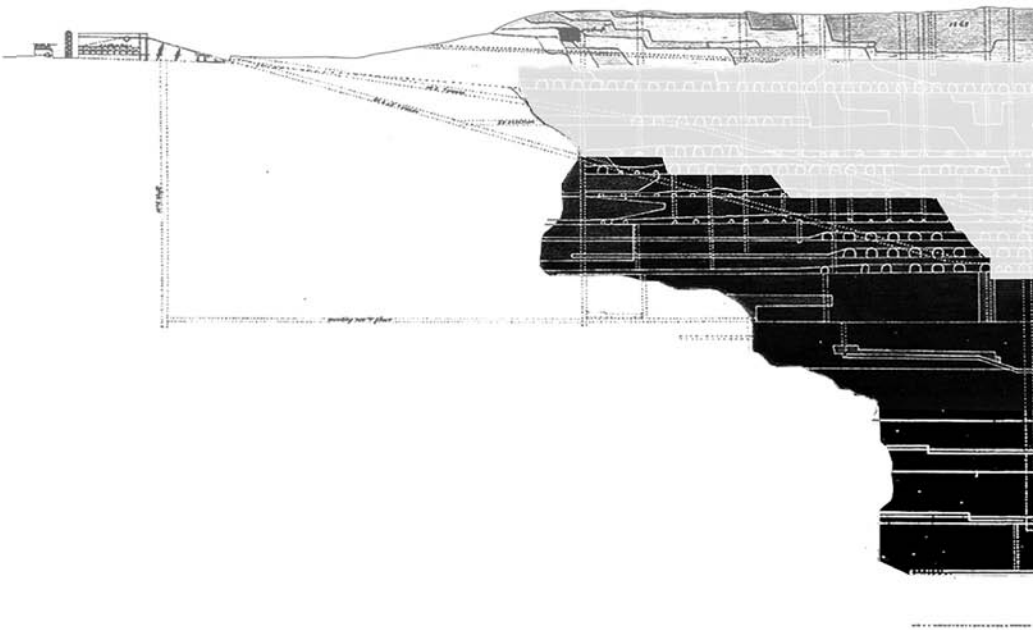
144 Axonometric view of the underground ventilation network at the S. Domingos Mine in December 1957. The 0m mining level (labelled as *Piso 0*), shown in the axonometric view, corresponds to the 130m above sea level contour. The 130m contour level can be observed on pages 314 to 315.


DOMINGOS
VENTILAÇÃO
ÚBICA
LEGENDA
ENTRADA DA VENTILAÇÃO
SAIDA DA VENTILAÇÃO
N.M.
10 M.
DEZEMBRO DE 1957

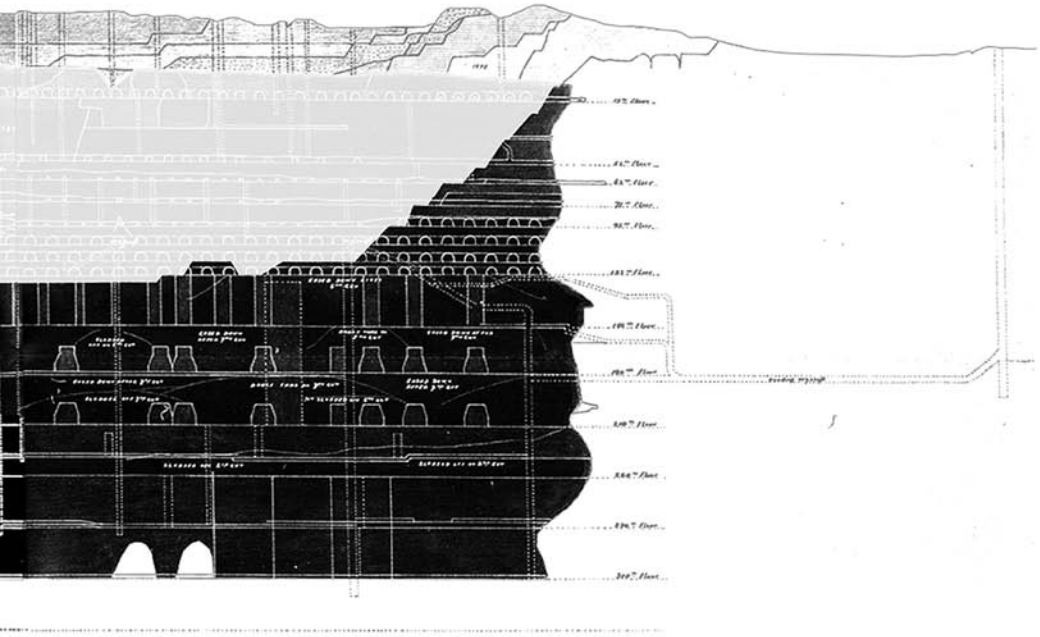


145 Adaptation of the longitudinal section of the S. Domingos orebody and mining exploitation drawn in 1945 showing four separate parts. The lowest section represents the current orebody. The three upper sections represent the matter that was extracted, from 1867-1890, to form the current open pit. © Jared Miguel Fantasia. 2018





146 Adaptation of the longitudinal section of the S. Domingos orebody and mining exploitation drawn in 1945 showing the current orebody. © Jared Miguel Fantasia. 2018



A phototographic survey

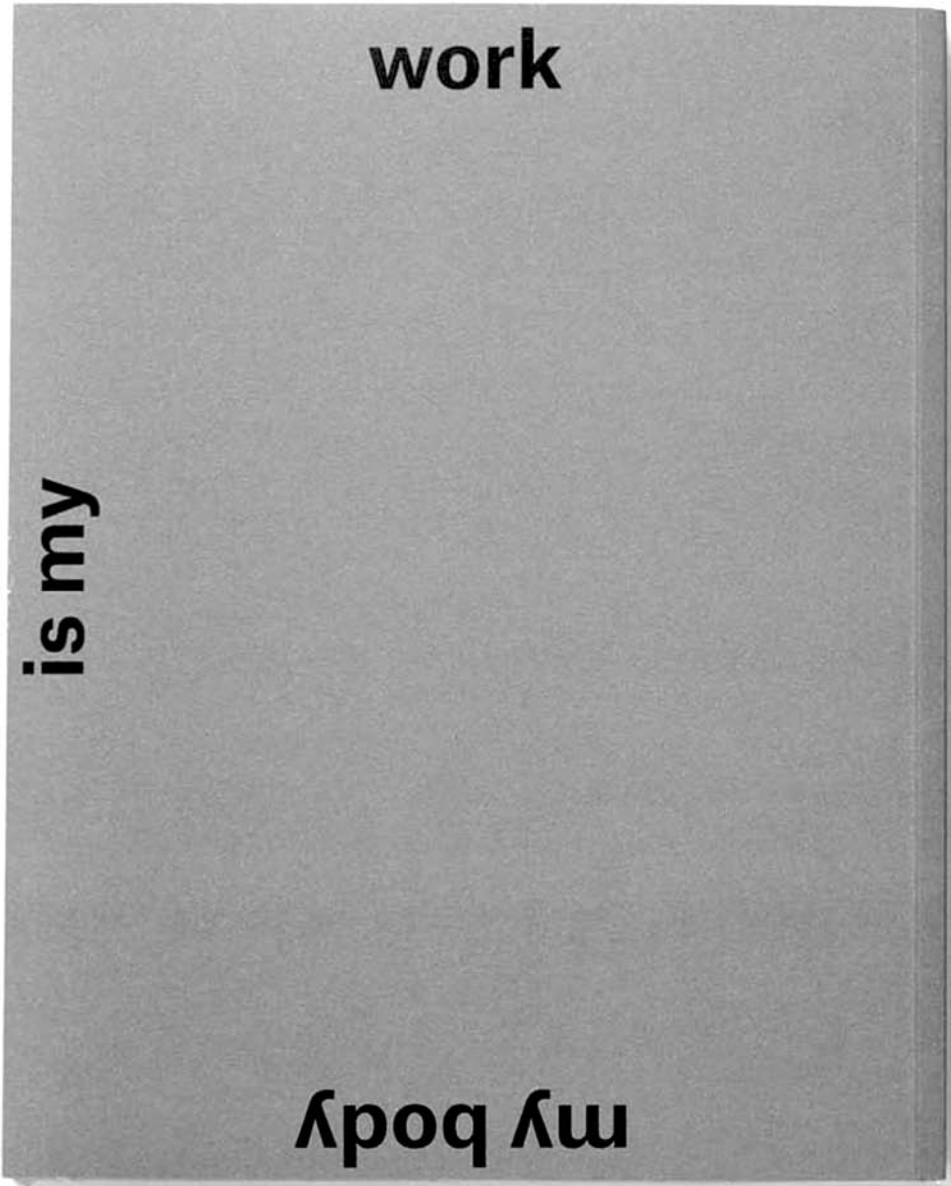
A photo-essay was employed in order to explore the genius loci of the mining area of S.Domingos by capturing further clues and details on which to focus attention. The art of photography is an important means of visually capturing the genius loci of a place (although filming can provide an auditory component). The medium gives a broader and deeper perspective of a place because it also reflects the experience and visual perception of the photographer from diverse viewpoints and which he chooses to impart visually to others in varying detail.

The following photographs, which were inspired by the work of artists in the New Topographics Movement, revealed in black and white prints the essential landscape be it natural or man-made. Their aesthetic is also influenced by the work of Robert Adams (black and white landscapes) which evokes a social consciousness as it tends to reveal an altered landscape - one that man has created at Earths' expense. (Landscapes without evidence of man may too speak volumes about ones irrevocably altered by him.) Robert Adams' Clearcut Humburg Mountain, Clatsop County, Oregon, (1999 - 2003, printed 2003) from his *Turning Back* series is one such an example. Here the photographer has engaged in environmental activism by revealing how man has interacted with the earth, altering the landscape in an act of destruction[85]. The post industrial area of S. Domingos is a place of a unique sublime beauty contrast and colour. The landscape - especially in the summer months - is blinding and silent and has a sulphurous odour. The selection of following photographs aims to transmit these harsh conditions through radical contrast, exposure and pixilation.

Sediments such as slag derived from the photographed slag heaps at Achada do Gamo, at S. Domingos Mine, were also collected and experienced through the senses - in situ and in isolation. This was done to try to understand their texture and the feeling they evoke. These were then turned into works of art through scanography - the process of capturing digitalised representations objects using a flatbed scanner creating printable art[86]. (These scanpgraphs can be viewed on pages 362 to 373.) The collection of material from a site to create a work of art is similar to the action of land artist Robert Smithson who (in the 1960s and 1970s) collected material from his sites and transformed them into *Non-sites* - pieces of earth placed in a container or frame in the museum, accompanied in close proximity by cartography and photographs of the site - as well as photographs and drawings of the created land artwork. *Non-sites* gave a connection to Smithson's work - a sense of *genus loci* as its were. Scanography has the ability to capture detail and texture of material and evokes its qualities through an arrangement and performance of it at a particular moment in time. Allowing a body of material to perform, can be seen in much the same the way as the works of Portuguese artist Helena de Almeida in her works exhibited in "My Work is My Body, My Body is My Work" (2016) where the body comes to the fore and occupies and defines the space it inhabits.

147 Adams, Robert. *Clearcut, Humburg Mountain, Clatsop County, Oregon. 1999-2001*. From the series "Turning Back".

148 Photograph of Robert Smithson (to the right) and Nancy Holt in the background (to the left) gathering slate in Bangor, Pennsylvania in1968 for the later production of Robert Smithson's *Non-Site (Slate from Bangor, Pa.)* 1968. The Non-site (material collected from the site and placed in a container or frame in the gallery - positioned near a wall with cartography and photos of the site where it was acquired) creates a relationship between the world of the site and what happens in the gallery. "The relation of Non-site to the site is also like that of language to the world: it is a signifier and the site is that which is signified." (Smithson 1996) Non-sites were created in the photographic survey in the form of scanographic art work that can be observed further on using retrieved slag from the mining tips in Achado do Gamo in the mining area of S. Domingos.



149 Cover (right) and back cover (left) of the catalogue for the exhibition entitled, "Helena Almeida: My work is my body, my body is my work" held at the Serralves Museum in Porto, Portugal (2016). The artist, Helena Almeida, uses painting, photography, video and drawing as a medium. The body becomes a tool for performance to encounter and define the space that surrounds it. In the photographic survey for this thesis, this way of engaging with the surrounding space was explored and developed in scanography work produced with retrieved slag from the mining tips in Achado do Gamo in the ming area of S. Domingos. Slag, which is placed on top of a scanner, becomes art with the interaction and stimulation of the movement of the hand.

my
work is
my body

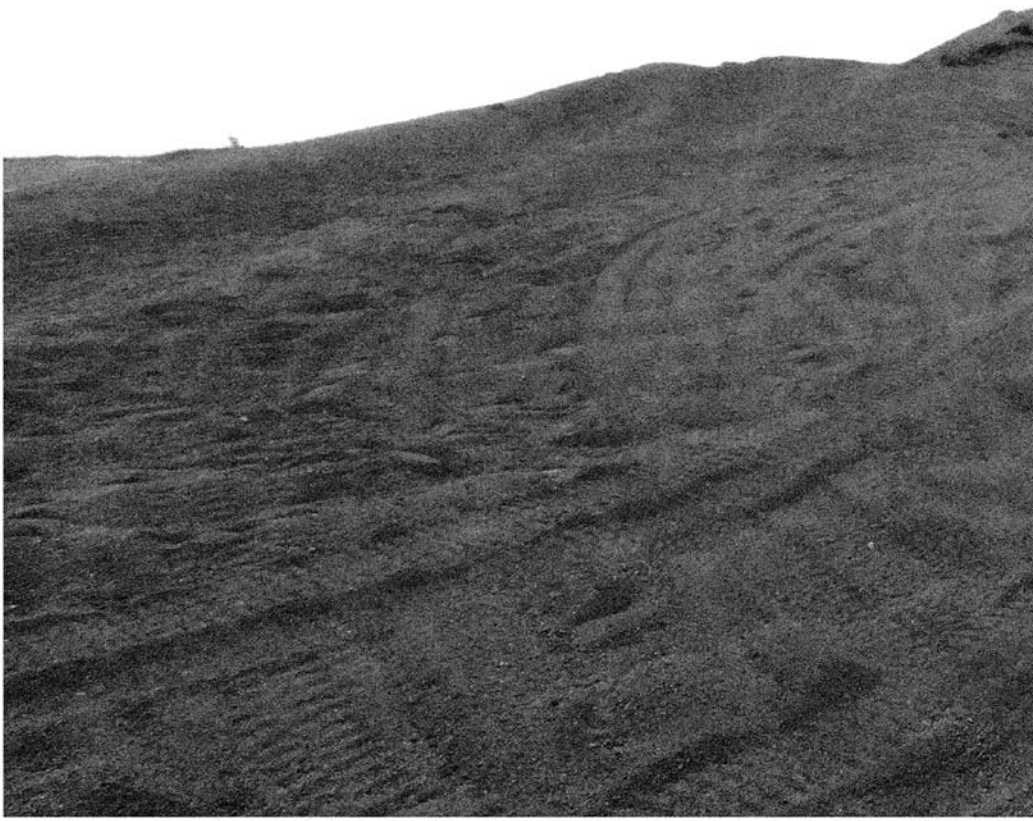
150 Pierre Guerot, *Number one*, 2014. Self scanography of body. The art of scanography involves the digital capture of an arrangement of objects (or as in Guerot's work) or parts of the body, using a flatbed scanner. Scanned images can be mass produced through printing. The scanned image reveals detailed imagery and gives a limited sense of depth to the object represented. Scanography allows a closer relation between the captured object and the viewer thus allowing them to position themselves from the object (frozen in time) and capture the body that becomes a tool for performance to encounter and define the space that surrounds it - below the glass bed on where the orchestration or performance of objects has taken place. We perceive the gesture of the performance of the object through the recording of minute detail according to its scale. It is as if we are attentively observing the movement of the object captured in time - a concept similar to that in the work of Helena Almeida.

151 Photograph showing the acid mine drainage and the various small scale dams constructed out of the surrounding sedimentary rock at the mining area of S. Domingos, Portugal. (These dams can be observed in the plan showing the S. Domingos mining railway to the port of Pomarão on the Guadiana River by Sequeira, Pedro Victor da Costa, 1883 on pages 312 and 313). The acid mine drainage creates still pools of red, toxic water. © Jared Miguel Fantasia. 2018

152 Photograph showing the cliff and a small linear retaining wall created out of in-situ sedimentary rock. These eroding cliffs, consisting of sedimentary rock, are located at the limit of the conceptual 130 meters above sea level contour. Along this contour there is a clear distinction between the vegetation above the cliff and the lack of it below (in the S. Domingos mining ravine) in the highly contaminated area where there is eroding ground. Most of the infrastructures around this area were built from the surrounding sedimentary rock. © Jared Miguel Fantasia. 2018

153 Photograph showing one of many infrastructures built for the passage of the railway line from surrounding sedimentary rock available on site. The structure built for the railway integrates with the cliff and also allows the water seepage, coming from above, to pass into the ravine below. © Jared Miguel Fantasia. 2018

154 Photograph showing a detail of the sedimentary rock that has been used to build most of the surrounding infrastructures in the mining area of S. Domingos. These structures therefore blend into the landscape and, in their decay over time, return to heaps of unorganized matter as they were in the original landscape prior to their use. © Jared Miguel Fantasia. 2018

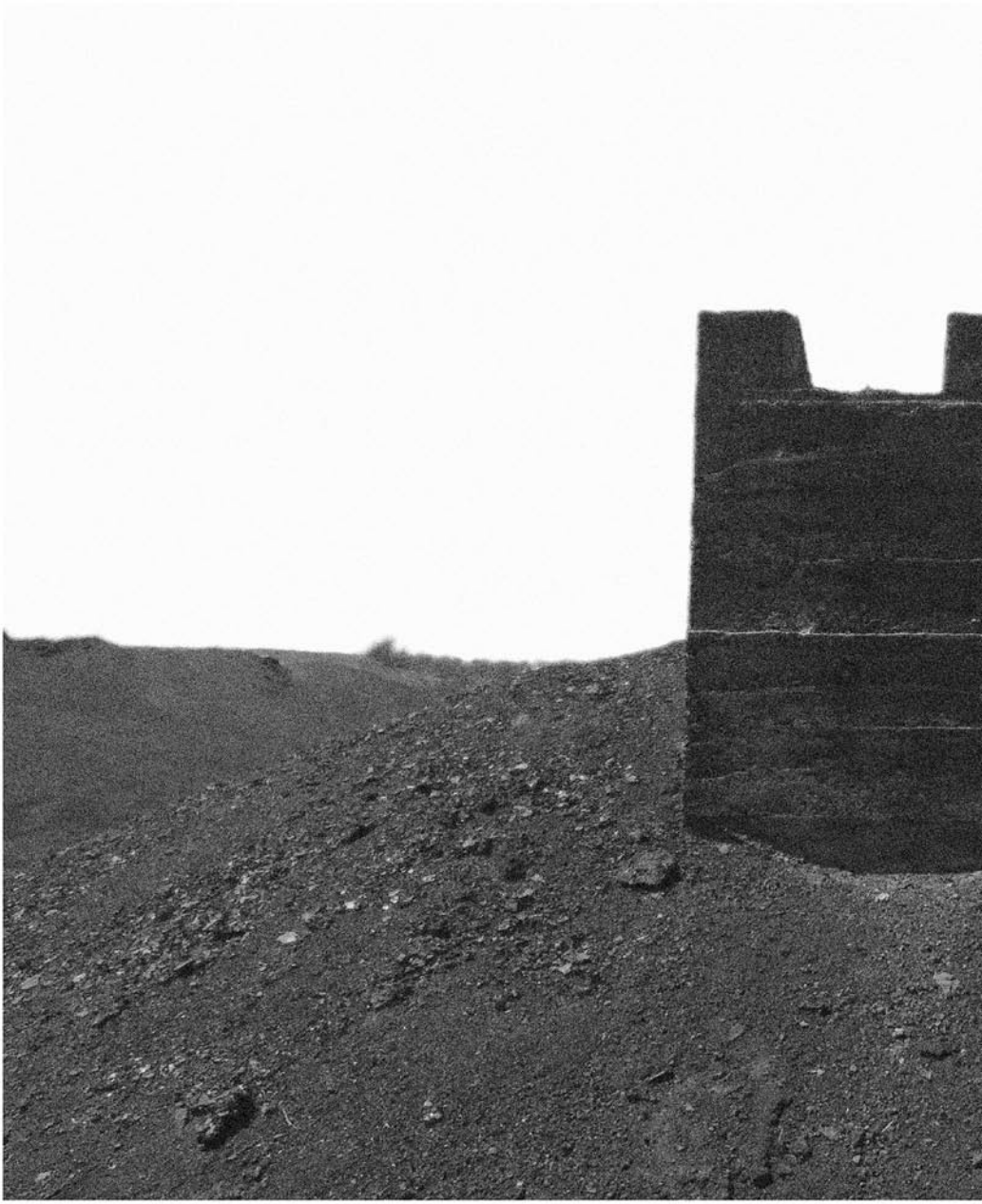


155 Photograph from on top of one of the mining terrils near the Achada do Gamo ore mills in the mining area of S. Domingos. These Artificial mounds of toxic waste at S. Domingos Mine are accumulations of matter that could be used and moulded to create new landscapes. Here we can also see the lines drawn by multiple tyre tracks. The concept of drawing in the earth with machine was explored by Michael Heizer in his *Motorcycle drawing (Circular Surface Planar Displacement), Dry Lake, Nevada* captured by Gianfranco Gorgoni between 1970–1972. © Jared Miguel Fantasia. 2018

156 Photograph (pointing north) from on top of one of the terrils near the Achada do Gamo ore mills in the mining area of S. Domingos and showing the full extent of the pollution and the erosion in this area. This arid eroding land is a man-made place abandoned to the elements and the erosion of time. © Jared Miguel Fantasia. 2018

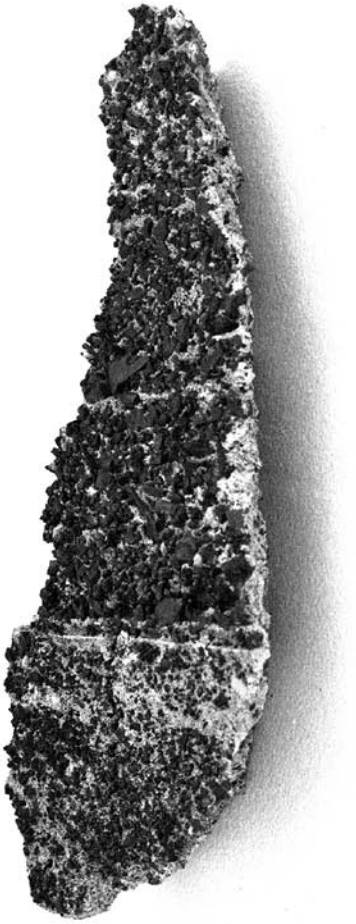
157 Photograph of the S. Domingos Open pit. The still mirror of acidic water that inhabits the once open air pit, acts as a horizontal plan whose height above sea level fluctuates during the year due to evaporation and accumulation of rain water. This mirror of water reflects the sky and the stars and contrasts with the eroding walls of the pit which enter and disappear within the toxic water. © Jared Miguel Fantasia. 2018

158 Photograph from a mining terril near the Achada do Gamo ore mills at S. Domingos mine. The photograph shows a negative space resulting in the subtraction and displacement of mining slag from the terrils using machinery (possibly a bulldozer). The consistency of the slag has become solid over years making the terril a compact and consolidated mass. As in Michael Heizer's *Double Negative (1969)*, the constant subtraction of the mass has resulted in the formation of an empty space. A negative space has formed by a cut or various cuts that shows the innards and the interior composition stratification of these monolithic mining waste dumps which are the result of years of dumping of slag waste, layer upon layer, to form a vast man-made sediment. © Jared Miguel Fantasia. 2018



159 Photograph of a standing concrete structure (composed of concrete and in-situ mining slag) at the mining tips near the Achada do Gamo ore mills at S. Domingos, Portugal © Jared Miguel Fantasia. 2018

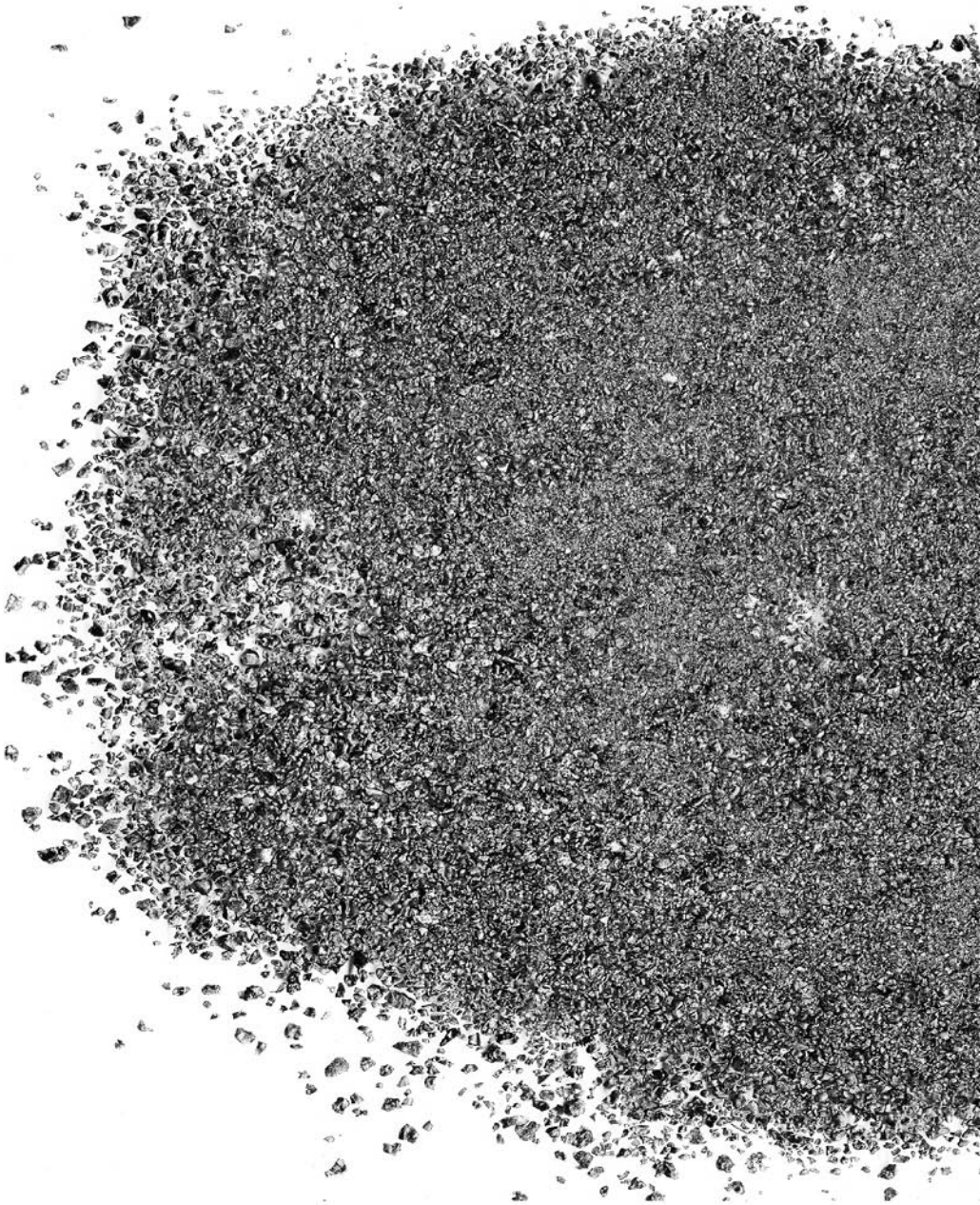
160 Photographic detail (from the previous image 159 on pages 354 to 355) of the concrete structure at the mining tips near the Achada do Gamo ore mills S. Domingos, Portugal. The composition of the structure is much the same as the rest of the concrete structures (built with mining slag) in the surrounding mining area. © Jared Miguel Fantasia. 2018



161 Photograph of a piece from a structure found at the mining tips near the Achada do Gamo ore mills S. Domingos, Portugal. Here we can see the particular texture due to the composition of slag added into the concrete mix © Jared Miguel Fantasia. 2018

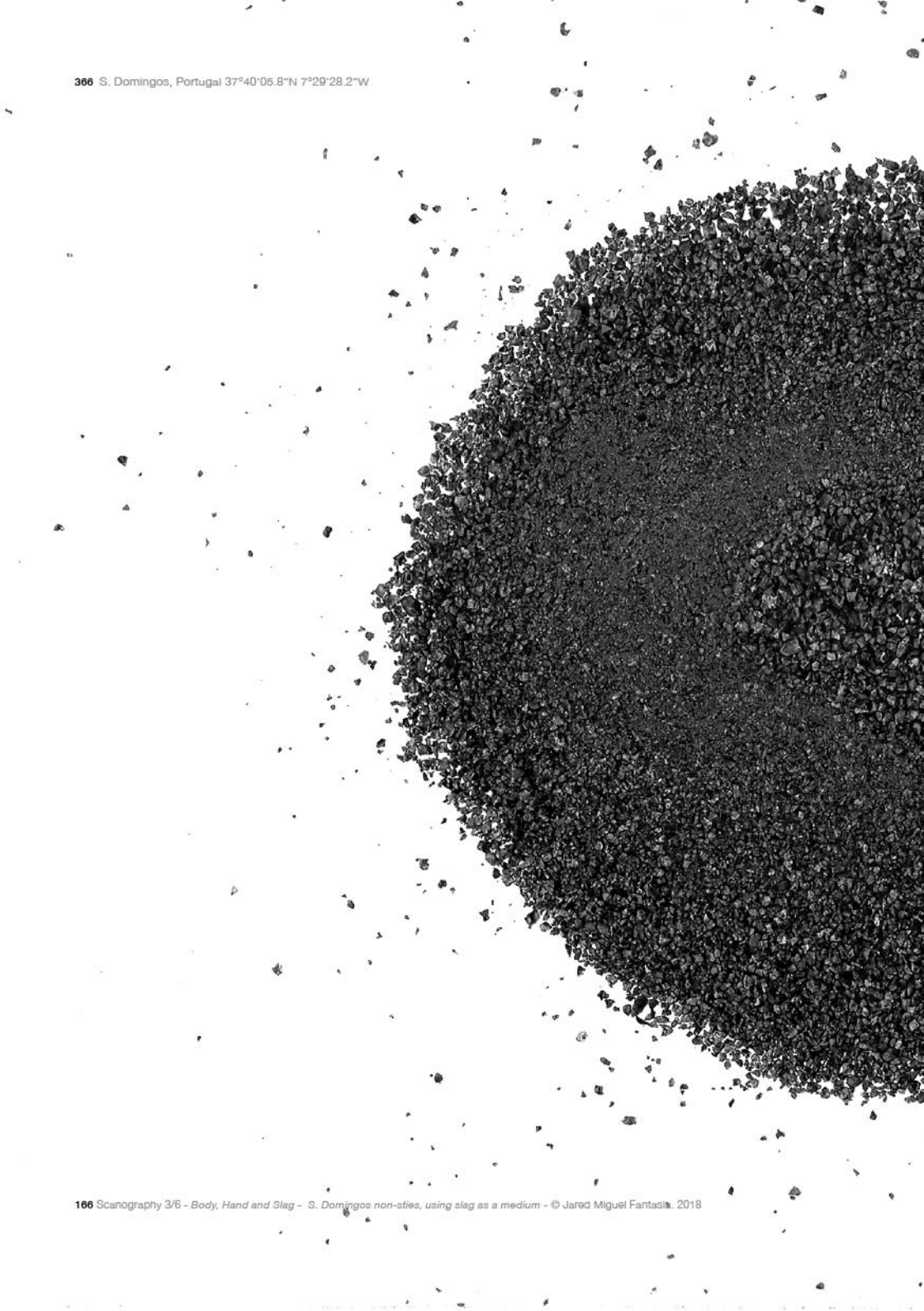
162 Piece of compact mining slag found at the mining tips near the Achada do Gamo ore mills at S. Domingos, Portugal. © Jared Miguel Fantasia. 2018

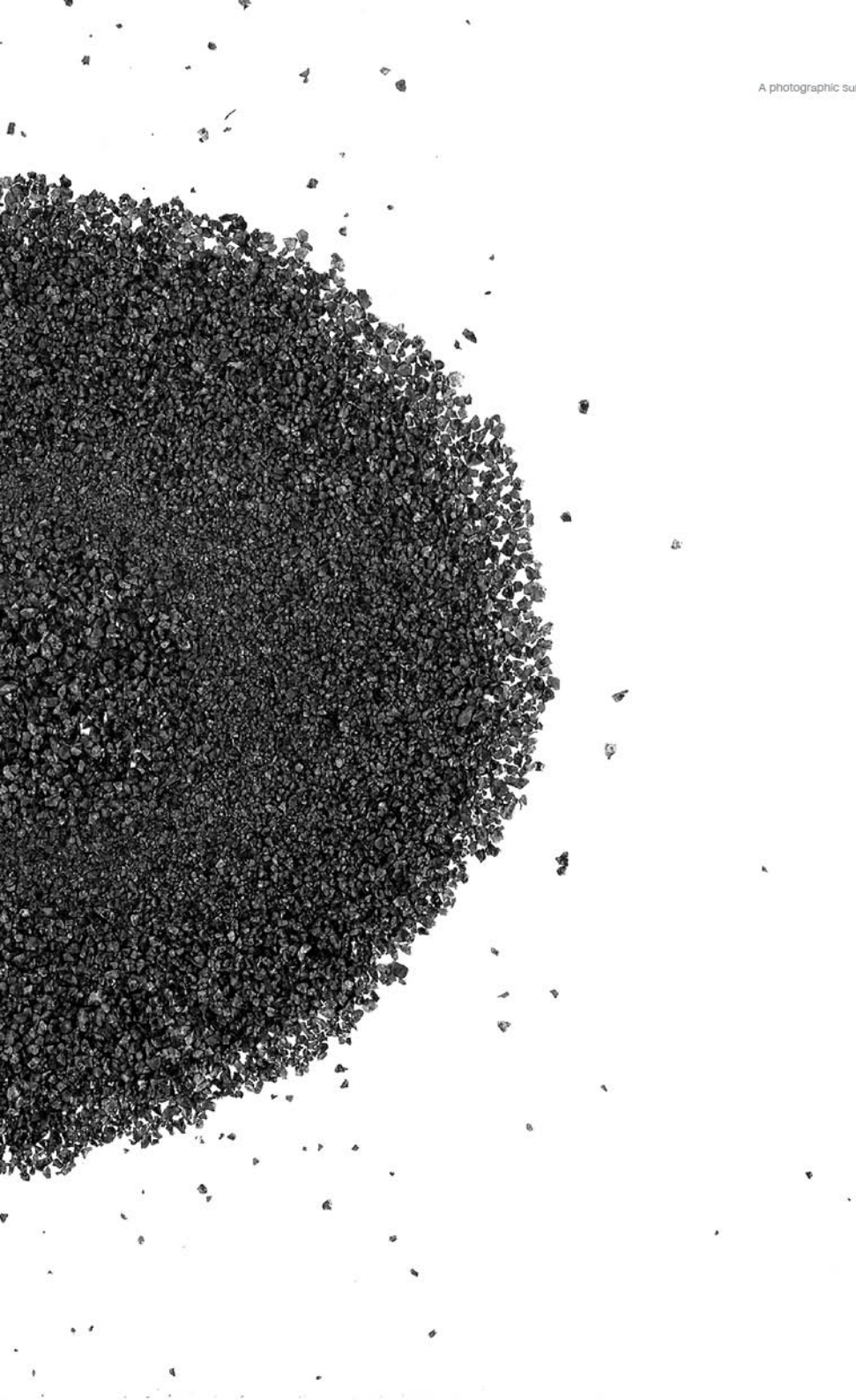
163 Digital Scans of three pieces of slag collected from the mining area of S. Domingos, Portugal © Jared Miguel Fantasia. 2018



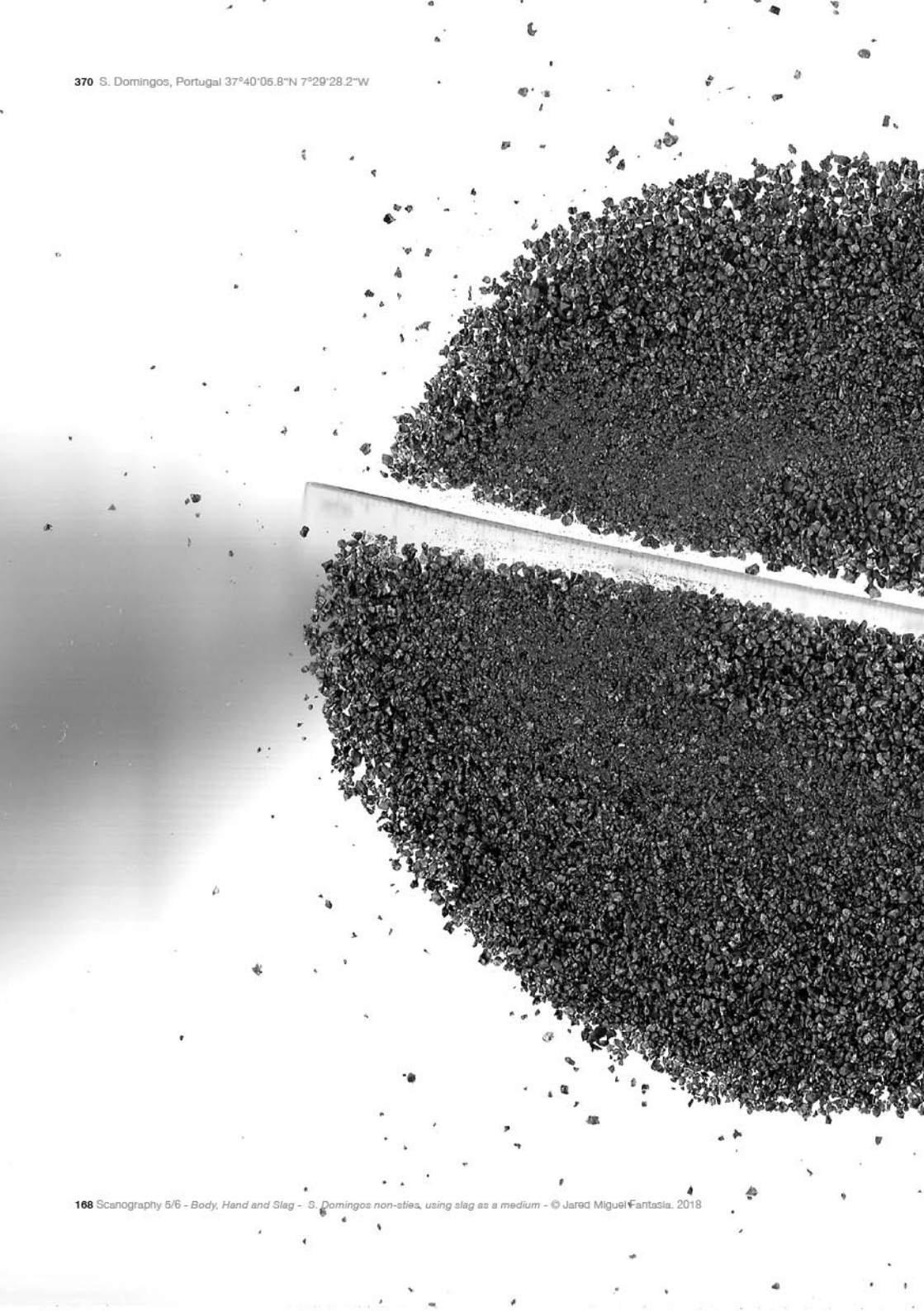
164 Scanography 1/6 - *Body, Hand and Slag - S. Domingos non-sties, using slag as a medium* - © Jared Miguel Fantasia. 2018

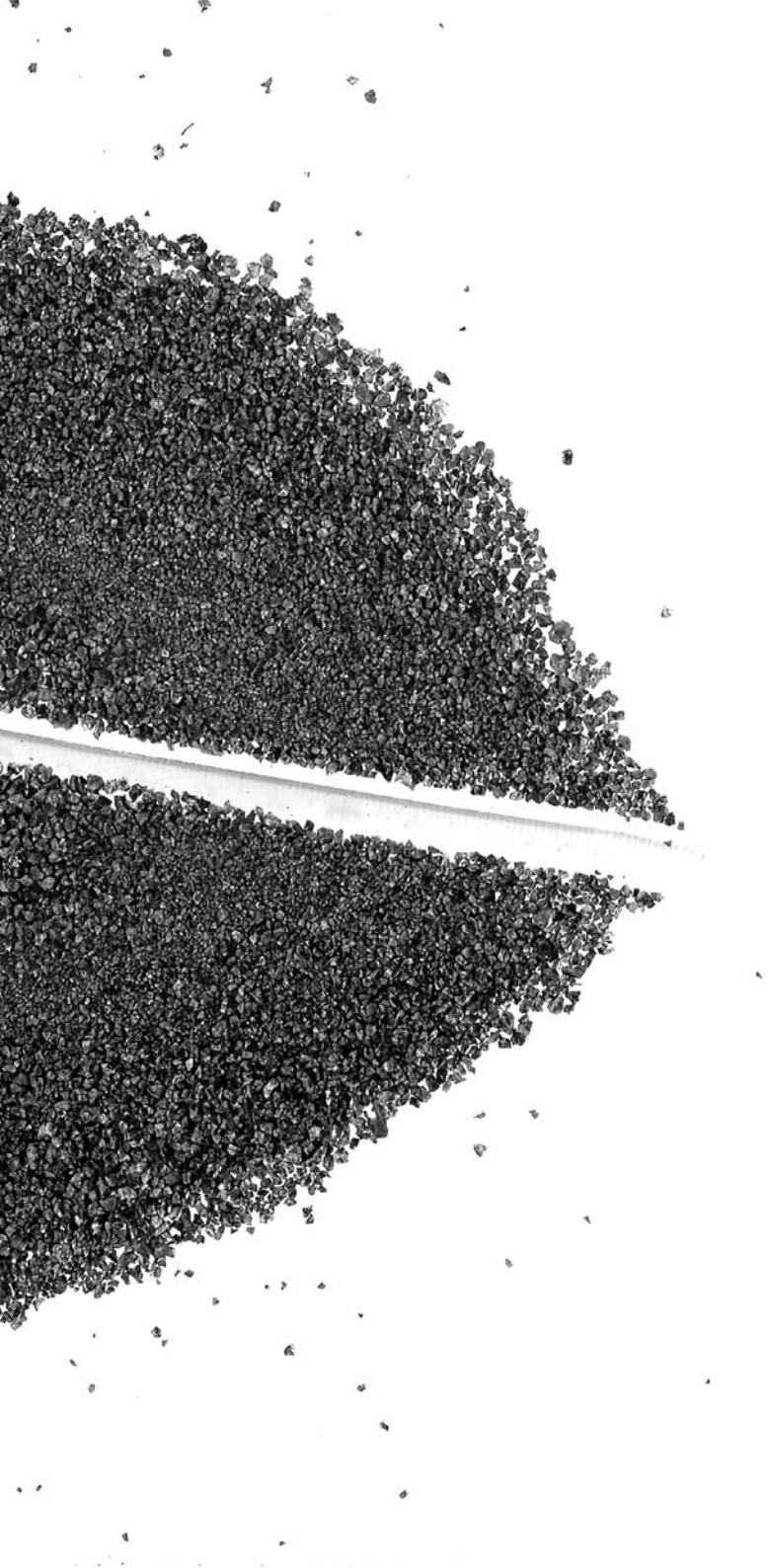
165 Scanography 2/6 - *Body, Hand and Slag - S. Domingos non-sties, using slag as a medium* - © Jared Miguel Fantasia. 2018





167 Scanography 4/6 - *Body, Hand and Slag - S. Domingos non-sites, using slag as a medium* - © Jared Miguel Fantasia. 2018





169 Scanography 6/6 - *Body, Hand and Slag - S. Domingos non-sties, using slag as a medium* - © Jared Miguel Fantasia. 2018

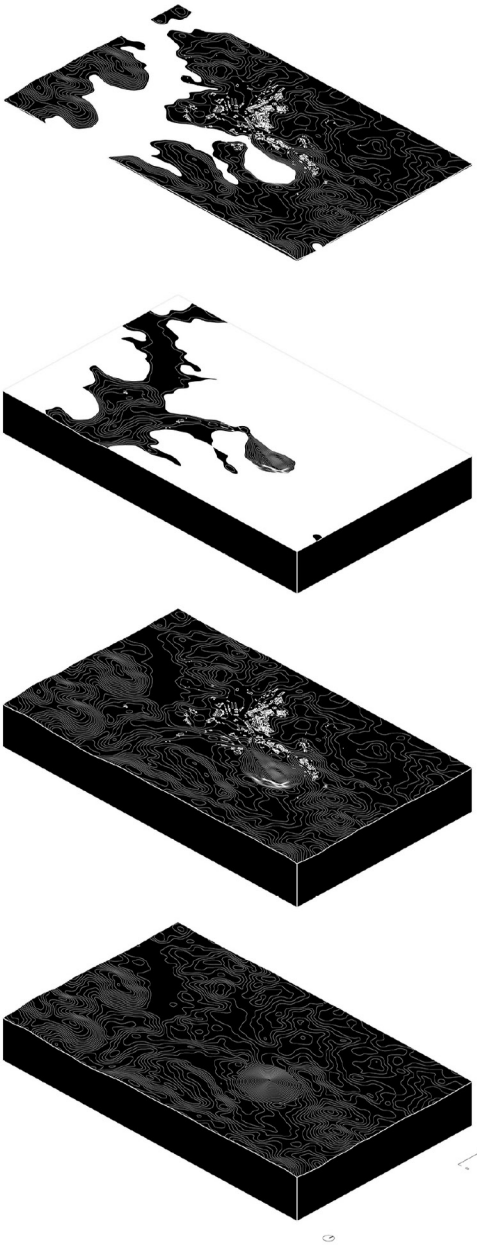
Process: an accumulation of waste

The following is dedicated to the design process undergone in the project that follows. This part aims to document the acts of making undertaken in the process and, the stages of the development of the project that will follow in the next chapter. Architects, Herzog & De Meuron consider that architectural "models and experiments with materials are not works of art but rather a kind of accumulated waste" (Ursprung 2002, 74). The collection of experimental models, drawings, photographs and sketches of process derived from the project, could resemble what Herzog & De Meuron would refer to as the "accumulation of waste" (Ursprung 2002, 74) or remnants of the design process which show intention and give the viewer insight into the conceptual moment. This chapter acts as a place of "accumulated waste" i.e. all that is left over from the design process when a project is done. This is just as Herzog & de Meuron have done in the exhibition *Archaeology of the Mind* and have discussed in the book, *Natural History*, that accompanies it (Ursprung 2002).

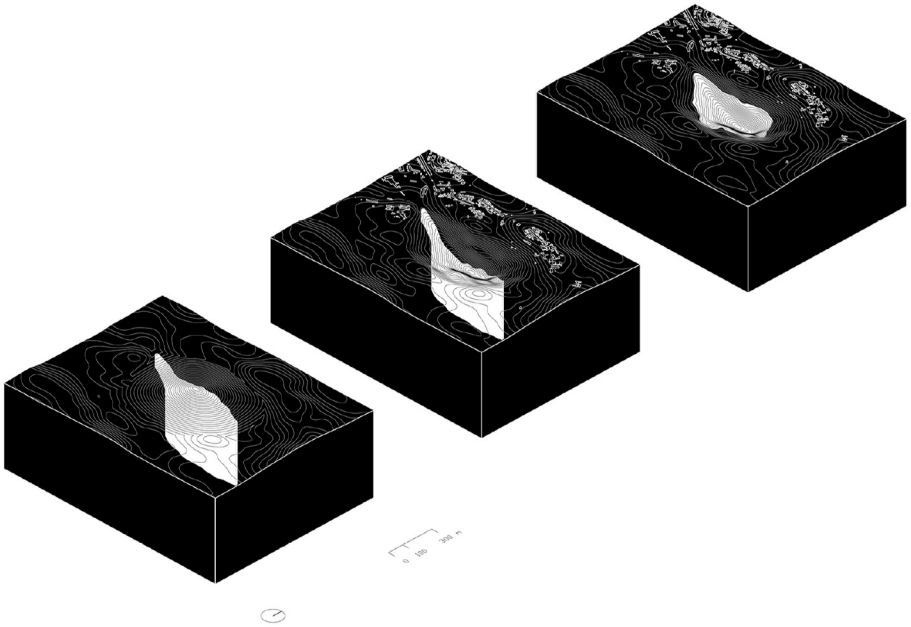
The process of thought behind the project has always focused on the S. Domingos open pit and its hidden VMS ore body. Initially the idea was to create a museum capable of allowing the visitor to enter and experience the hidden VMS deposit in a negative void - much like that, for example, of being within the interior of the Itaipu dam [87] and touching the rock at its base.

Further analysis of the terrain began to prove more interesting when investigated: the N-S cross section through the S. Domingos ore body (Mateus et. al. 2011, 139); historical cartography from Richard o' Harvey's watercolour, *Plan of Mina de São Domingos 1889,* which was recreated from the note book of Cornish mining engineer Federick o' Harvey in 1889[88] ; Portuguese mining engineer Sequeira, Pedro Victor da Costa's 1883 plans of the S.Domingos ore body (before and after the establishment of the S. Domingos mine)[89]. The S. Domingos ore body could be now understood as a vulva-like shape within the delimitation of a horizontal plan of 130m contour corresponding to the 0m mining line. As there is no actual existing model of what *was* and what *is* the open pit of S. Domingos and its complete VMS, it was necessary to create graphic material and models on which to work and experiment with. Exploring the contour line opened up a wider area delimiting the pit from its surroundings and initiated the thought that one did not really have to enter down within the open pit but could simply have contact with its former outline at the 0m mining level. Ideas developed though a continuum of work composed of sketches, computerised imagery for subsequent construction of architectural models (made out of expanded polystyrene sliced with a simple styrofoam hot wire cutter). Sections of the terrain allowed one to understand the deposit in its past and project its future. The approach was much like French scientist Étienne-Jules Marey's[90]; study of movement when he created a chronophotographic gun (1882) to produce 12 consecutive frames of the subject per second (all on the same picture) allowing him to study the movement of beings. Although movement

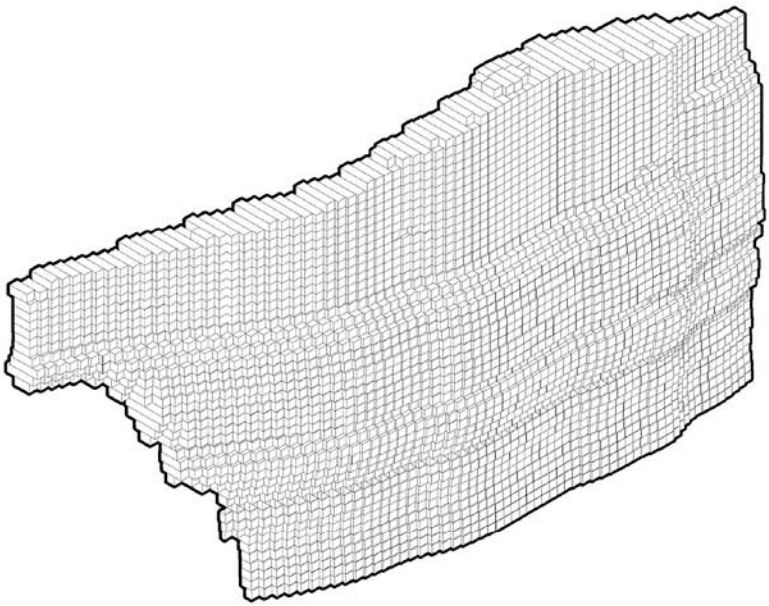
was not being studied here, it was necessary to construct a way of studying the open pit, and its today invisible VMS deposit within, through a rhythm of "still frames" - sections going from west to east - based on Mateus' N-S cross section through the S. Domingos ore body (Mateus et. al. 2011, 139). This hypothetical reconstruction of the ore body acted in the same way as a Computed Tomography (CT) scan might do, i.e. to reveal the hidden VMS deposit and the ante form of the open pit through vertical sections.



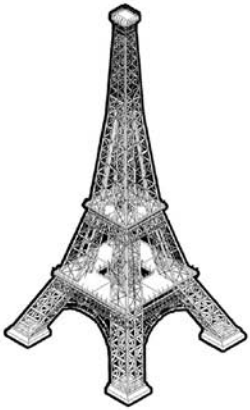
170 Images of 3D models digitally produced in the developmental stage of the project with the intention of understanding the topography of the S. Domingos mining area: before mining (bottom); after mining / current topography (middle); current topography sectioned at the 130m above sea level contour where the vulva-like shape of the contour, defining the open pit, is apparent. (top). © Jared Miguel Fantasia. 2018

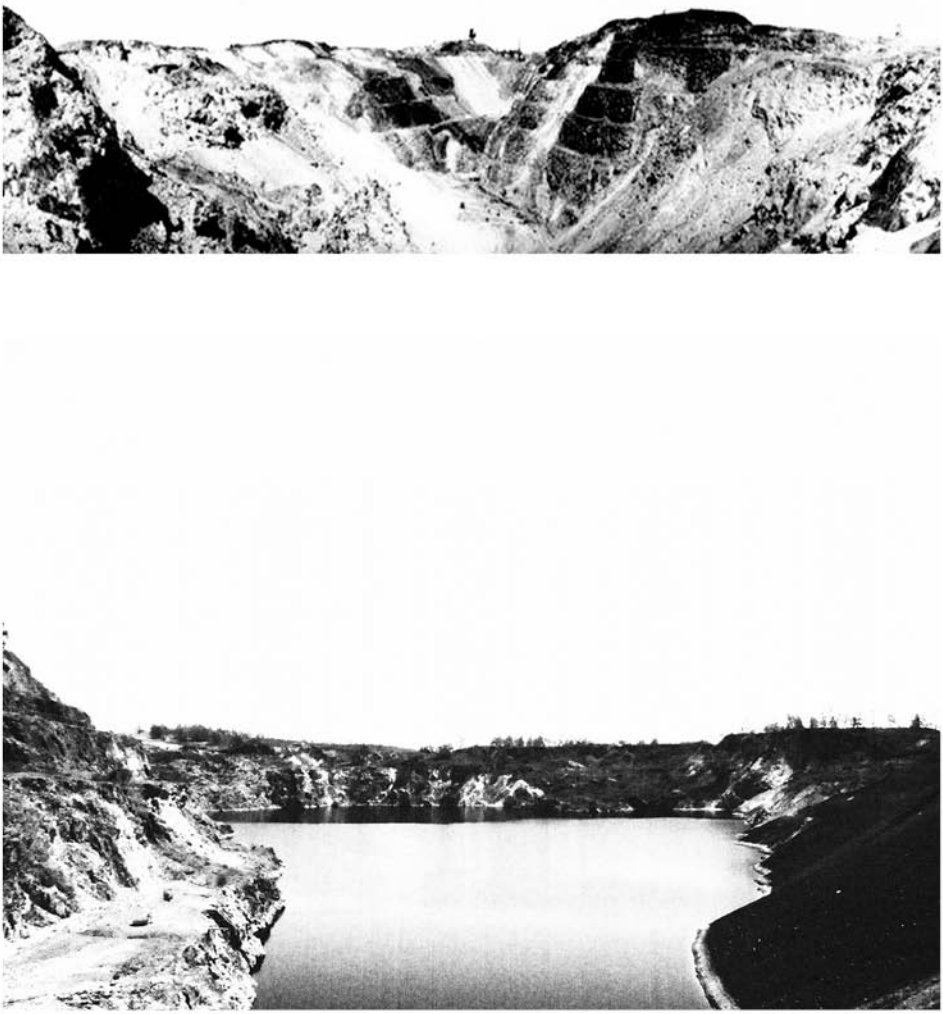


171 Images of 3D digital models of the topography produced in the developmental stage of the project showing the VMS deposit of the S. Domingos open pit: before mining (left), the current orebody (centre) and the current open pit filled with acid mine drainage (right). © Jared Miguel Fantasia. 2018

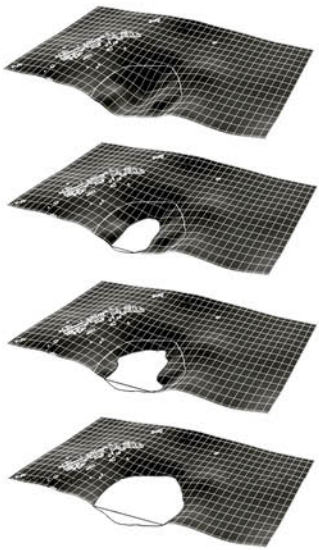


172 Conceptual 3D digital images produced in the developmental stage of the project, to compare the hypothetical size of the original S. Domingos VMS deposit (before mining) with that of the Eiffel Tower in Paris. With this comparison, we can understand that the VMS deposit is a vast subterranean monument hidden from view. © Jared Miguel Fantasia. 2018



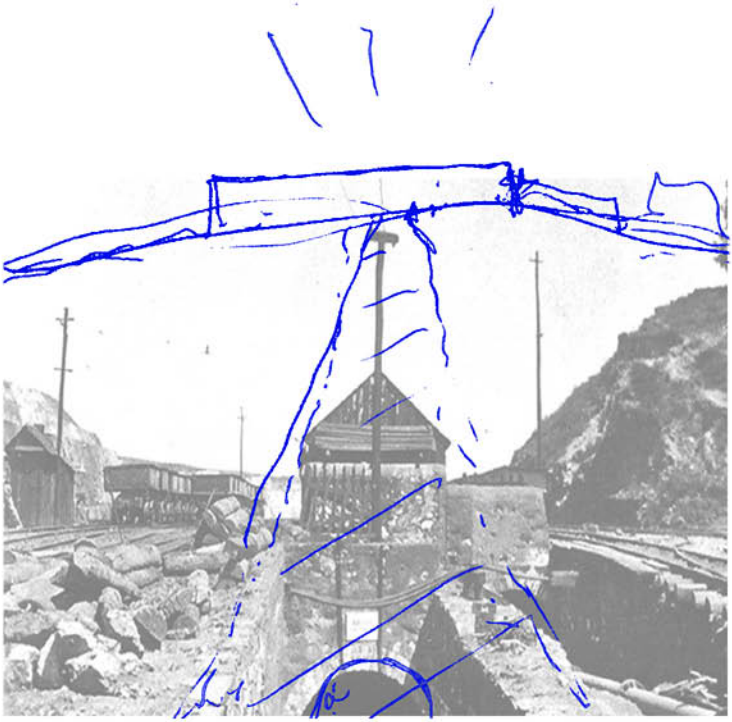


173 Comparison of images relating to the open pit at S. Domingos, Portugal. Top: 1960? View to the west of the open pit. Bottom: Image of current day open pit filled with acid mine drainage (view to the east).

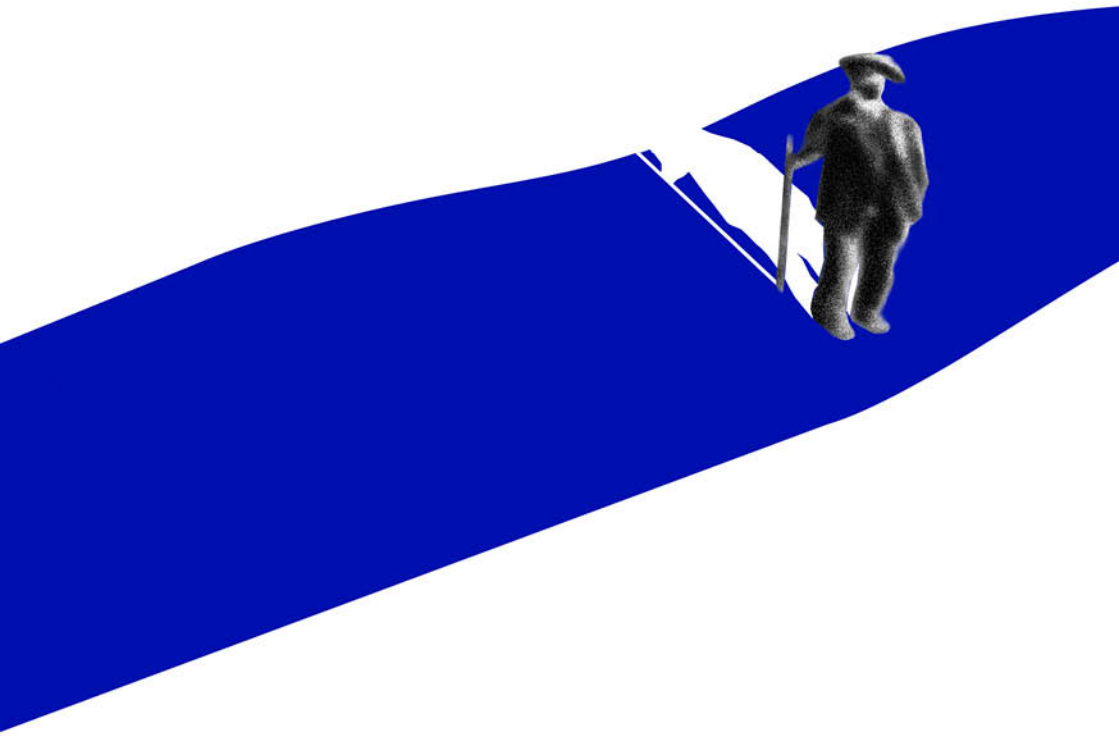


174 Diagram composed of conceptual axonometric views showing the progressive filling of water of the S. Domingos open pit after its closure in 1965 (top) to current day (bottom) © Jared Miguel Fantasia. 2018

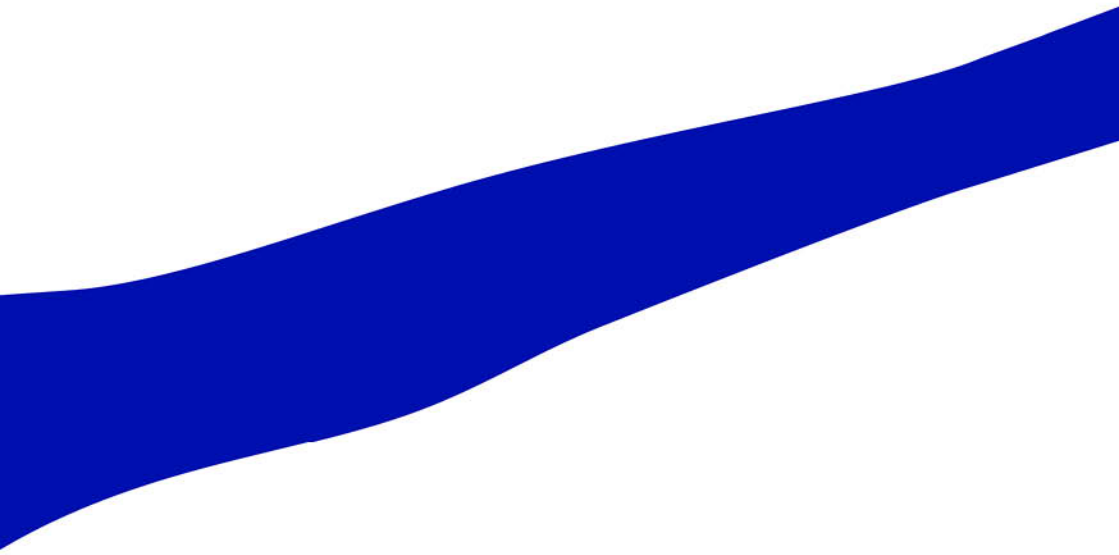
175 Comparison of two images Left: Photograph by Antoine Claudet? 1864). This shows the entry to the S. Domingos underground tunnels. The hill of the S. Domingos orebody can be observed. Right: Overlay of a sketch in blue on photograph of 1945, entry to the S. Domingos underground tunnels. The sketch shows a conceptual representation of the pre-existing hill of the S. Domingos VMS deposit and the movement of the orebody in an easterly direction. © Jared Miguel Fantasia. 2018



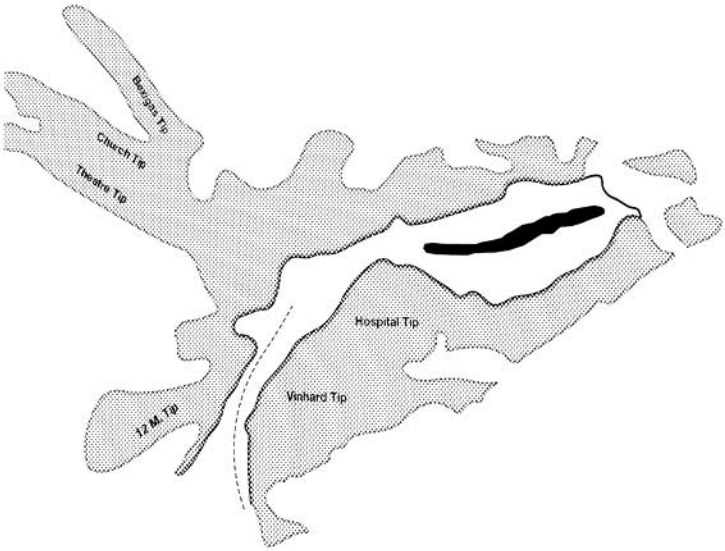
176 Photograph taken on 16th of June 1854 showing Piedmontese Nicolau Biava on the VMS orebody (in and east to west direction) which later became the site of the S. Domingos mine pit. Nicolau Biava, paid by the owners of the Tharsis mine (Spain), found an ancient Roman mine on the site which later led to exploration and the establishment of the S. Domingos Mine.

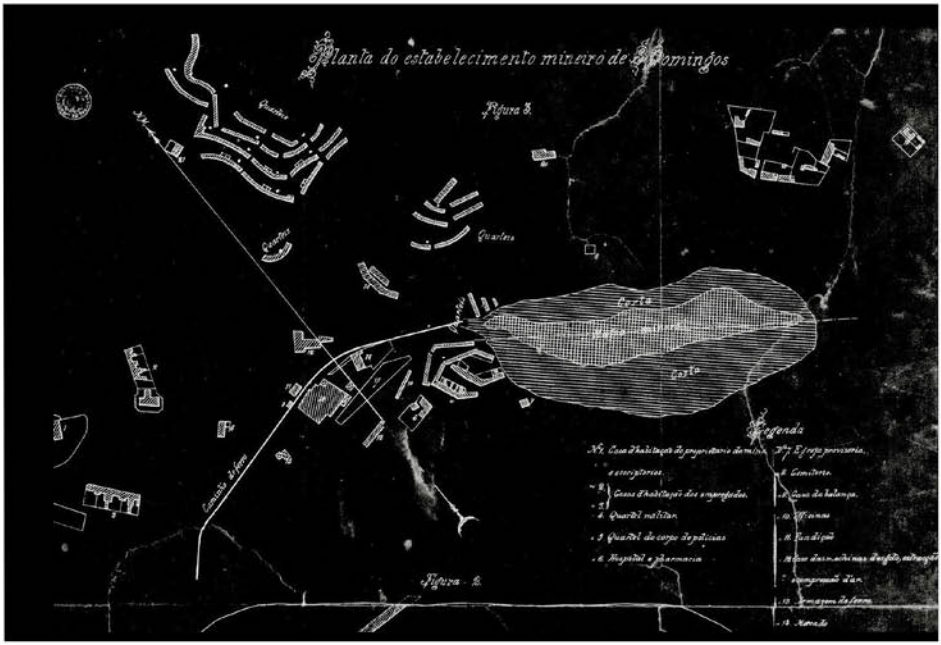


177 Photomontage depicting Nicolau Biava on the previously existing Serra de S. Domingos (shown on pages 384 and 385). Here the thick blue line depicts the direction of the S. Domingos orebody, running in an east-west / west-east direction. © Jared Miguel Fantasia. 2018

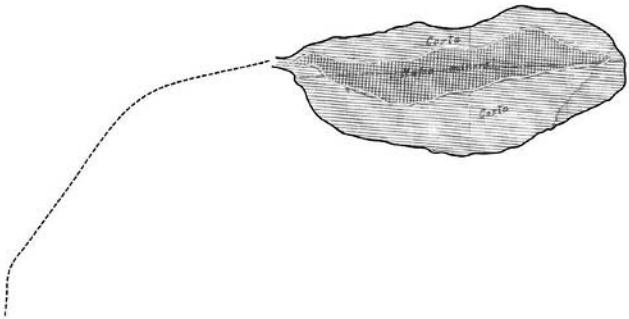


178 Comparison between Watercolour "Plan of Mina de São Domingos 1889" by Richard o' Harvey (left) (that can be seen in bigger scale in image 140 on pages 316 to 317) and, a conceptual drawing (right) synthesising the map on the left. Here we can see that the vast area delimiting the open pit is composed of various mining tips at what apears to be part of the 130m above sea level contour delimiting and contouring the shape of the open pit (the 0m mining level that can be seen in image 139 on pages 314 to 315). The S. Domingos railroad enters this vulva-like shape to where, in the middle of the pit, lies the S. Domingos orebody.


Burgers Tip
Church Tip
Theatre Tip
Hospital Tip
Vinhard Tip
12 M. Tip



179 Comparison between (left) Plan of the S.Domingos orebody - after the establishment of the S. Domingos Mine with its mining village and vulva-shaped mineral ore outline as depicted by Sequeira, Pedro Victor da Costa,1883 - and, a conceptual drawing (right) synthesising the map on the left by showing part of the 130 meter above sea level contour that delimits and contours the shape of the open pit (the 0m mining level that can be seen in image 139 on pages 314 to 315) and the railroad which leads to the opening of the open pit with the orebody within.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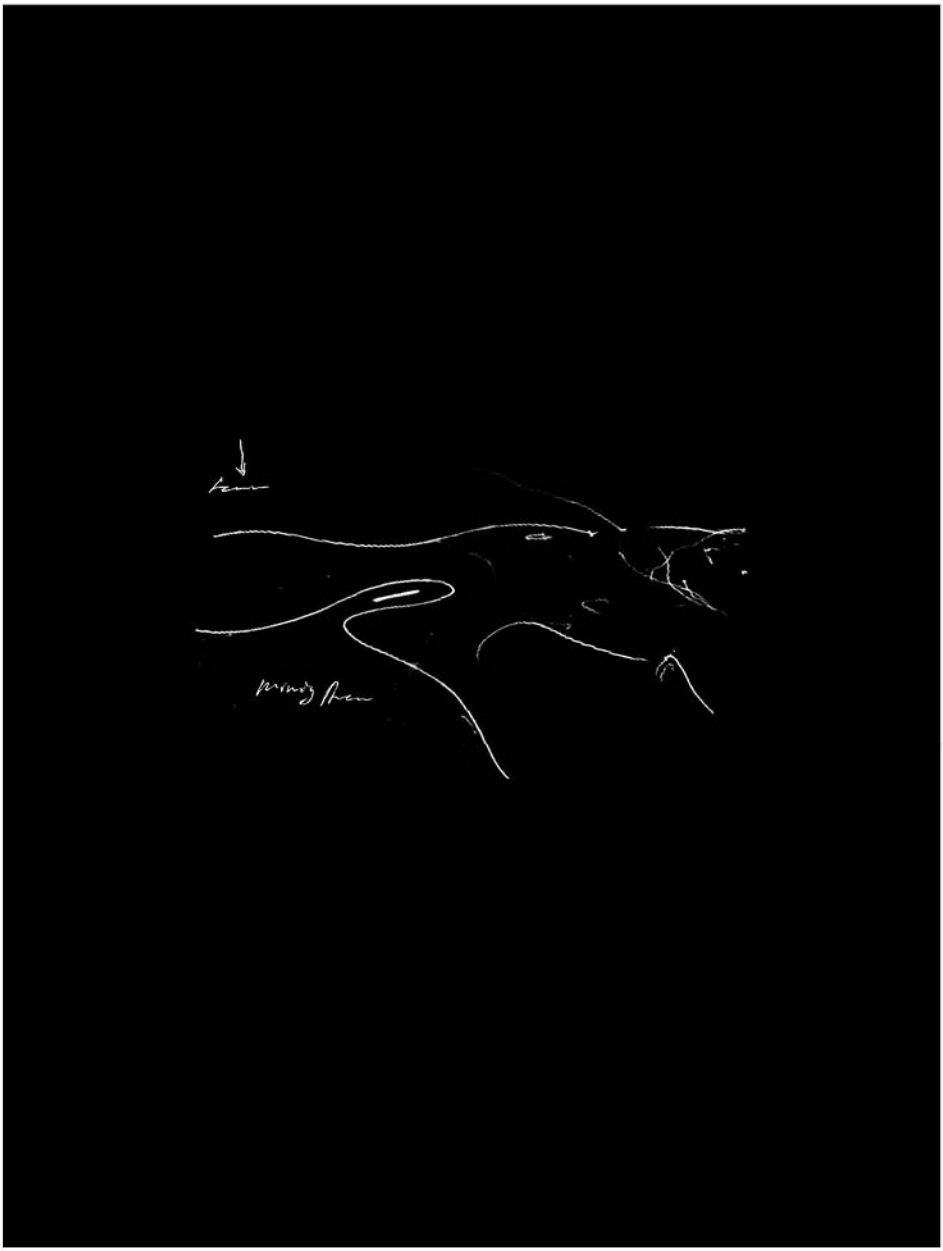
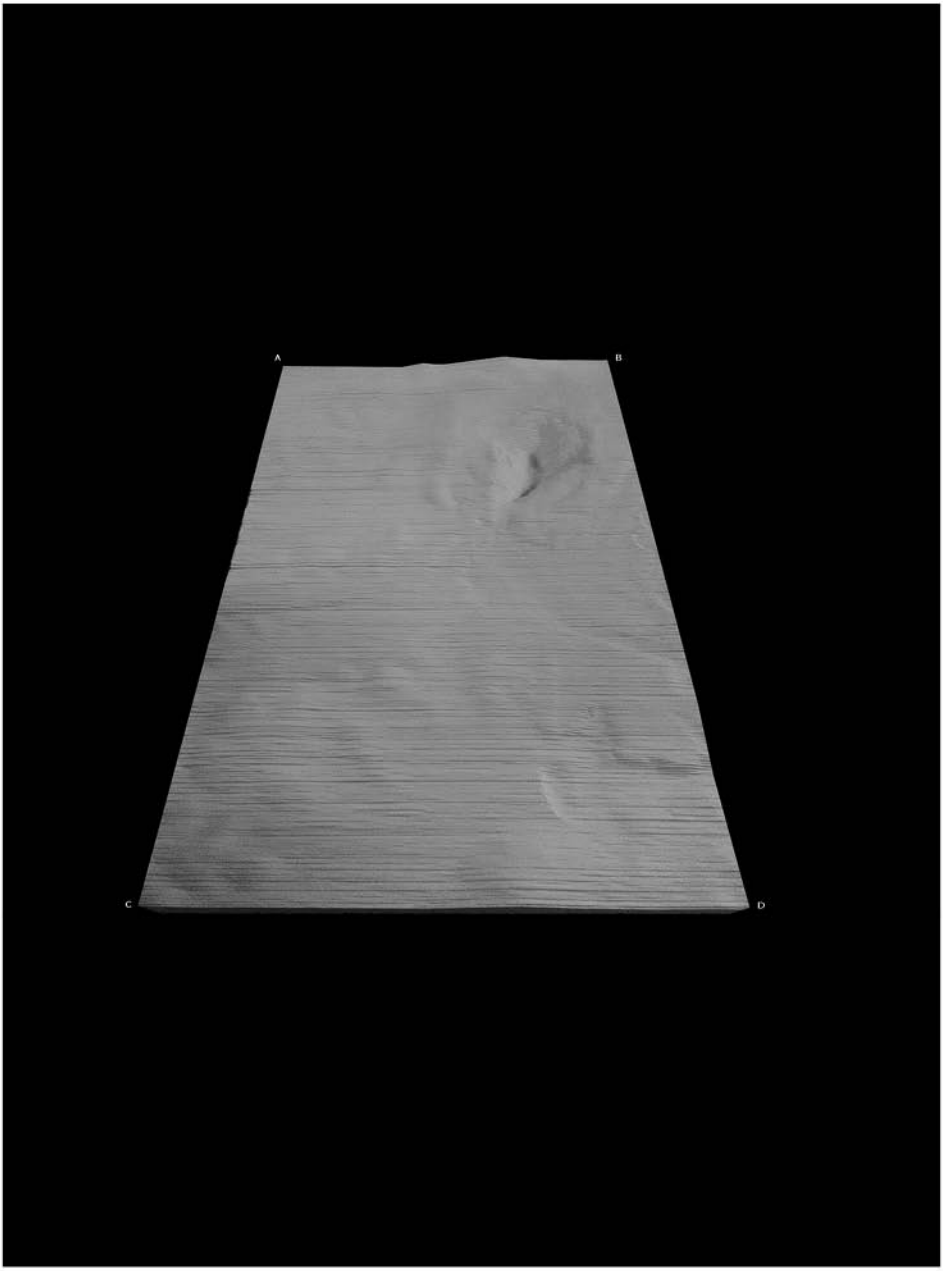
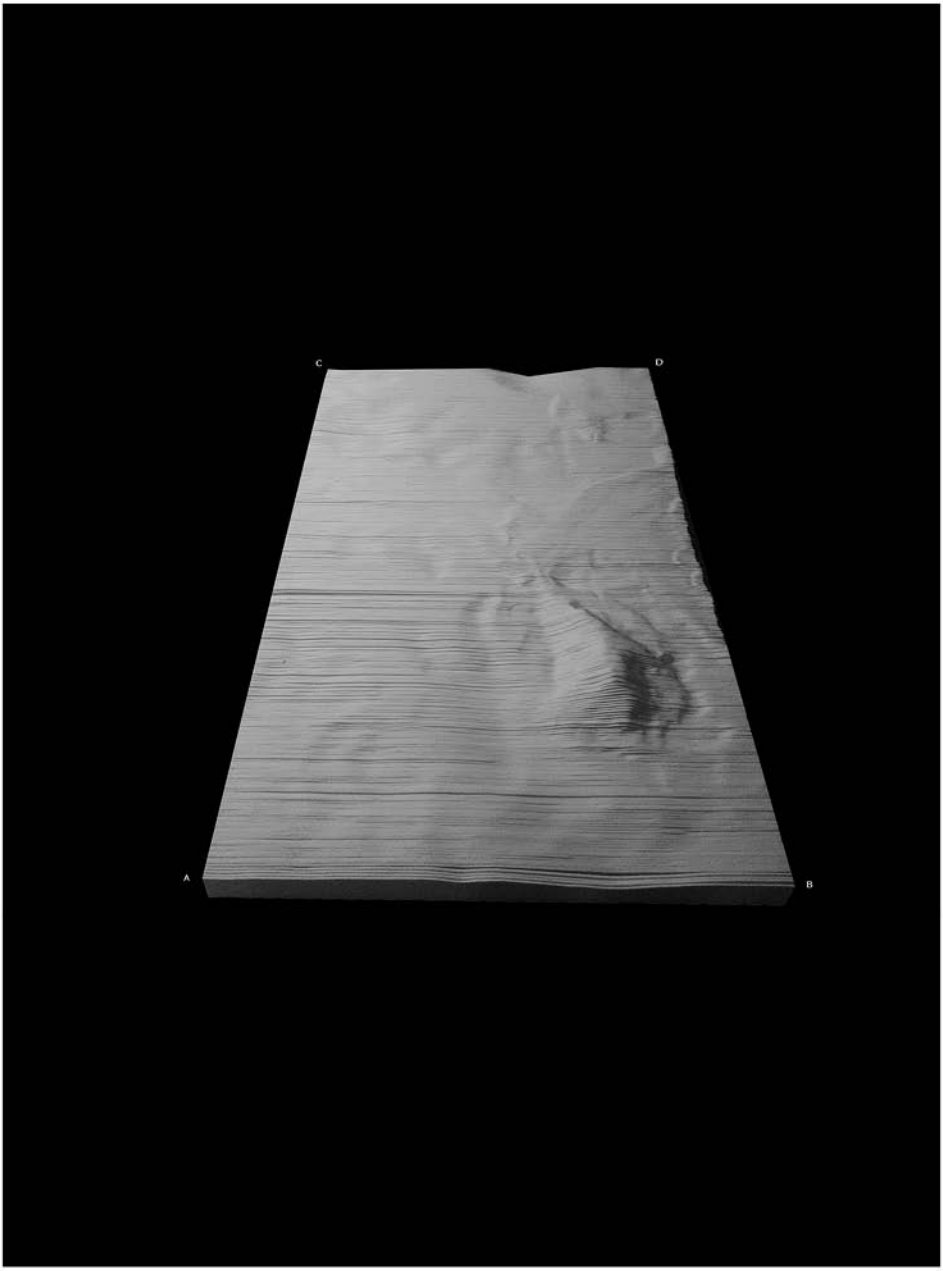


180 Sketch (left) showing the S. Domingos open pit and contour lines. The seemingly vulva-like shape of the pit and contour lines as a woman's legs (in the sketch above) can be metaphoric. Throughout history, from the Early Paleolithic to the Modern Era, the vulva has been depicted and associated with nature and fertility - with the vulva seen as a reproductive seed. In this way, we can perceive the prolongating east to west S. Domingos orebody as a seed within the vulva. We can see the pit as a reproductive body because it gave ore that was used to reproduce cultural items that were needed for technological progress of mankind through the ages. © Jared Miguel Fantasia. 2018

181 Three images of art works which could be metaphorically linked to the shape of the S. Domingos elongated orebody (as shown in image 180) in terms of a crack or a line running east to west throughout the Iberian Pyrite Belt - Top: *Feuille de vigne femelle* by Duchamp (1950 -1961). Middle: *The Origin of the World* by Gustave Courbet in 1866. Bottom: *Shibboleth* by Doris Salcedo exhibited at the Tate Modern in 2007. The top image represents the capturing of a line and negative space which represents beauty as represented in the female form. The middle image shows the erotic female form linked to the lines of the vulva-like orebody in image 180. The bottom image represents societal segregation through its contrast of positive and negative space which could be seen perhaps here as a segregation between the workers at the S. Domingos Mine with the negative space representing the pit miners who were the poorest and the most vulnerable.



182 Comparison of two models showing the current S. Domingos open pit and its surrounding area created by the compilation of multiple terrain cross sections (north to south direction). The model to the left represents positive space and to the right the model shows its corresponding negative space. © Jared Miguel Fantasia, 2018


C
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A
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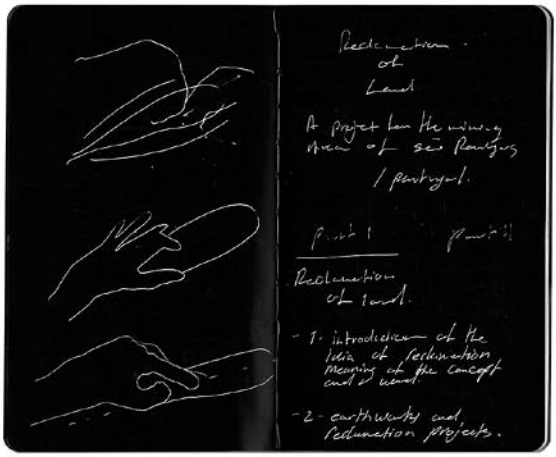
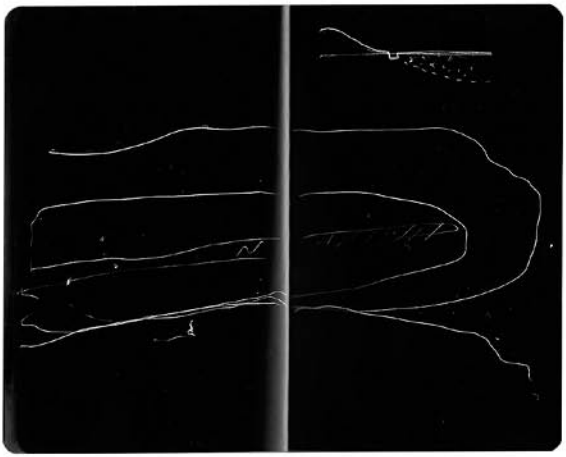
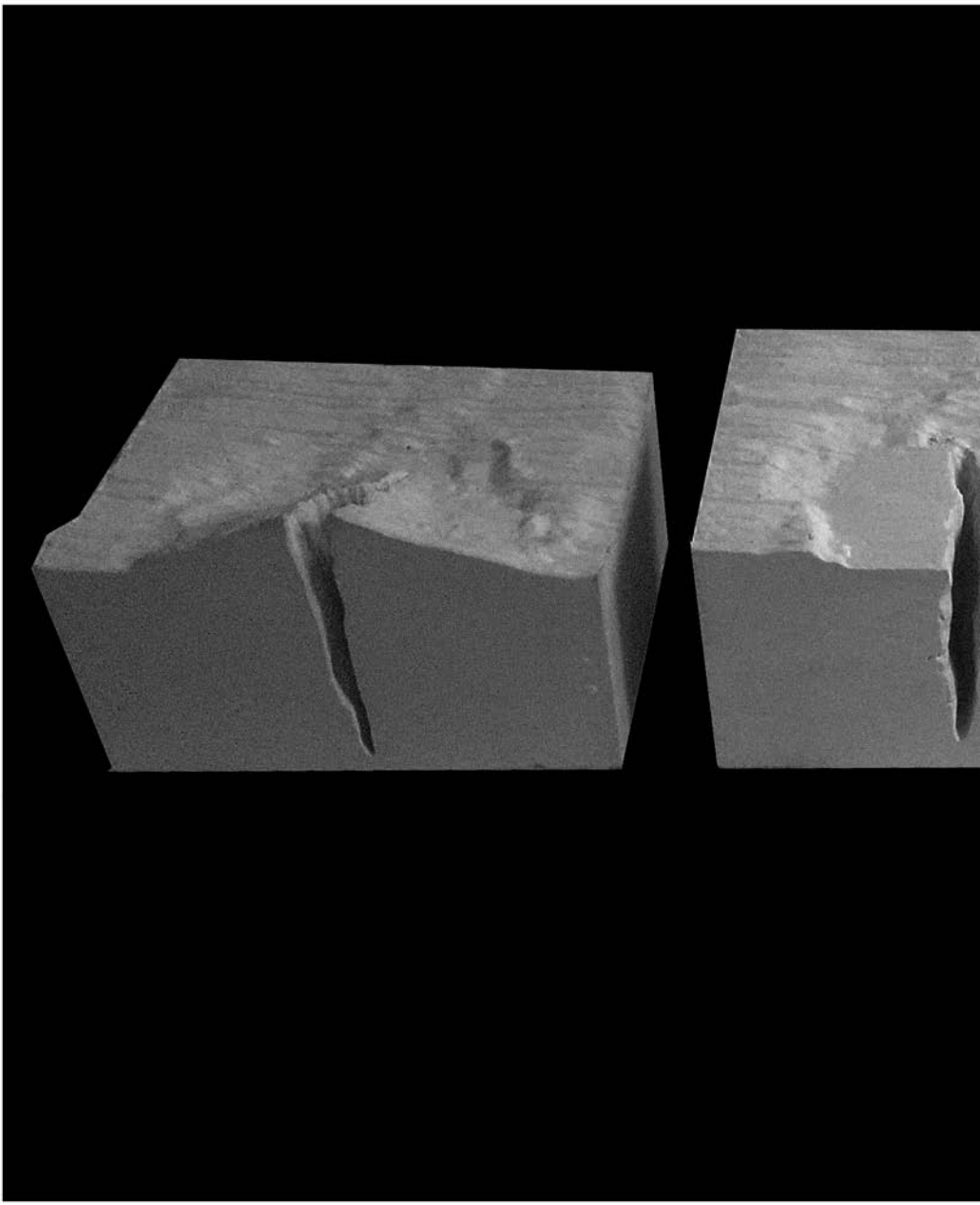
183 Two conceptual photo-montages (left and right) showing the east to west movement with the hand, within a conceptual model of the current S. Domingos open pit (shown on pages 394 to 395) The direction of the S. Domingos orebody is in correlation with this movement east to west (depicted in blue). © Jared Miguel Fantasia. 2018

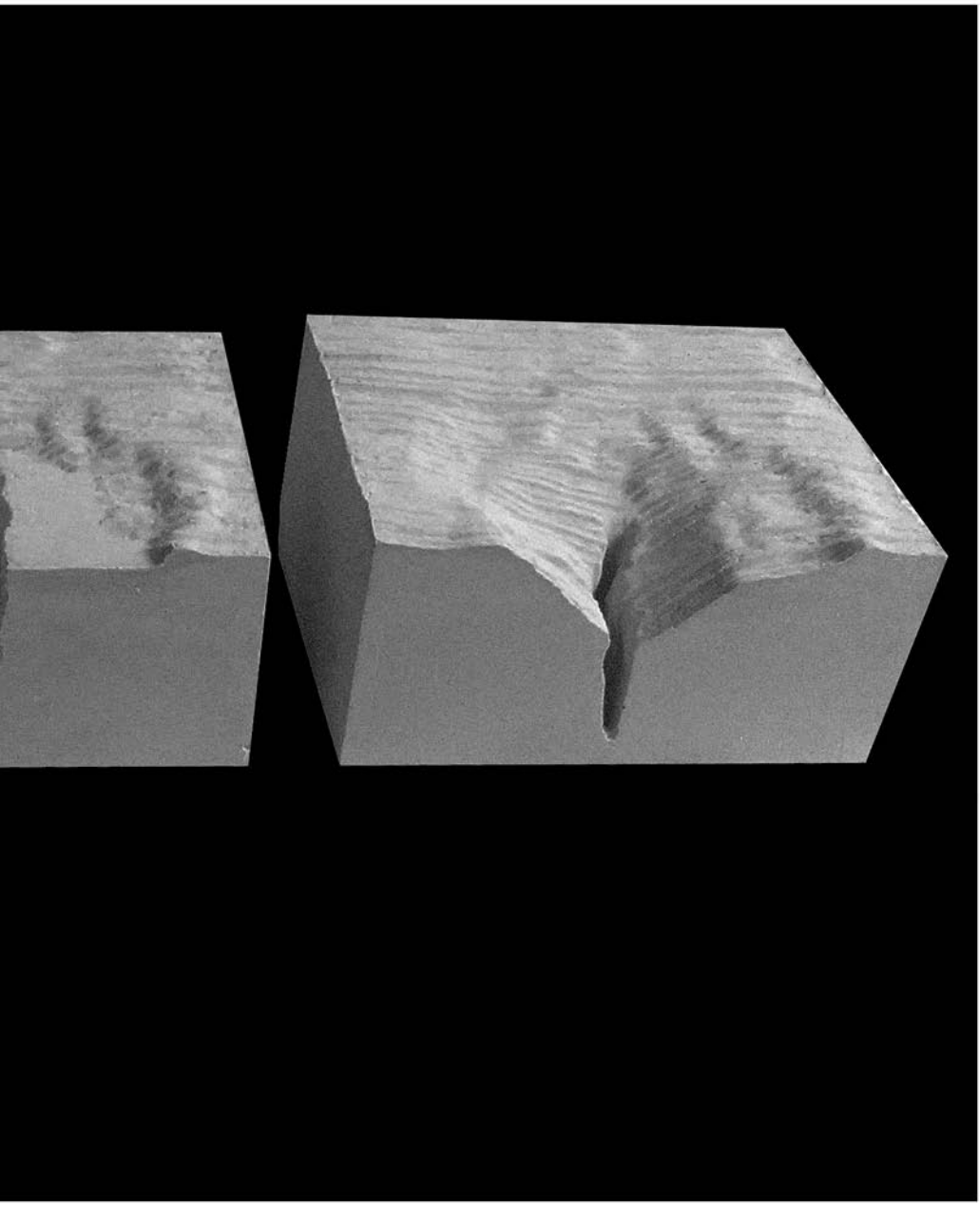


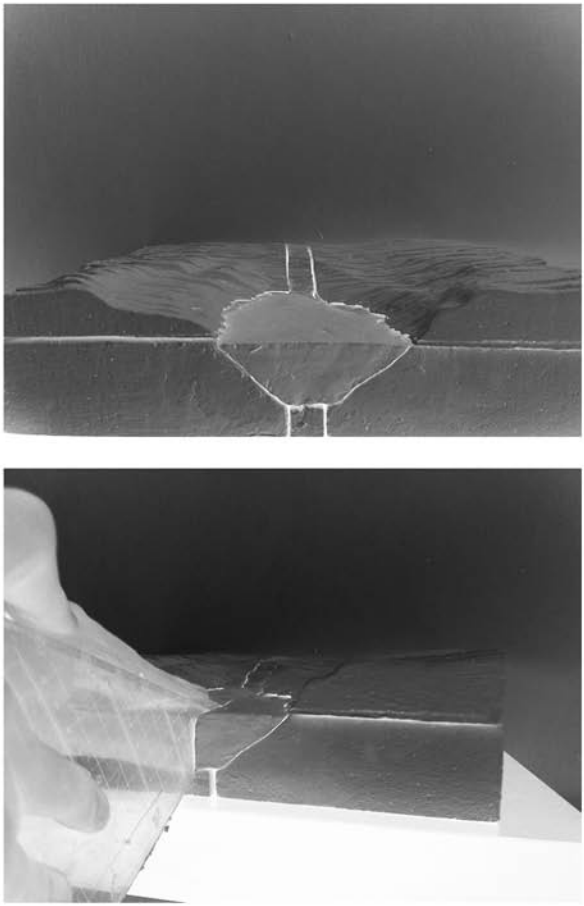
184 Two conceptual drawings (© Jared Miguel Fantasia. 2018) produced in the developmental stage of the project. Left: Perceiving the S. Domingos open pit as an open wound, imagining opening it, touching and feeling the S.Domingos orebody deep within and then sculpting it. This drawing is an analogy to Caravaggio's painting, *The Incredulity of Saint Thomas* (where the doubting apostle, Thomas, touches and reaches into the wound of Christ in order to establish the truth) . Right: A drawing depicting the filling of the open pit and the marking of the pre-existing orebody (extending from east to west and vice versa). The top right hand side of the drawing shows the thought process behind the contact of the filling of the open pit - with the existing wall above the 0m mining level (130 meters above level contour line). The line produced from the contact and the contrast of the new and the old could become a gutter line to stop drain water seepage into the pit. The line also serves as a antechamber. A line delimited on the floor clearly not only marks the transience from the old to the new but that between the normal to the sacred- just as the *Pomerium* was a religious boundary around the city of Rome.



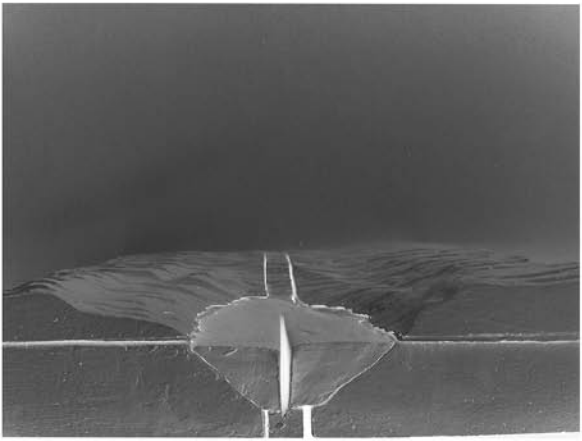


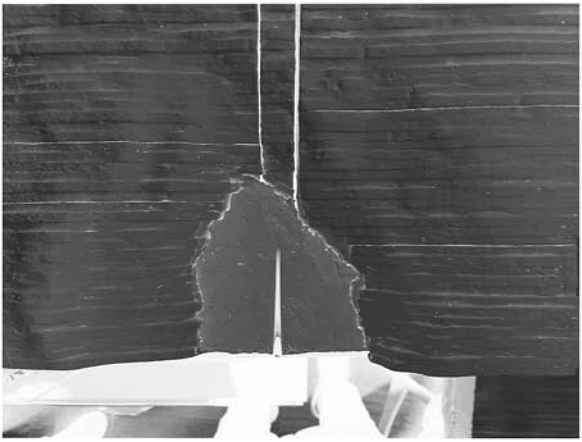
185 Three conceptual models showing the S. Domingos open pit in three phases: before mining (left); backfilled until the 130 m above sea level with negative void (middle), empty open pit after the closure of the mine in the 1960s (right). © Jared Miguel Fantasia. 2018

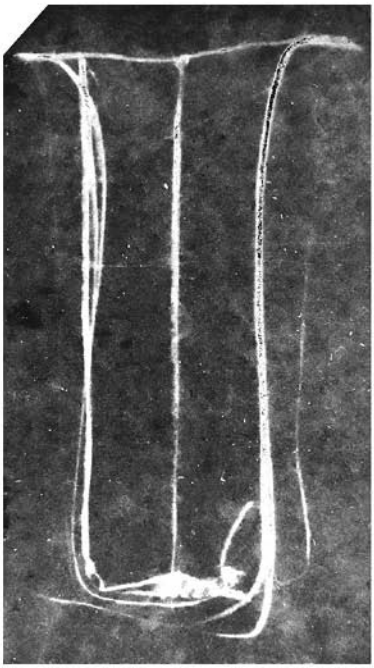




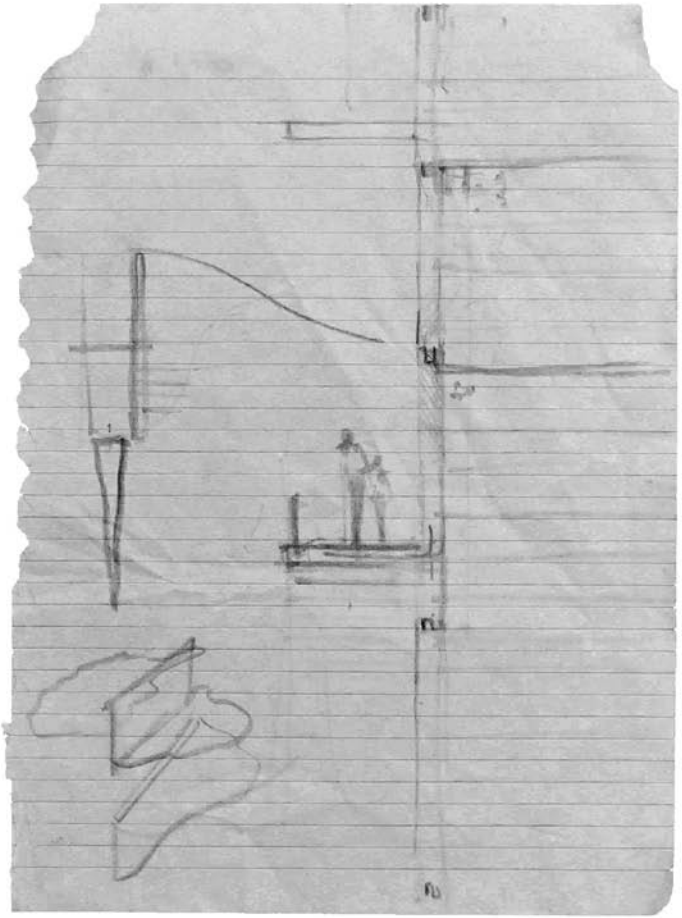
186 A sequence of four photographs showing: (Top Left) the filling of the S. Domingos open pit; Bottom Left) a photograph showing the capture of the gesture of slicing open the open pit with a set square; (Right) two images showing the result of the gesture within the filled pit. © Jared Miguel Fantasia. 2018

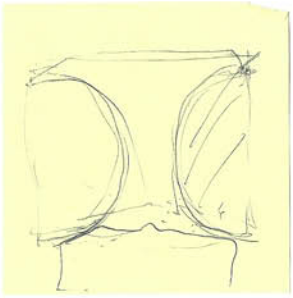


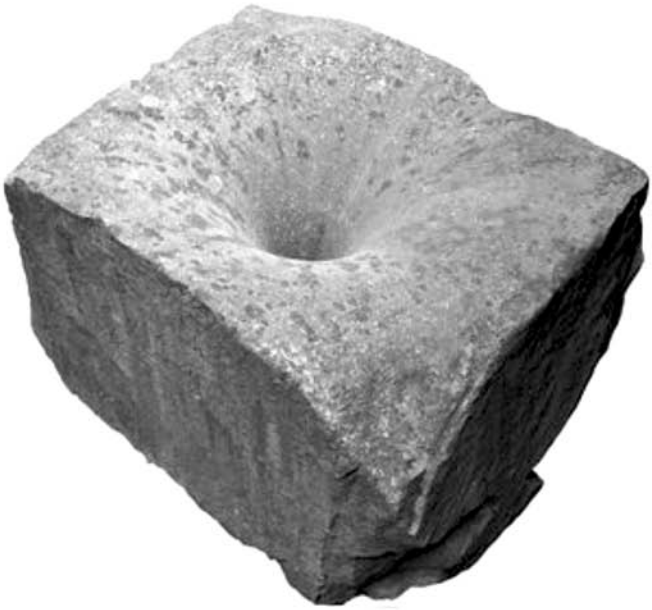




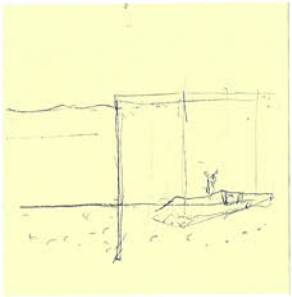
187 Process undergone during the academic year of 2012/2013 of project III. Two sketches (top left and right) showing the conceptual idea of an architectural project that allowed one to enter within the newly reclaimed open pit and be in contact with the remaining VMS deposit. The S. Domingos orebody acts as a hidden body buried deep beneath the earth, much like the still body in John Sturgeon's *Installation performance* in 1992-1994 (bottom left).

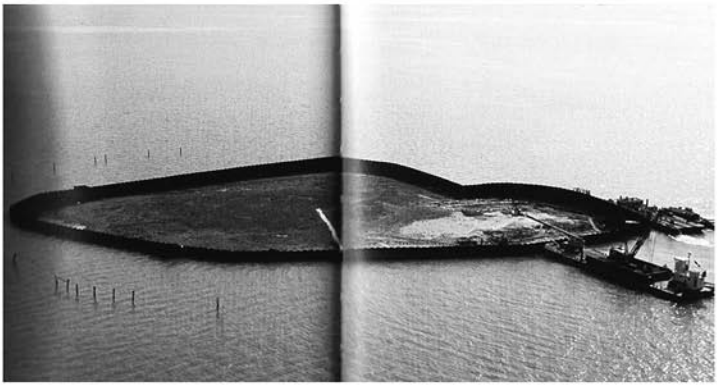






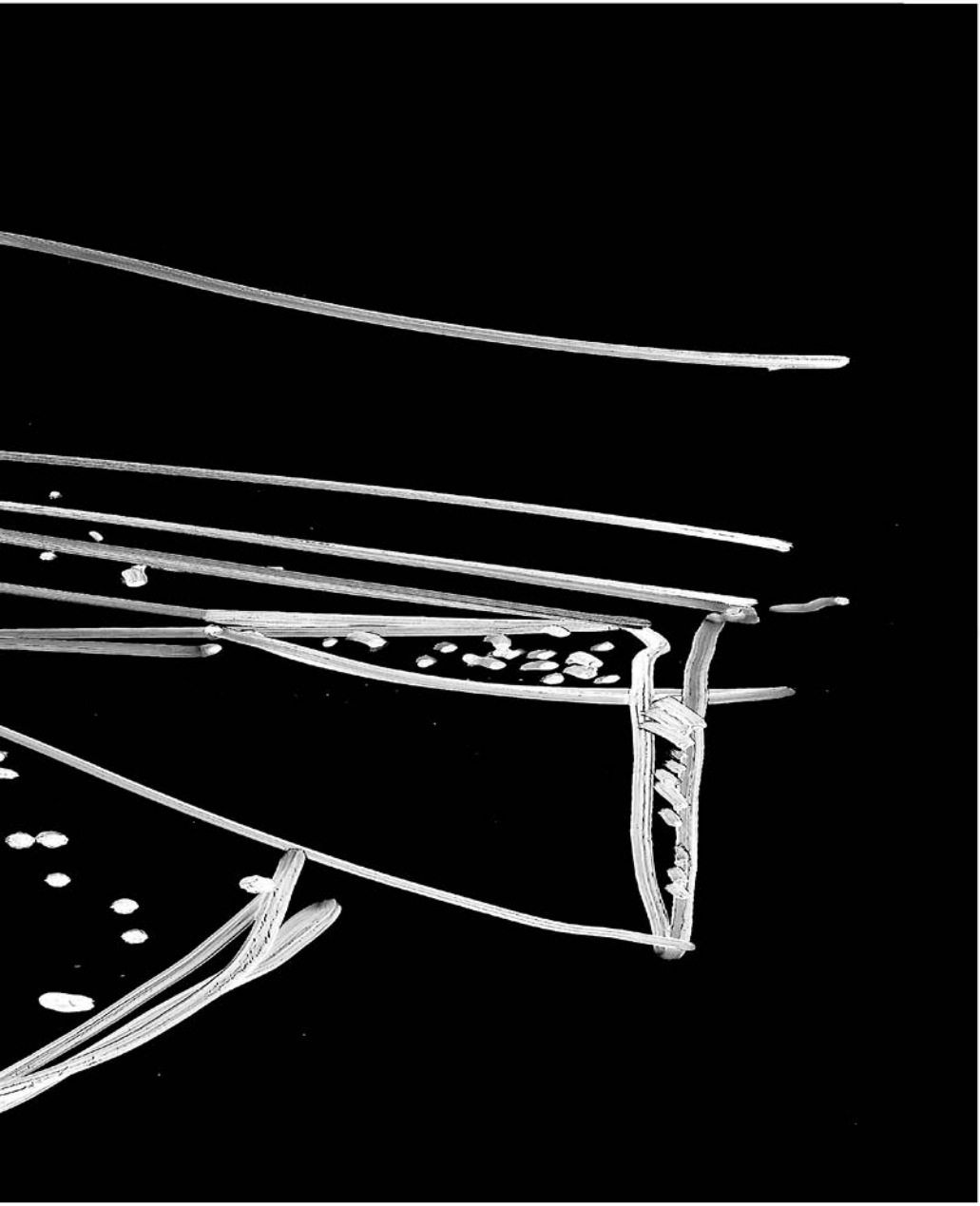
188 Bottom: Kapoor, Anish. *Untitled*. 1993. Top: A sketch made imagining the thought process between Anish Kapoor's work and that of the thought of a project concerning the negative void inside the S Domingos Mine filled open pit.

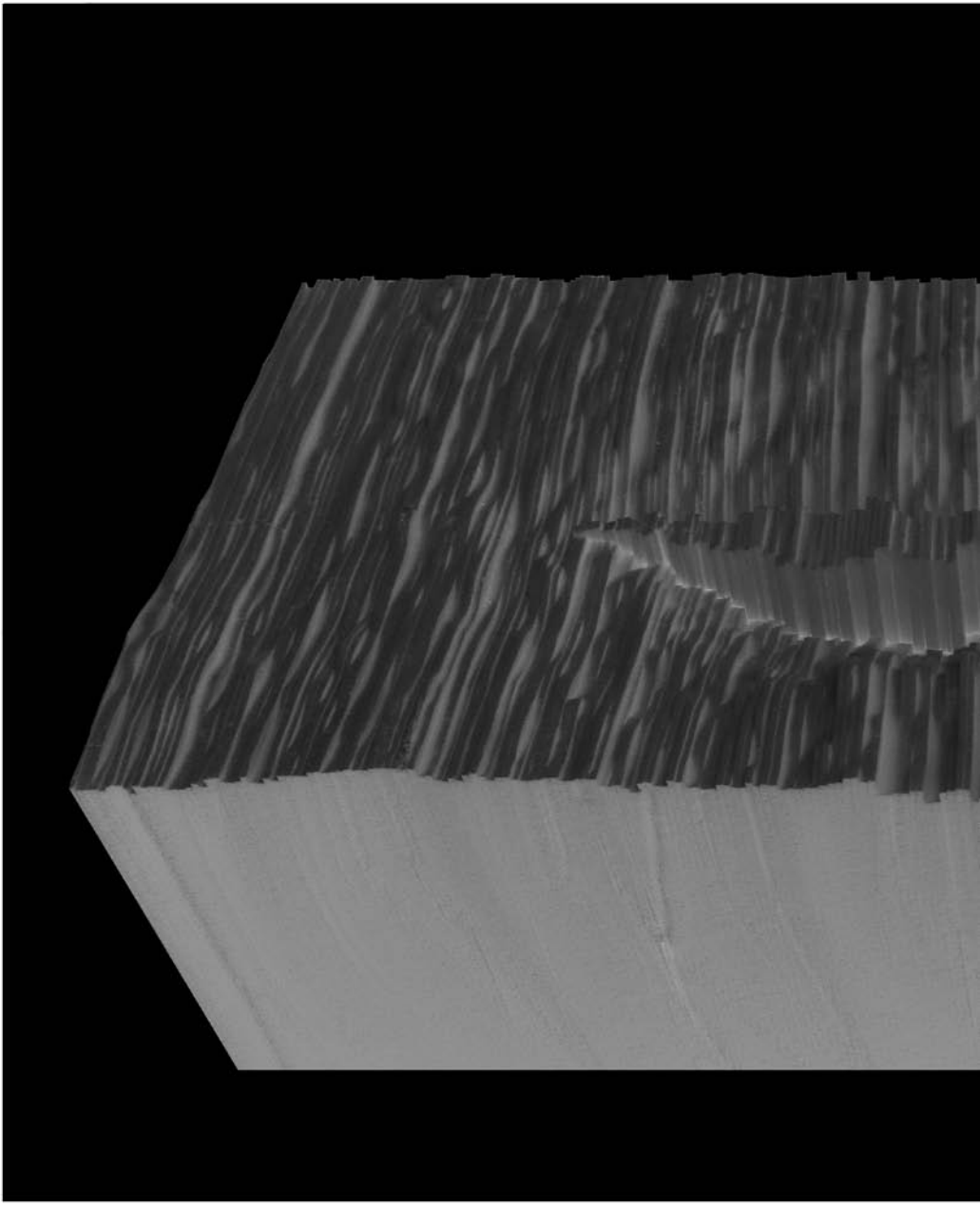




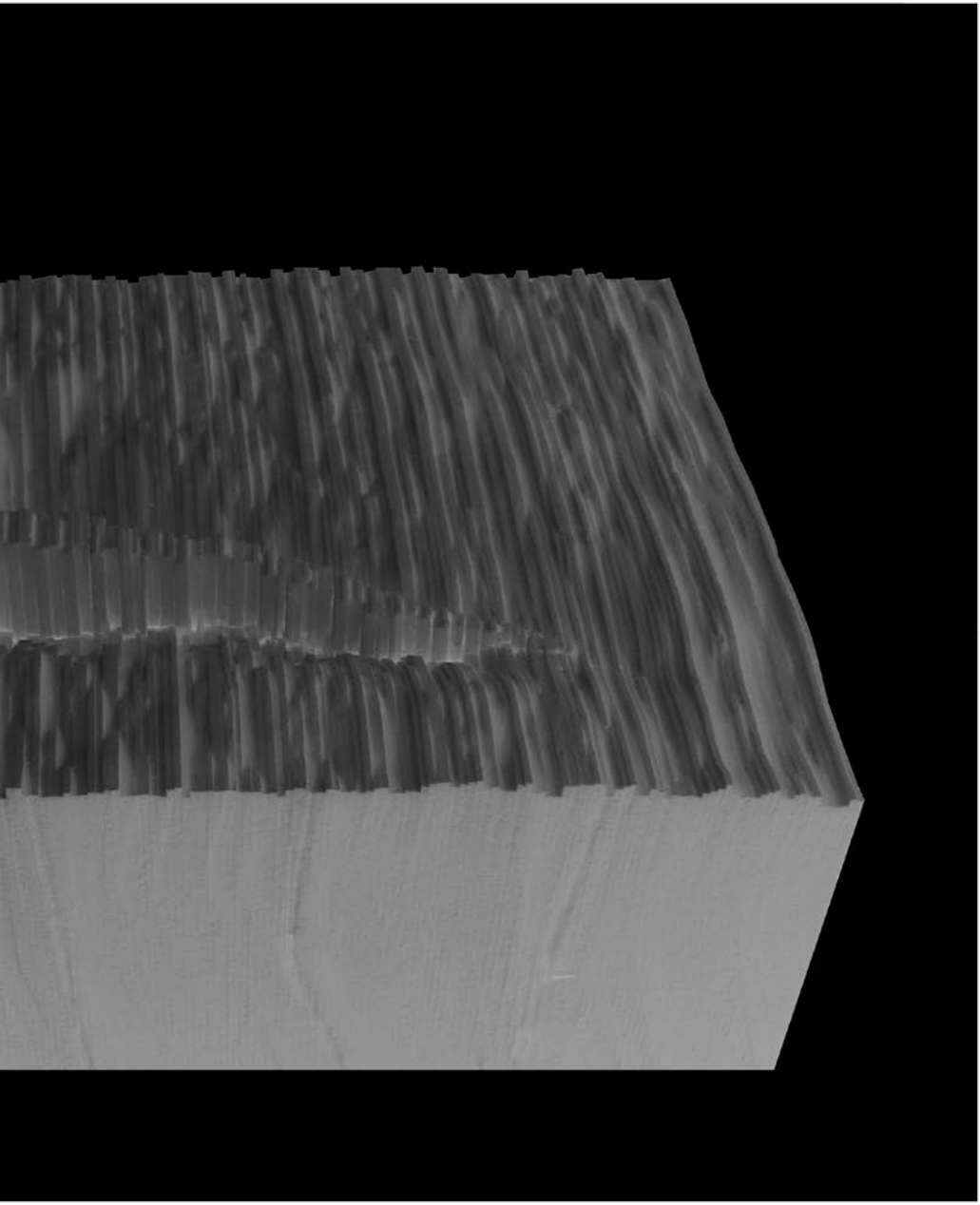
189 Bottom: Photograph from the book *La Galea Ritrovata. Origine delle cose di Venezia* concerning the discovery of two medieval Venetian galley wrecks near the island of San Marco in Boccalama near the city of Venice. 600 sheet piles were placed all around the island, and five large pumps worked to dry up the entire area in a few days to reveal what had existed on the island before it was submerged i.e. the perimeter, foundations and some walls of the monastery that occupied a large part of the land. Top: A sketch imagining a section of the image below. The draining of this archaeological site served as inspiration for what it would be like if the same method was applied to the pit of the S. Domingos Mine, allowing the visitor to enter in contact with the orebody and to access the abandoned shafts below.

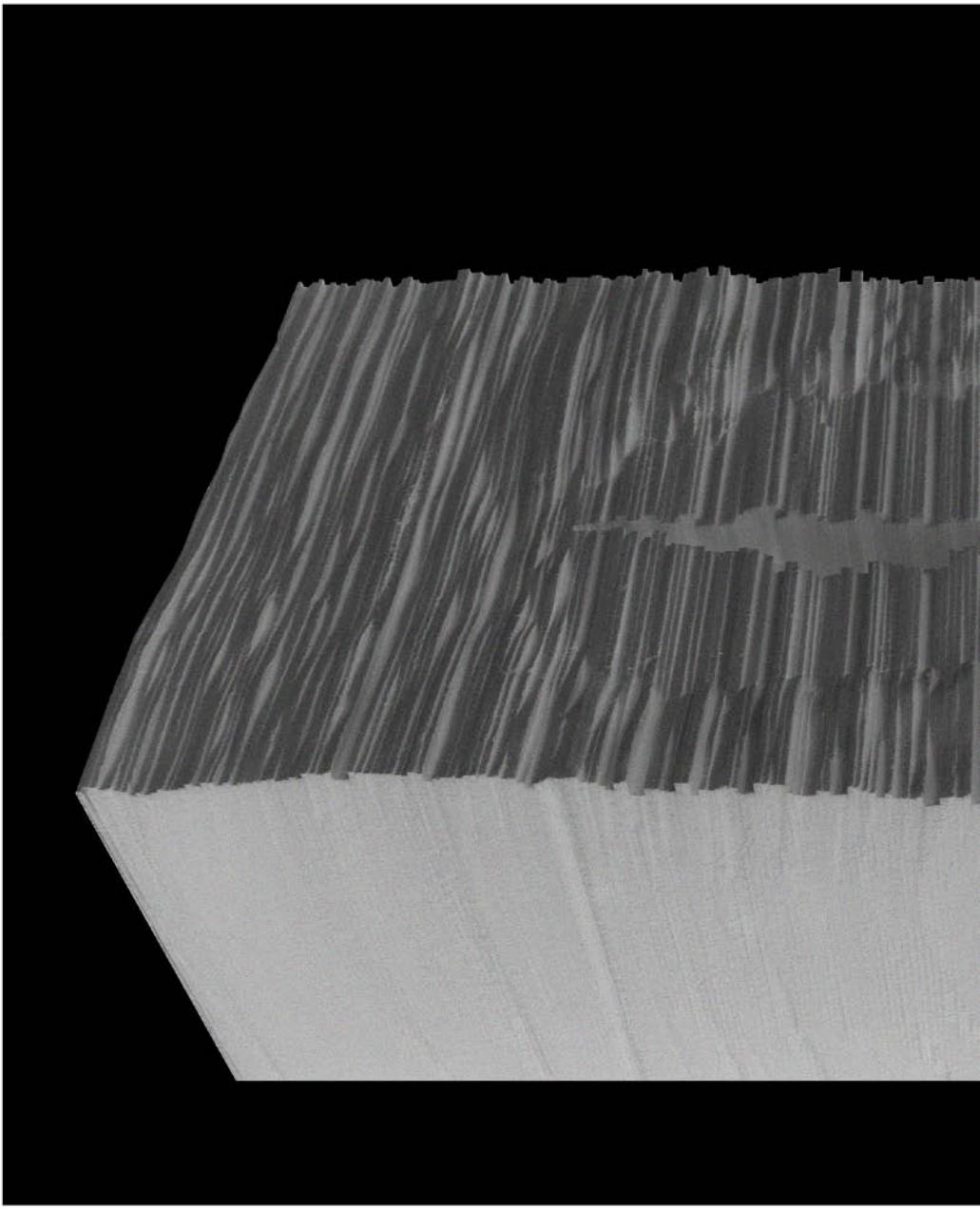
190 Conceptual drawing produced in the developmental stage of the project showing the filling of the S. Domingos open pit until the 130m above sea level contour and, a negative void - that would allow one to enter the open pit and be able to be in contact with the S. Domingos east to west orebody. Here we can see the 130 meter contour line resulting in the contact of the newly filled open pit and its intersection with the open pit's walls. © Jared Miguel Fantasia. 2018



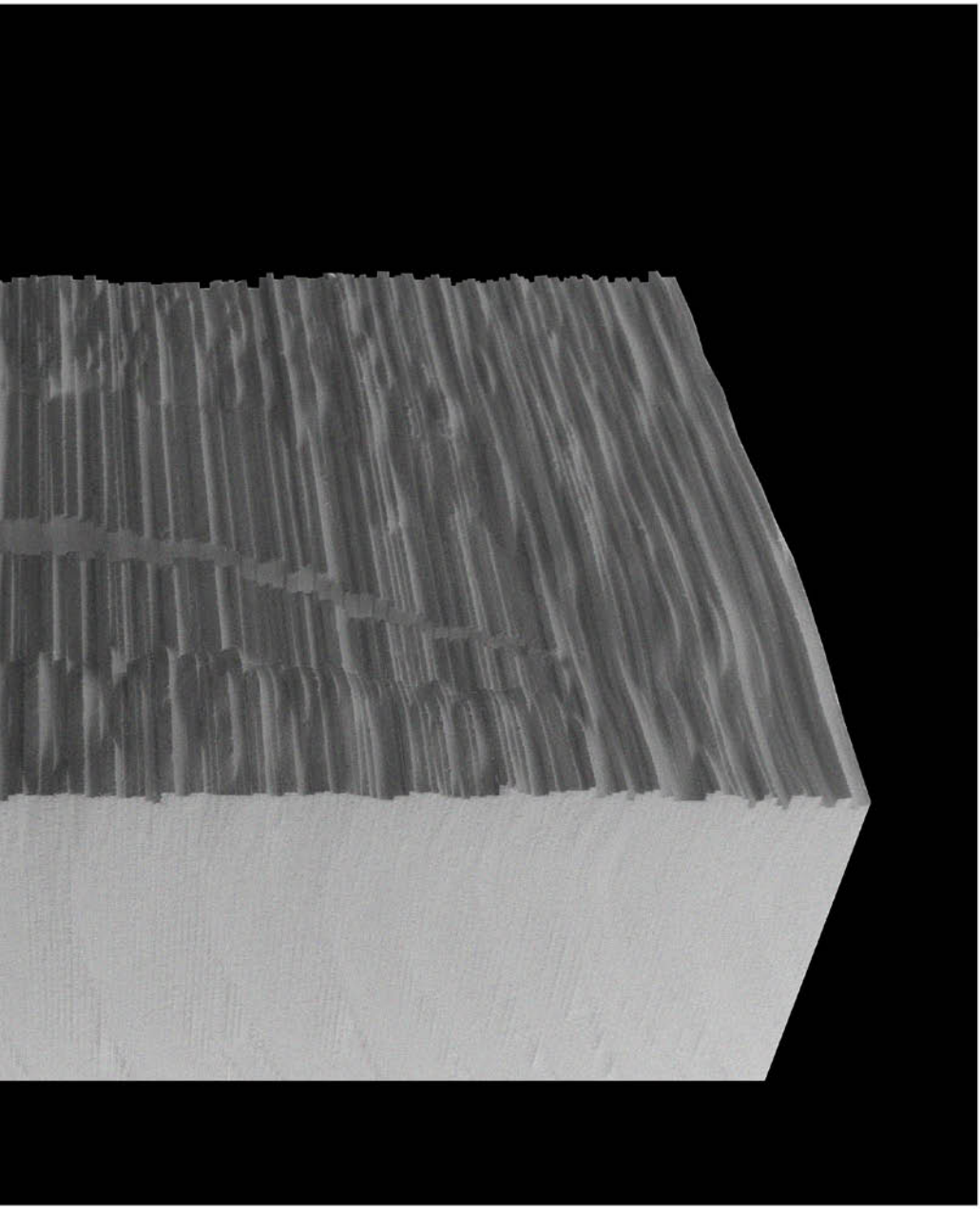


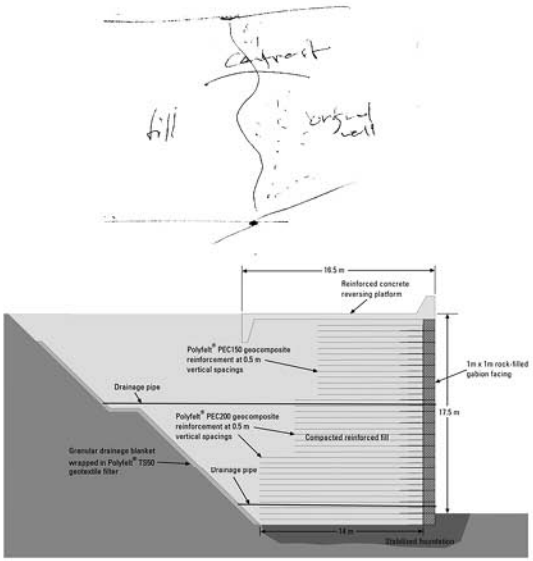
191 Process model consisting of the VMS deposit at 130m above sea level produced in the developmental stage of the project. © Jared Miguel Fantasia. 2018

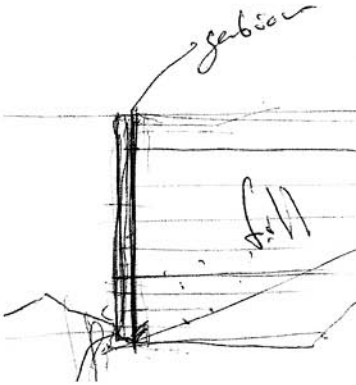




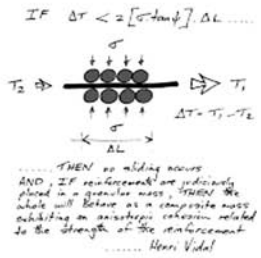
192 Process model consisting of the filling of open pit to 130m above sea level with the negative void of the VMS deposit which was produced in the developmental stage of the project.© Jared Miguel Fantasia. 2018

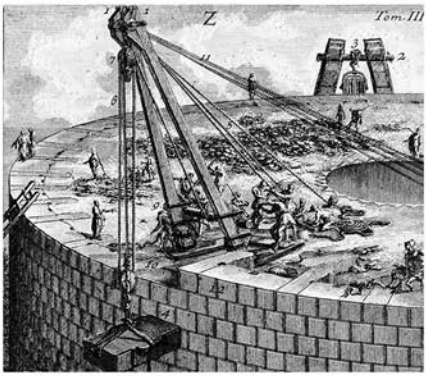






193 Left and Right: Composition of images and sketches showing thought process behind the idea of the inherent process of construction relative to the filling of the S. Domingos open pit with the creation of an interior void (representing the conceptual negative space of part of the orebody that once lay underground and which was mined through open cast mining). Left - center and bottom: Cross section and image showing the construction of reinforced soil structure with outer gabion retaining walls. (Further information on the constructive process of the coal mine dump wall at Sangatta Mine, East Kalimantan, Indonesia can be consulted in Attachments -pp. 088 - 089). Left - top and middle: sketches relative to the thought process behind the S. Domingos open pit and its filling, resulting in an interior void within. Here we can see the thought process behind the outer gabion walls of the interior void and the contrast between the contact with the filled space and the original open pit walls.





Composition of three images regarding the constructive technique of reinforced earth structures that was utilized in the design process for the filling of the S. Domingos mine pit resulting in an interior void. Top: Henri Vidal's theory for the invention (1963) of *Terre Armée* or reinforced earth also known as mechanically stabilized earth. Middle: Piranesi, Giovanni, Battista. *Le antichità Romane, t. 3, tav. LIV. Modo col quale furono alzati i grossi travertini, e gli altri marmi nel fabbricare il gran Sepolcro di Cecilia Metella.* Here we can see the same principle as the process of construction with reinforced earth. Bottom: One of the first illustrations of the principle of *Tierra Armada*® by Henri Vidal.

194 Still frames taken from the documentary *Masters of Engineering*, episode 7, "Mega Dams & Channels" showing images from within the Itaipu Dam. Here the rock that was once at the bottom of the Paraná river can be touched within the structure. The initial vision of the project for the S. Domingos open pit was of this nature - to be able to access the hidden S. Domingos orebody beneath the filled body of the open pit.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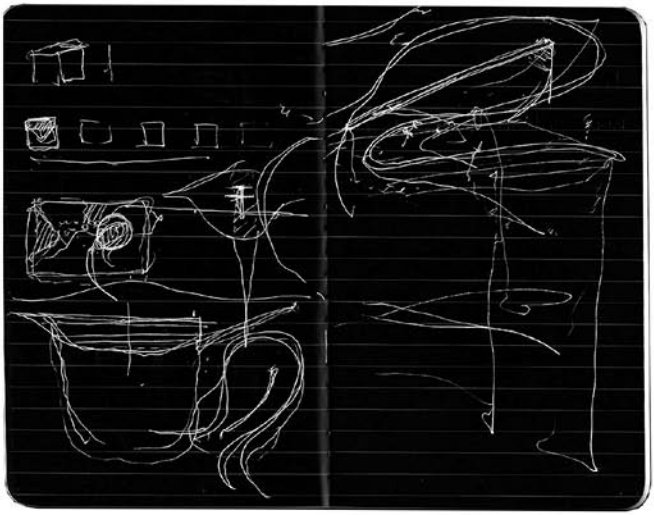
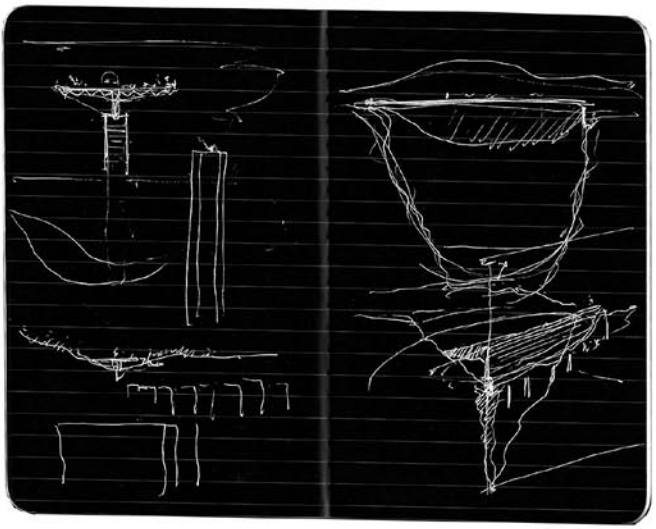
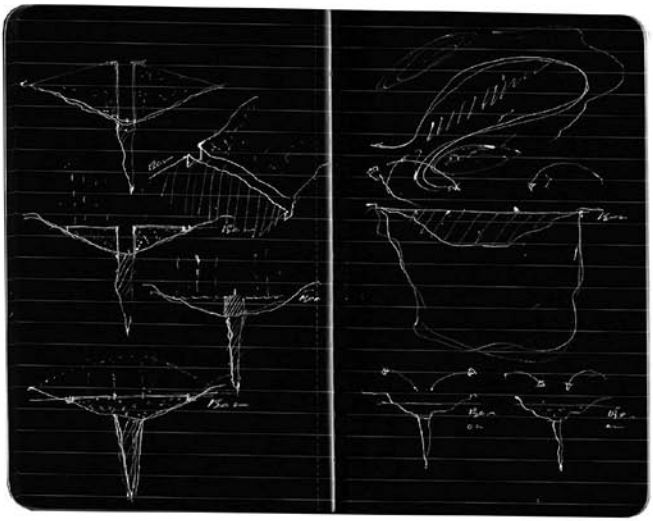


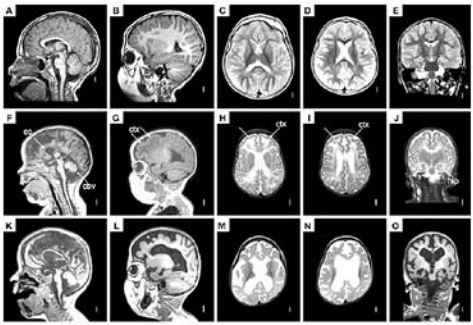
195 Compilation of drawings from a notebook depicting the thought process hypothesis for the east to west concrete structure to be built within the S. Domingos open pit allowing the visitor to be able to walk within the pit and experience the magnitude of the open crater created by man. The structure takes the same direction as the axis of the previous orebody- in the direction of the Iberian Pyrite Belt.



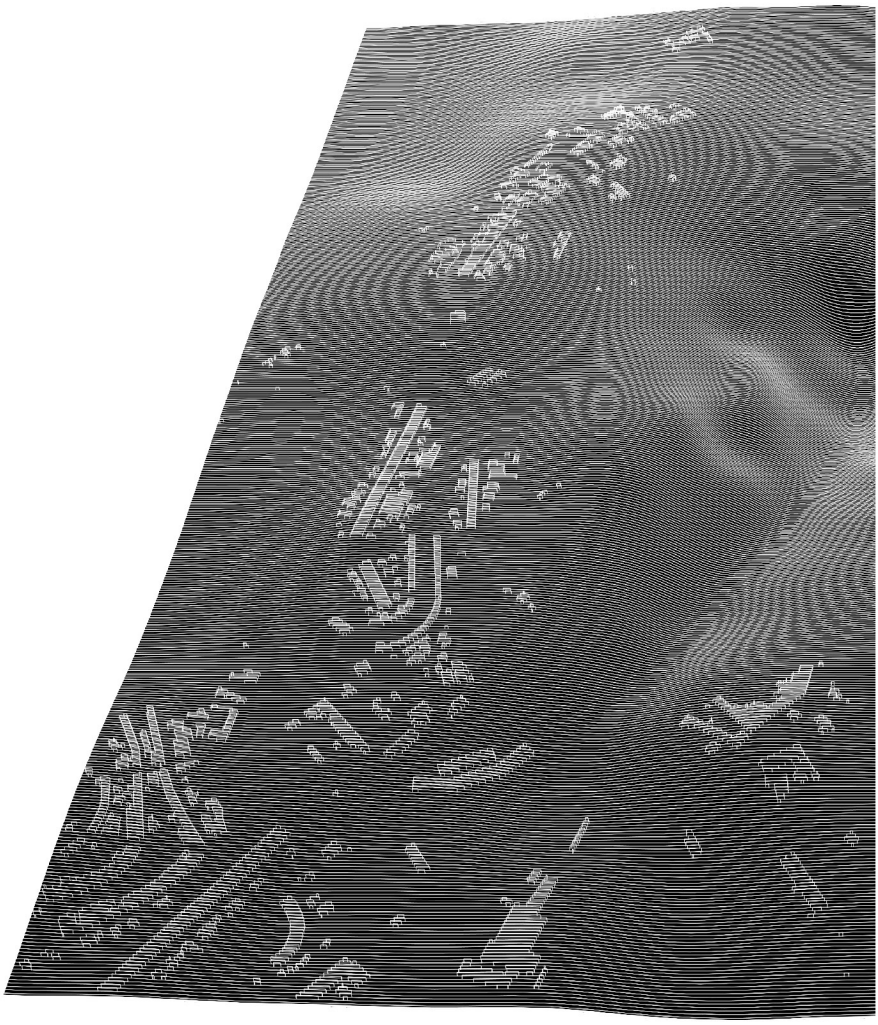


420 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W

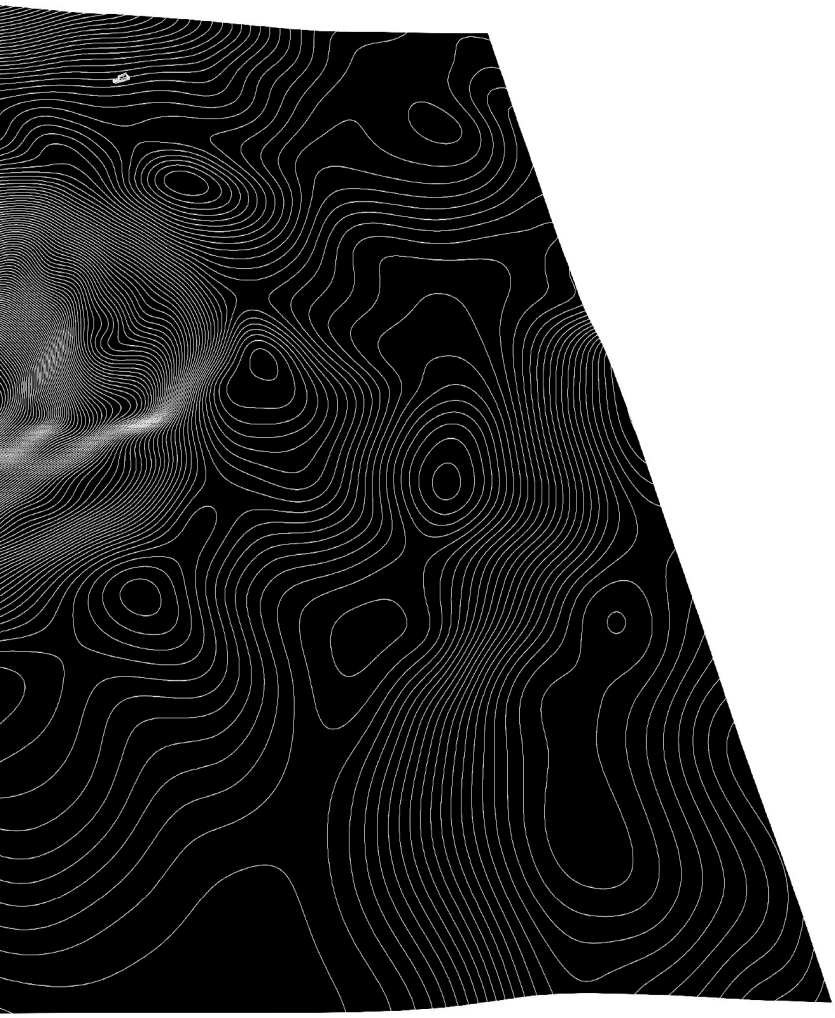
196 Marey, Étienne-Jules with Georges Demeny, *Untitled (Sprinter)* After 1893

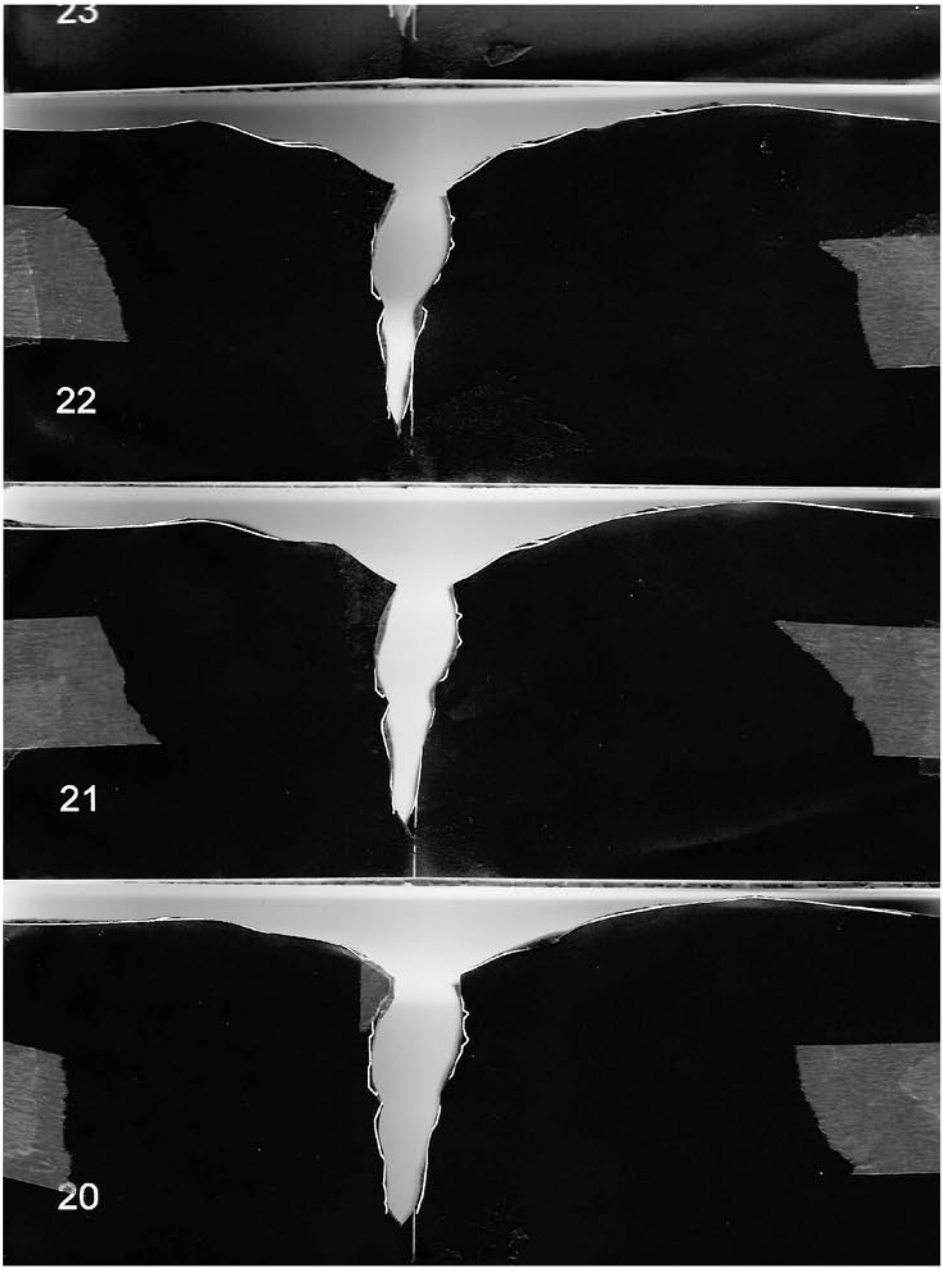


197 MRI scan images of an individual consisting of horizontal and vertical section.

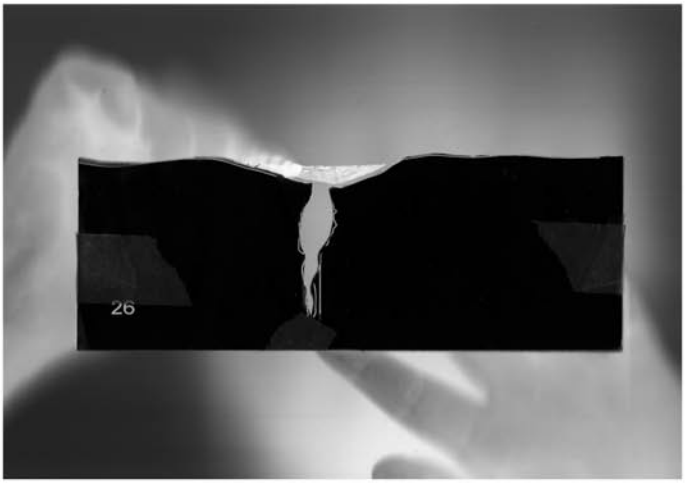


198 Image from digital 3D model, produced in the developmental stage of the project, of the S. Domingos open pit. To the right, the model was sectioned horizontally and to the left vertically. © Jared Miguel Fantasia. 2018

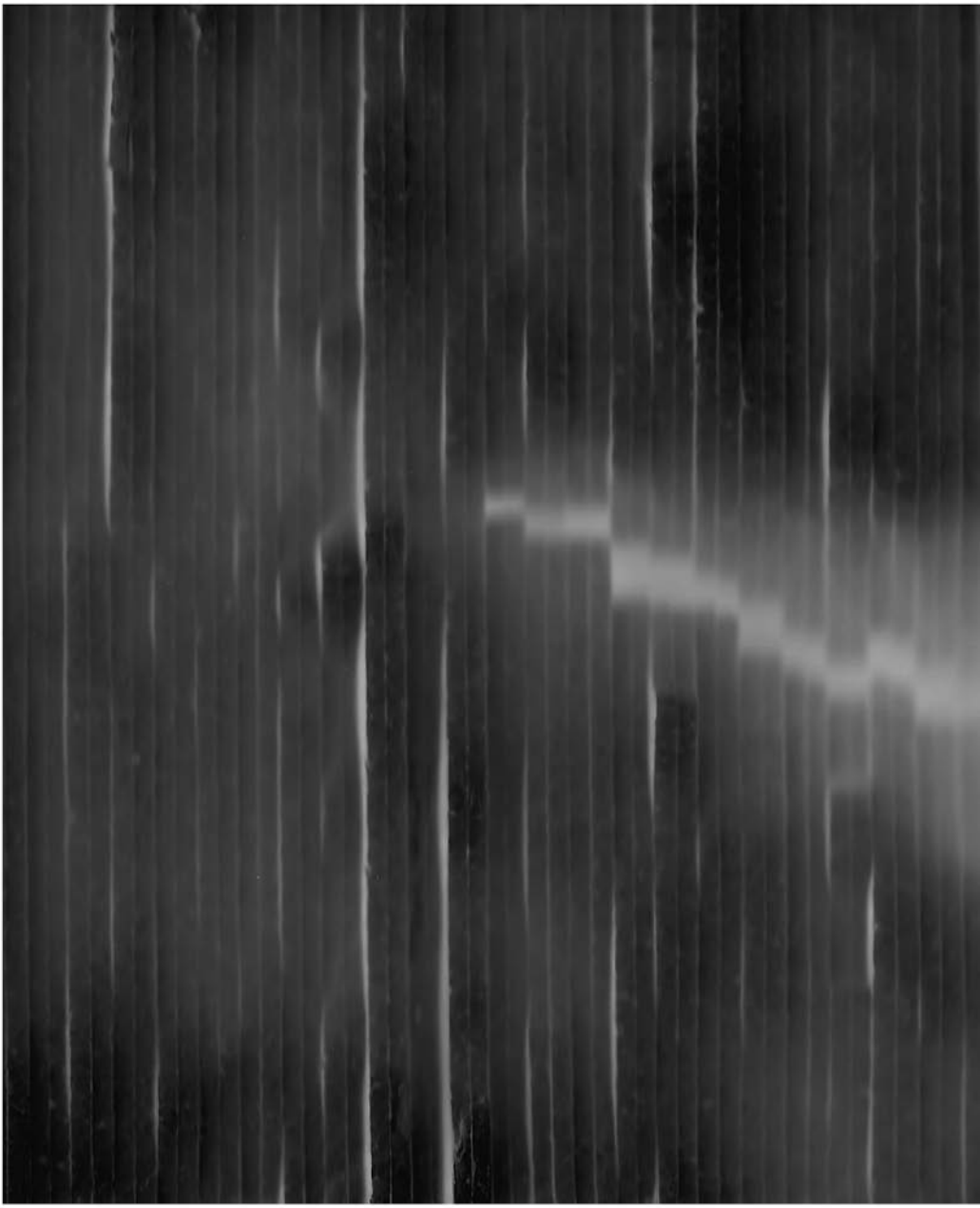




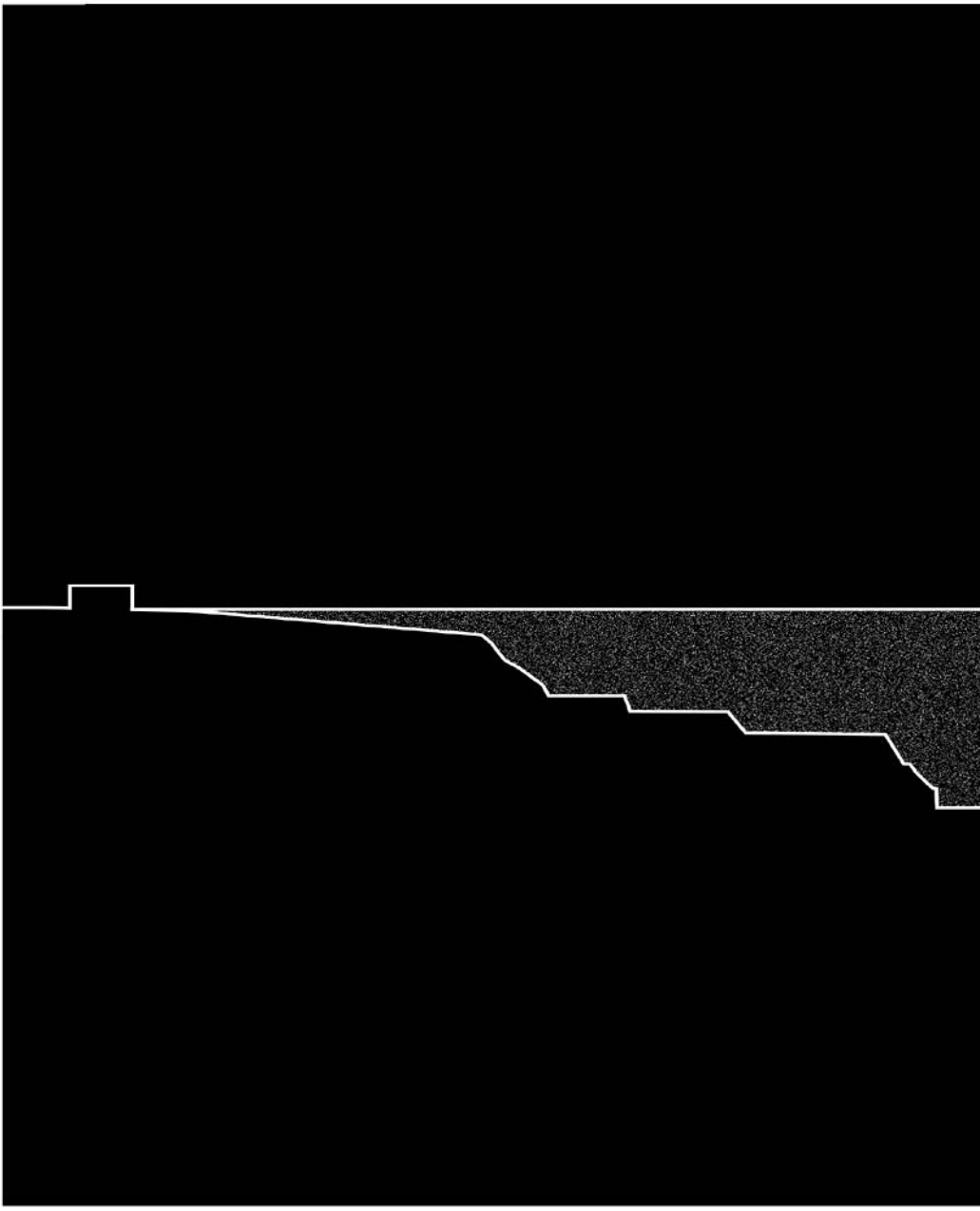
199 Digital scan of sections of the S. Domingos open pit made for the construction of architectural study models. © Jared Miguel Fantasia. 2018



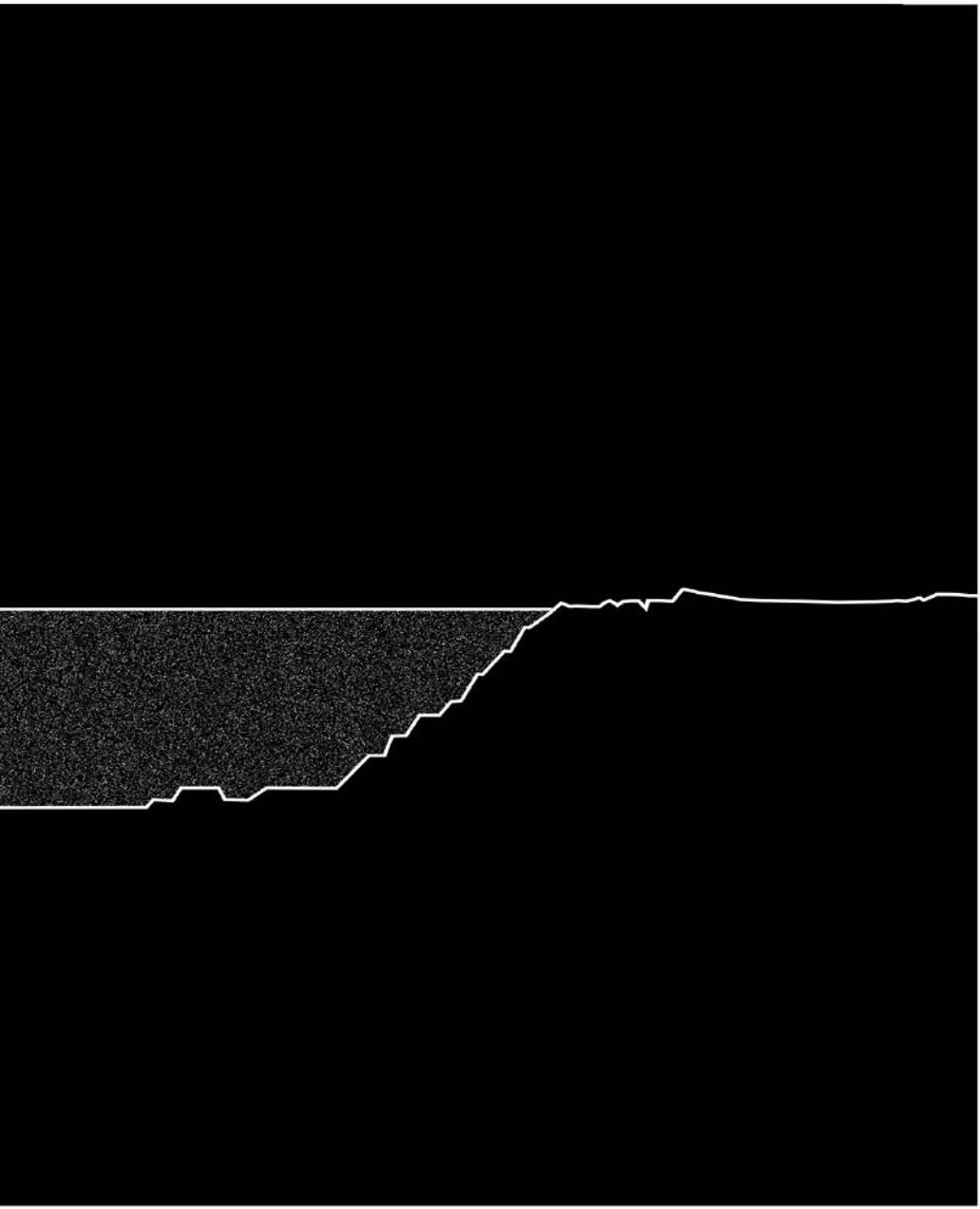
200 Digital scan showing a hypothetical filling of the open pit to the height of 130m above sea level through one of the sections consisting of the open pit. © Jared Miguel Fantasia. 2018

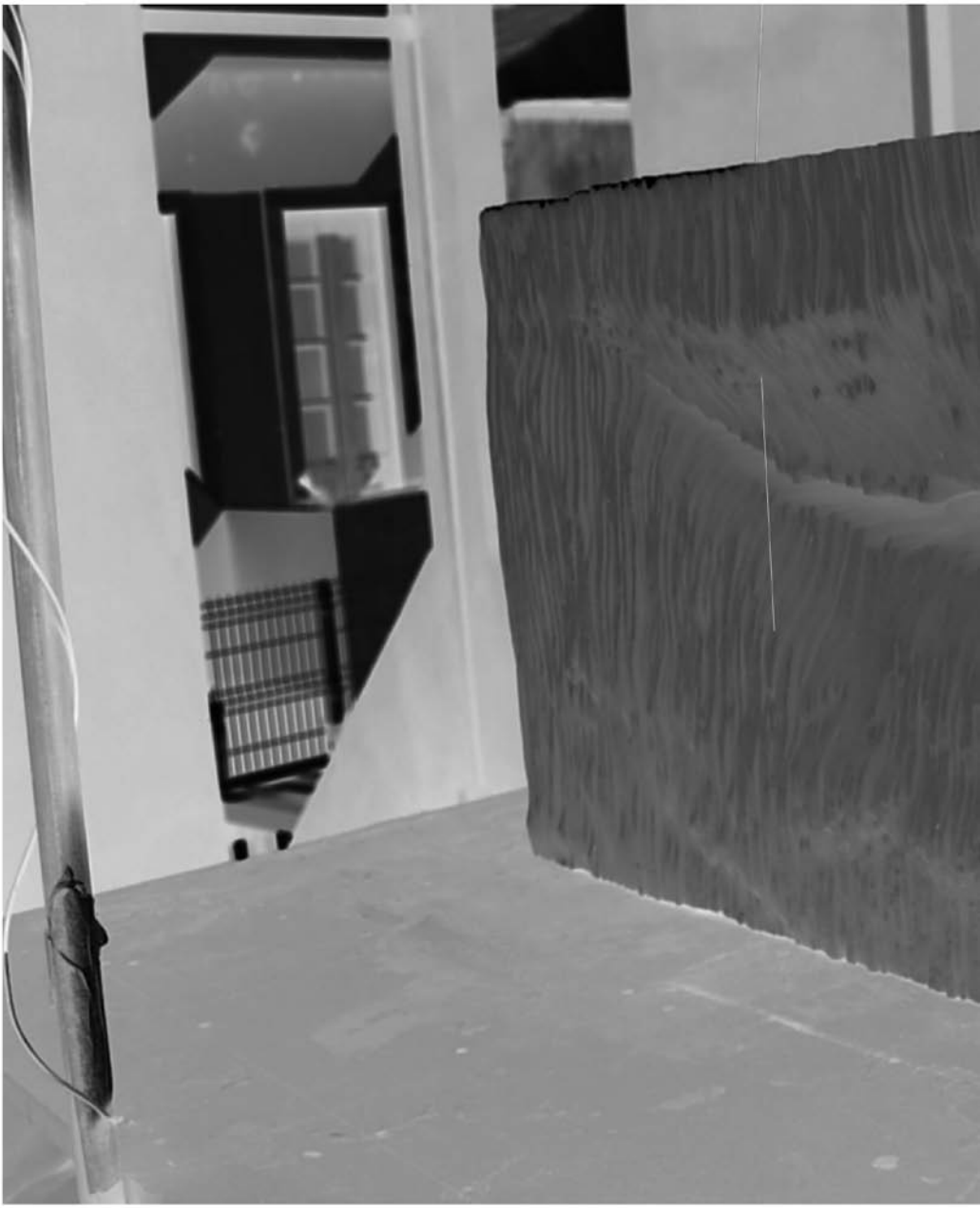


201 Model composed of a rhythm of multiple vertical sections revealing the form of the S. Domingos orebody. © Jared Miguel Fantasia. 2018

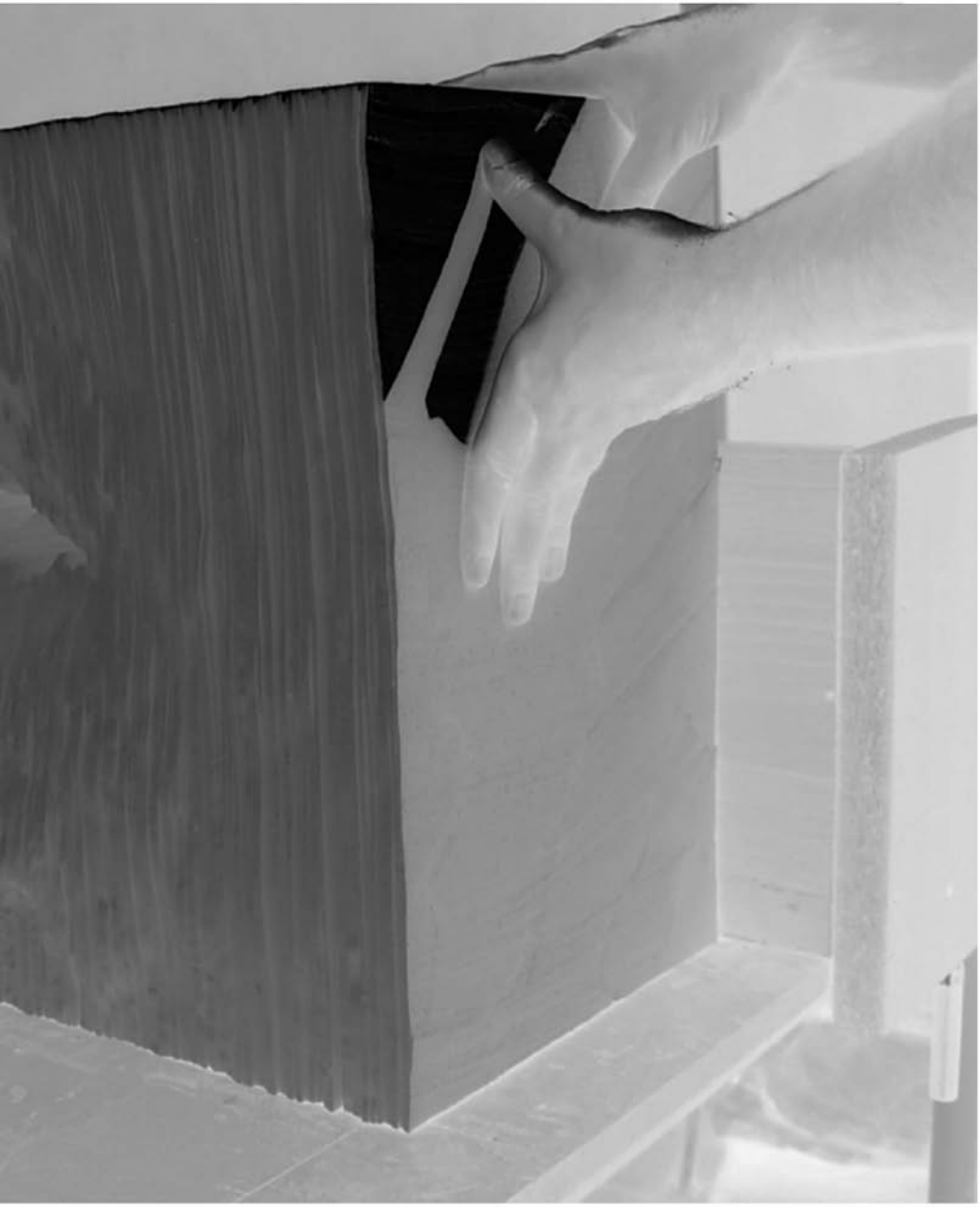


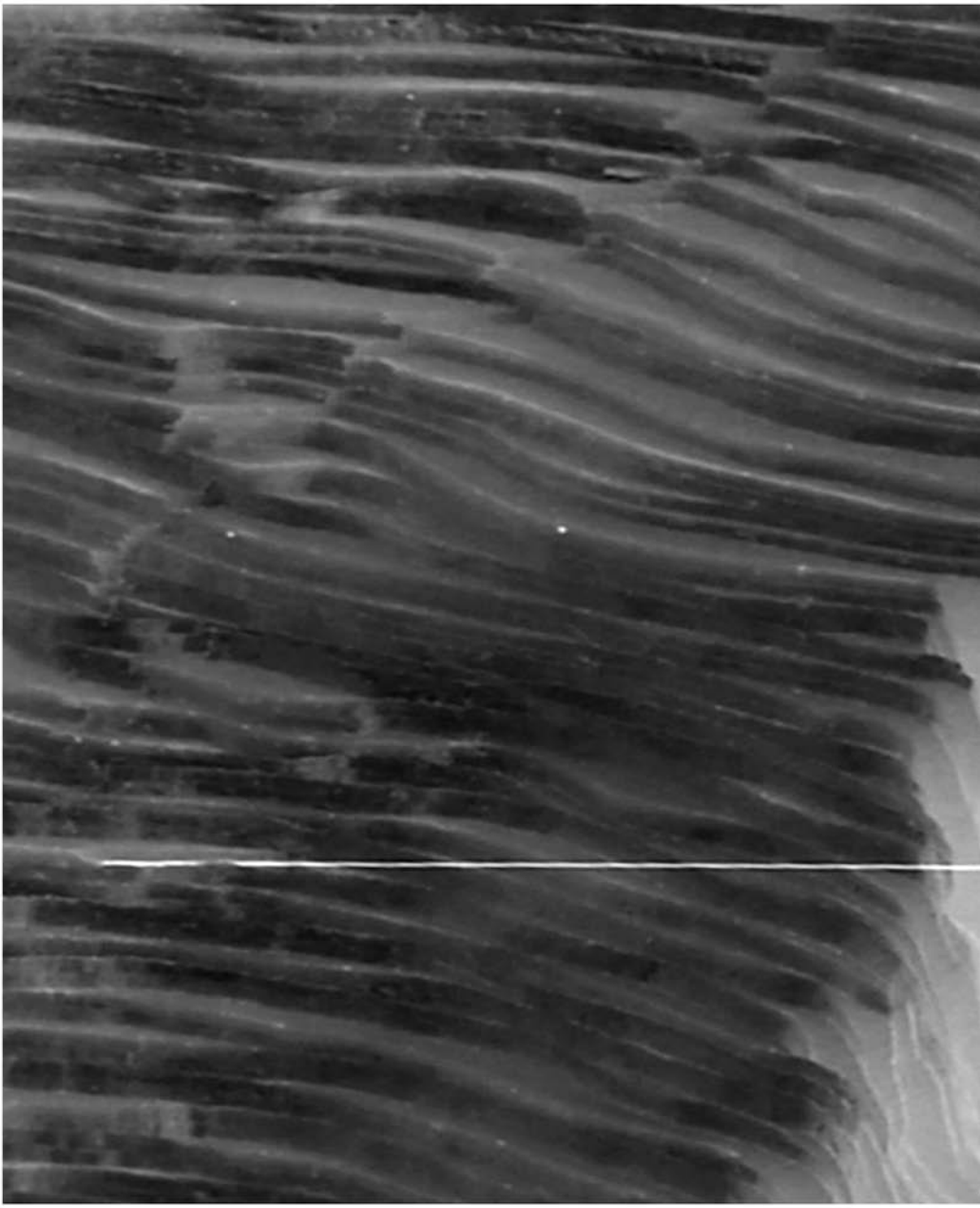
202 Conceptual section showing the filling of the open pit to 130m above sea level - equivalent to the 0m mining level. This drawing was made based on the longitudinal cross of the S. Domingos orebody represented on pages 320 to 321. © Jared Miguel Fantasia. 2018



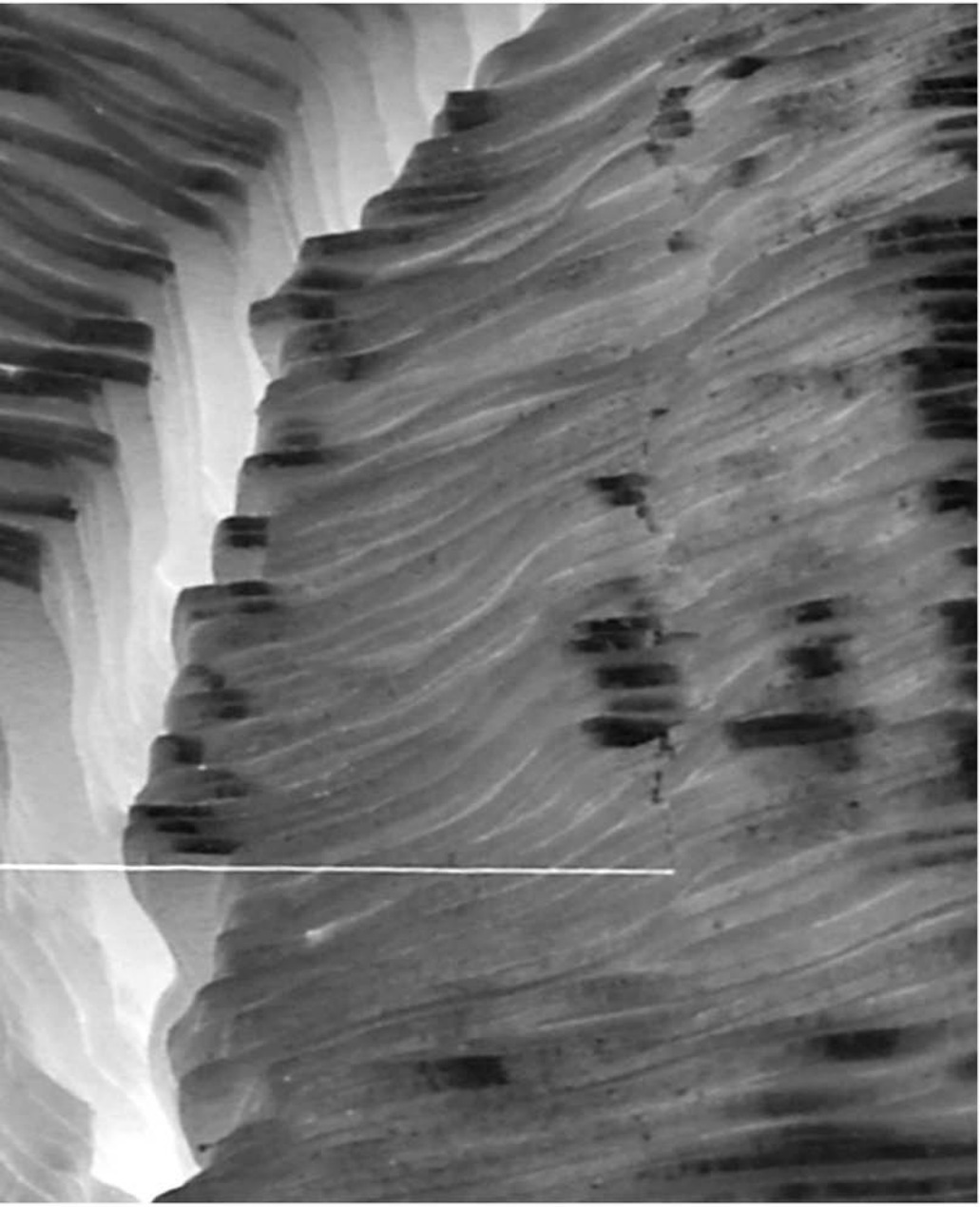


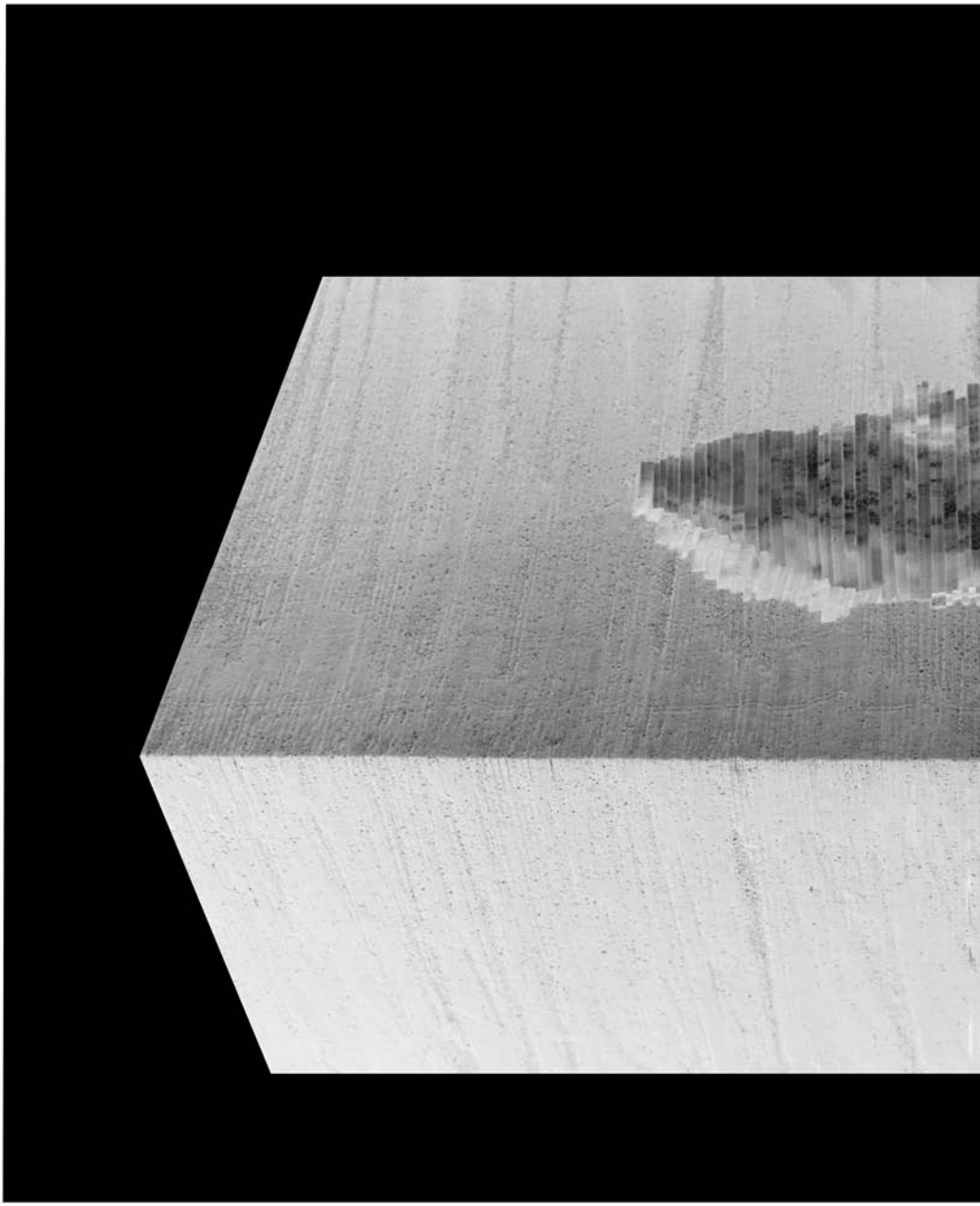
203 Photograph showing the gesture of the slicing of a conceptual model (of the S. Domingos open pit) at the 130m above sea level contour using a hot wire polystyrene cutter. © Jared Miguel Fantasia. 2018



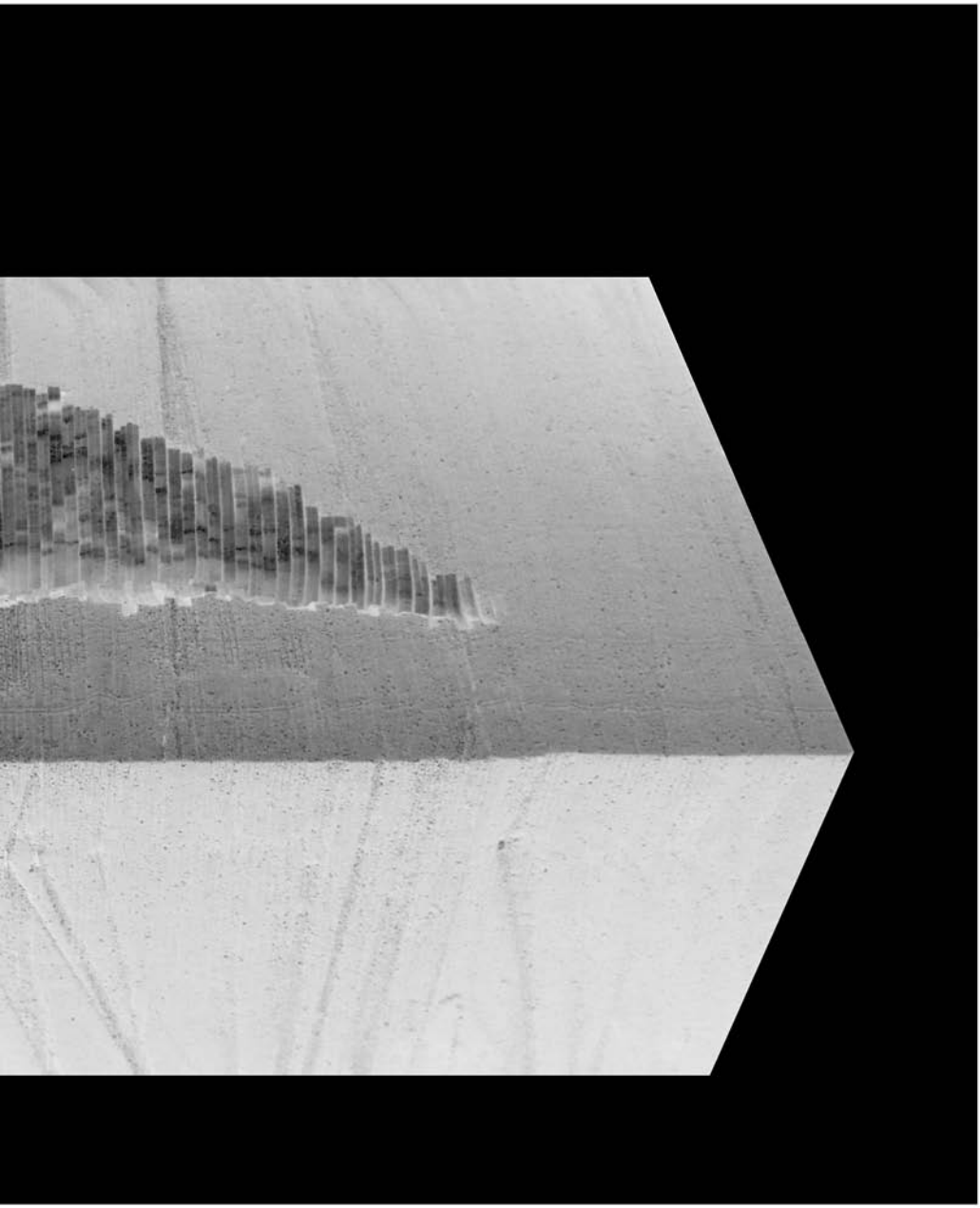


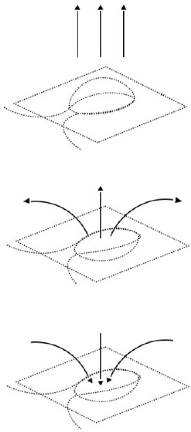
204 Detail showing the gesture of the slicing of a conceptual model (of the S. Domingos open pit) at the 130m above sea level contour using a hot wire polystyrene cutter. © Jared Miguel Fantasia. 2018



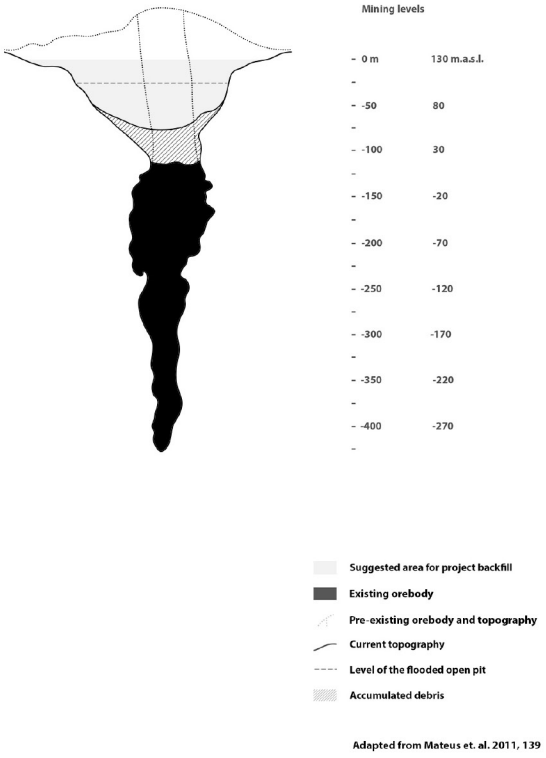


205 Process model consisting of the S. Domingos open pit sliced at the 130m above sea level. © Jared Miguel Fantasia. 2018

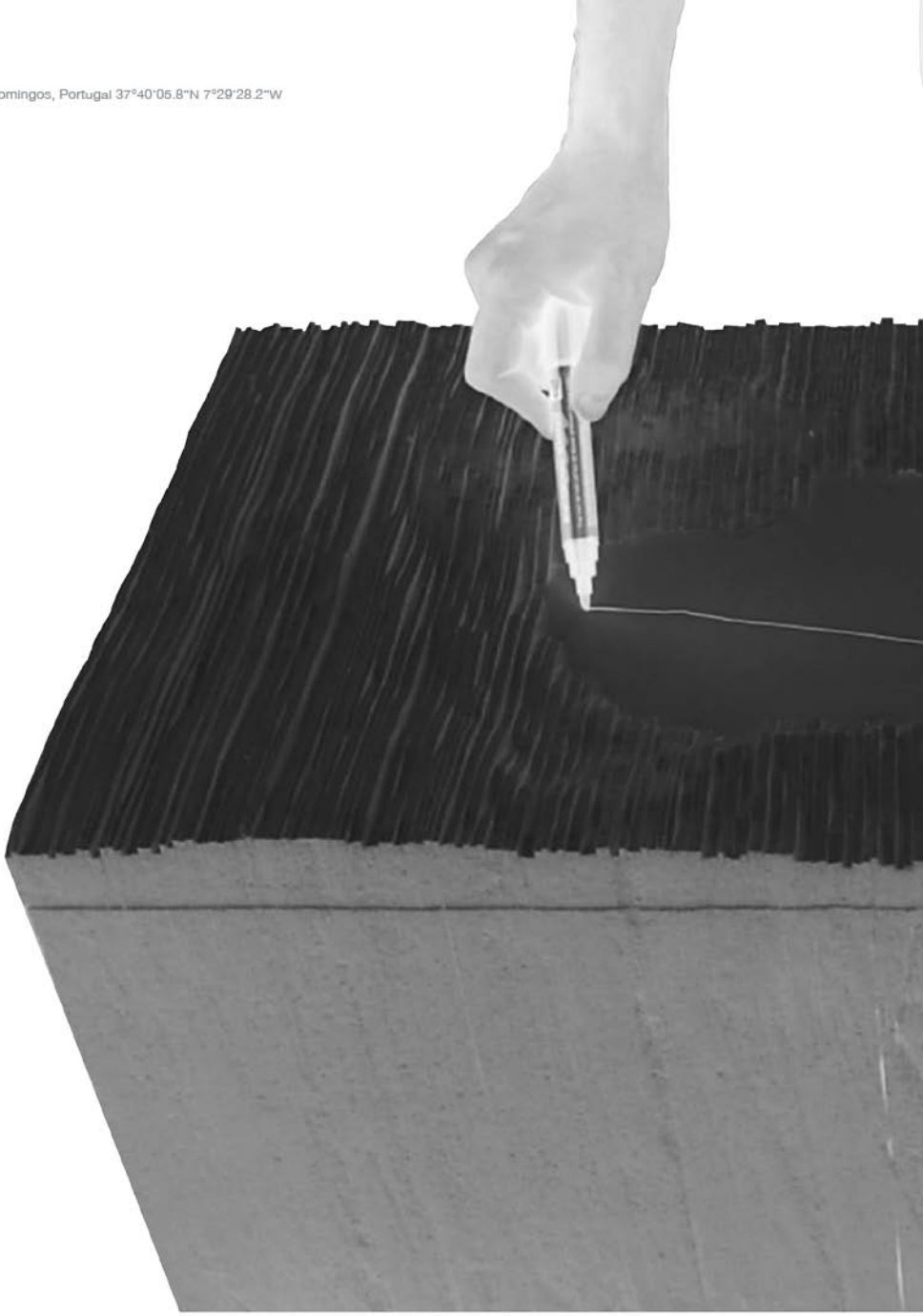




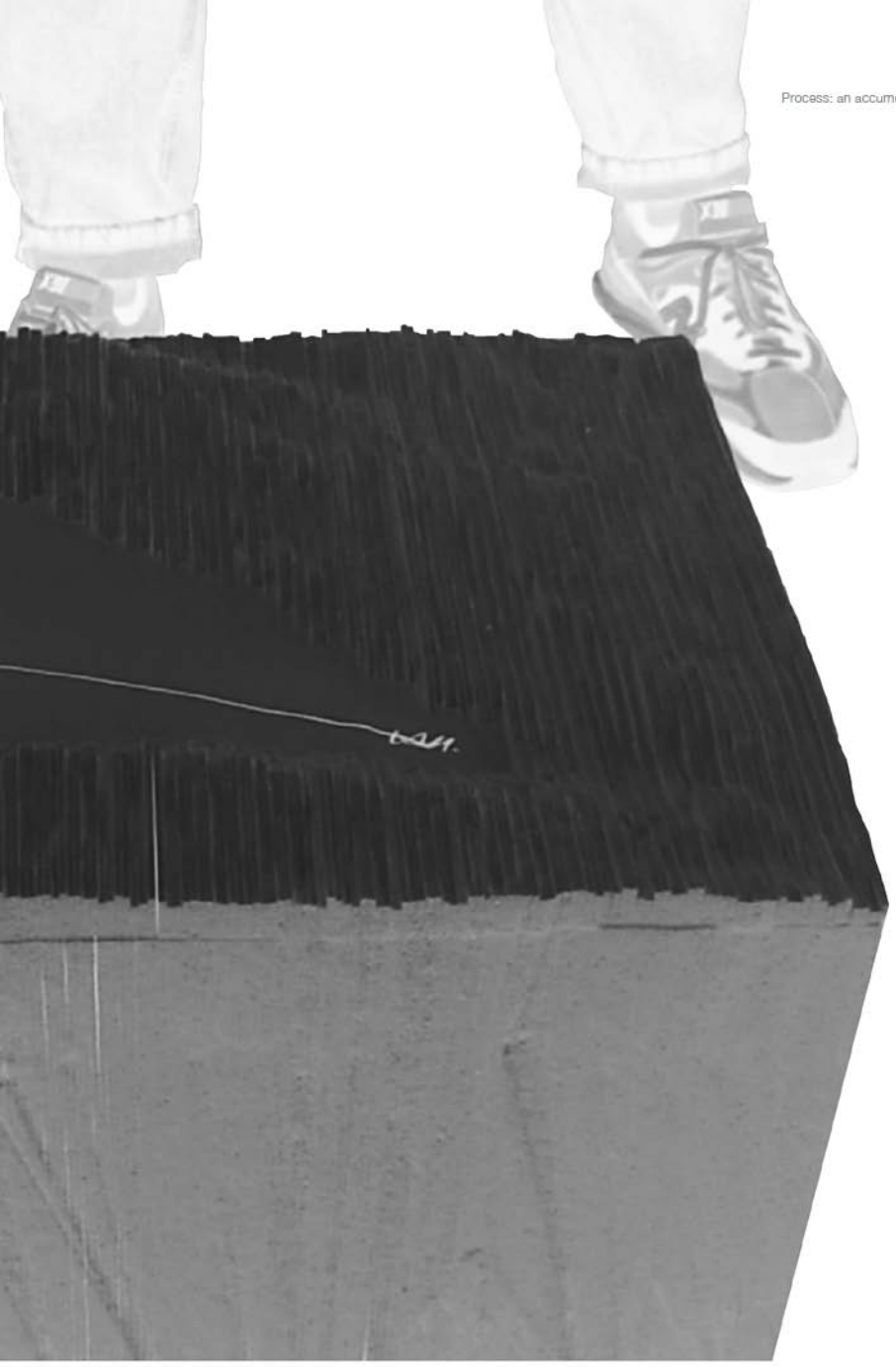
206 Conceptual drawing showing the 3 stages of the S. Domingos open pit: the first being its geological formation (top); the second, being its mining and extraction by the hands of man (middle); the third, its abandonment being left to fill with water and the slow disintegration of its walls into the pit through decomposition - this 3rd stage could also be considered for the project (bottom). © Jared Miguel Fantasia. 2018

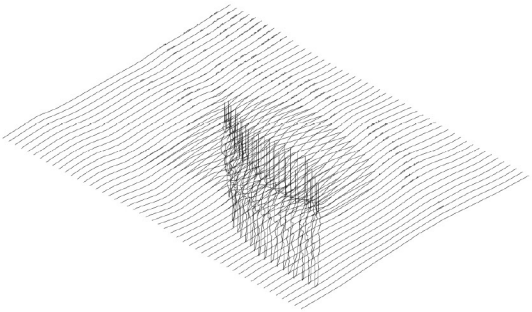


207 Conceptual cross section adapted to the N-S cross section through the S. Domingos orebody (Mateus et. al. 2011, 139)



208 Conceptual model of the S. Domingos open pit filled to 130 meters above sea level and the capture of a gesture drawing the direction of the the S. domingos orebody ontop of the 130 meter above sea level surface. © Jared Miguel Fantasia, 2018





209 3D digital image of the S. Domingos open pit composed in sections showing the VMS deposit before the intervention of man and, now in its current form.

210 3D digital image showing the S. Domingos pit in axonometric section: the filling of it until the 130m above sea level contour and the marker of the VMS deposit (before and current). This was produced in the developmental stage of the project. © Jared Miguel Fantasia. 2018

Architectural project

The following architectural proposal considers the mining pit at S. Domingos Mine (37°40'05.8"N 7°29'28.2"W) as a monument built by man[91]. The VMS deposit, consisting of rich layers of precious metals, has been mined from the Calcolithic Age to modern times. The mineral deposit, part of the extensive Iberian Pyrite Belt (IPB), was one of the most important mineral deposits of this territory through time and space as various people and cultures mined it and these metals still exist in circulation today. The mining of this deposit was essential for the processing of copper, zinc and sulphur contributing to the progress and technological enhancement of western civilisation. Today, the existing crater and surrounding mining terrils, resulting from continuous extraction for nearly two thousand years, is testimony to the ingenuity of man.

The IPB is a territory that once lay beneath the ocean. Today, the surface area at S. Domingos has freshwater dams nearby and acid mine drainage systems - the latter, predominantly in the body of water in the open pit. By day, the site is a place of scorching heat and light with a strong smell of sulphur in the air. These surrounding bodies of water act as mirrors; they are calm, reflective surfaces of bright orange - their colour resulting from the acid mine drainage originating from the leaching of terrils in the surrounding landscape. At night, they reflect the moon and the stars without light pollution[92]. We can also see this beauty in relation to the mirrors of water and the night sky at S. Domingos Mine, through the photography world of Miguel Claro[93]. Due to their toxicity, we can only look at these acidic bodies of water from a safe distance and speculate what it would be like to walk such gigantic mirrors and moreover *that* within the open pit where a negative space (that is representative of the prior positive mass and the human energy involved in its removal) can be truly experienced. This is a territory that speaks not only of the time of day but also of the seasons. The level of the water table fluctuates; during the winter (the rainy season) it rises and, in the heat of summer water evaporates leaving impressive colours of light blue and orange as according to Daniel de Oliveira[94] "due to the extremely high concentrates of S-bearing minerals as well as sulphate salts, it is common to find carapaces made up of native sulphur crystals and neo-formed sulphates (melanterite, jarosite) at the edges of the various acid dams in the area. The sulphates are mostly visible in summer as they dissolve when it rains." Thus we can understand that there are two main moments in this territory: one of extreme heat and evaporation (resulting in the lowering of the water table of the surrounding territory and generating patches of concentrated salts of extraordinary colour) and, another - the exact opposite - in the elevation of the water table (where water streams develop, mix and pass through the surrounding mining terrils, generating lakes of acid mining drainage).

The following architectural reclamation project for the open pit at S. Domingos Mine, proposes the creation of a reclamation Earthwork through the backfilling and waterproofing of the open pit with the mining waste from the surrounding terrils

until 130 m above sea level, within the open pit, to create a platform - a flat surface - that (just like a gigantic horizontal plane that intersects with the open pit and contrasts with the above crater) allows the visitor to enter the open pit and to encounter the evidence of the mineral deposit which was previously inaccessible. It also aims to enhance the landscape, as a piece of contemplation - in much the same way as the situations of reference on earthworks in this thesis, do. Also, it will draw attention to the axis of a conceptual line (East to West and vice versa) of the IPB through the experience of the elongated shape drawn within the pit. This is an idea similar to the experience of William Bennett's *Jamesville Quarry Sculpture* (cf. situations of reference pp.176-189) where, through the encounter with the Earthwork in the quarry, the spectator is connected to the conceptual axis of the Onondaga geological formation - a place once underwater. The experience of Bennett's earthwork changes with rainfall but doesn't hinge on it; the seasonal change in water level is by contrast, integral to this project at S. Domingos.

The vast, open space created by the above-mentioned filling and waterproofing of the pit will allow the visitor to walk upon it as a flat open plane and to experience the performance of slag and water within the Earthwork. The idea of the performance of rising and falling levels within the pit, is rather like the disk or platform (with its panoramic view) proposed by Robert Smithson on the yellow acidic lake of the Bingham Mine pit (*Bingham Copper Mining Pit – Utah/ Reclamation Project*, 1973). When dry, the individual is confronted with a multisensory experience: visually experiencing intense colours deriving from the concentrated blue an orange salts and the panoramic view from within the crater of the open plain; olfactory, from the smell emitted from concentrated salts under foot when walking over the slag; auditory from the sound of pieces of slag rubbing against one another – much like when we walk on gravel. When it rains, the open plain will be covered with a thin layer of water as the water table rises, having the appearance of a lake or a thin mirror of water and creating a moment of encounter by allowing the visitor to discover that it can be walked upon. The mirror could be interpreted much in the same way as Robert Smithson's *Mirror Displacements* (1969) where mirrors reflect and refract the surroundings rendering the fragility and temporality of the landscape in 'splintered' forms though the passage of time. The changing seasonal experience is also much like that which occurs when encountering with Robert Smithson's *Spiral Jetty* (1970) where there can be no expectations of how it will appear at any given time due to the way the salt lake rises and lowers in times of rain or extreme drought. For example, we can either find the decaying piece in relation to a still body of water that reflects the sky or as still body of dried earth salt crystals on an eroding spiral body of filled basalt rock; it is all a question of serendipity and entropy. Similarly, through the passage of time, according to the seasons and atmospheric conditions of heat and rain, the proposed earthwork at S. Domingos Mine will alter. The open pit is also part of an entropic process as its naturally degrading walls will collapse and deposit onto the dry plain or 'mirror' lake surface. Smithson explored the idea of mirrored images in his 'non site' work: In *Mirror/Salt Works, Installation View*, 1976 where he

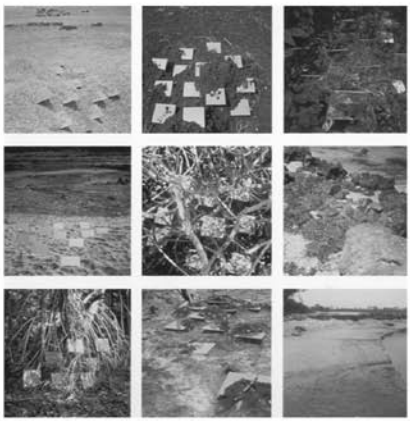
placed land on a mirror i.e. the placing of land onto a work of art. The collapsing of the S. Domingos pit walls forms part of the work and its performance, with entropy reminding the spectator of the ephemerality of place.

The experience intended in this earthwork at S. Domingos Mine is in line with that which takes place in land art created in 1970s and 80s in the USA, for example in Nancy Holt's *Sun Tunnels* (1973 -1976), Walter de Maria's *Lightning Field* (1977) and on monumental scale, Michael Heizer's *Effigy Tumuli* (1985). As in these works and others, the work determines the viewer's experience of it (rather than the other way around) and this is achieved through: the journey; the surprise encounter; the point of entry; its elusive state at any given season and time; the differing angles of view and perspectives from different elevations; changing atmospheric conditions of light and passage of time. In the proposed project, there is however no specific path, entry to the work or perspective chosen; it is up to the individual how they want to experience the piece and when.

The finishing piece of the project is in actual fact a piece that could be placed there today, without the main project (the backfilling and impermeabilization of the open pit) being undertaken. It is a simple gesture consisting of a bench - a $3m^3$ solid copper cuboid weighing approximately 26.82t and representing 1.25% of copper extracted from $240m^3$ of S. Domingos pyrite ore. Understanding that 20 million tons of ore was extracted from the S. Domingos ore body (since modern operations began in 1854 and ended in 1966) we can understand this amount to be equivalent to 9321 $3m^3$ copper benches[95]. The copper bench placed on top of the spoil heaps at a strategic point overlooking the open pit would be inscribed with the ancient Greek words, *Et in Arcadia Ego*. In the painting of this name by Nicolas Poussin (1637-1638) in Musée du Louvre, Paris, there is a poetic passage of time. By representing a scene in the past, Poussin shows a nostalgia for it but also reveals the transience of life and human works - all being subject to death or an end as it were. However, Poussin perhaps suggests that despite this, the work of art has the power to transcend time and has the power to transport us. *Et in Arcadia Ego*[96] inscribed on a tomb in Nicolas Poussin's painting would convey the idea that we can be in a place of greatness by acquiring knowledge but also, that all greatness is subject to entropy through time. As the inscribed tomb in the painting, the bench overlooking the pit at S. Domingos with this message, acts as a portal, a key or a guide that reveals the hidden history of the place and the transcience of human activity. The visitor discovers the hidden greatness of the past but, also sees the transience of human activity. The Earthwork becomes a work of art in the same way as what Alessandro Poli says when referring to his work, *Il Piper* of 1964 "You could park your car inside and, seated in your vehicle, you would observe, you would watch, and you would enter into a new silence, a new reality."[97]. Therefore whether located on site or as a 'non-site' work, the bench serves as a 'song line' or a dreaming track - a portal that transports us to a new reality of consciousness that talks to us about a universal topic of the human

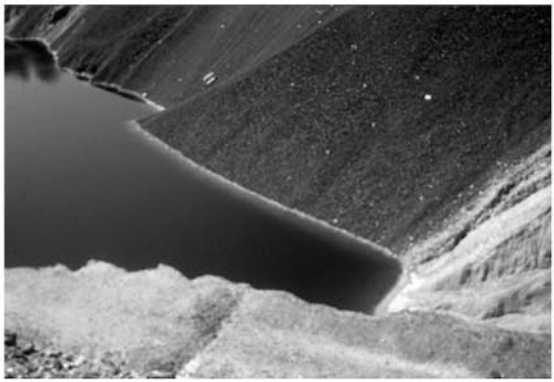
nature of extraction that all humans and cultures can relate to. This is also much like the copper spheres which South African artist, Dillon Marsh creates in photographs of arid mining landscapes or Swiss conceptual artist, Julian Charrière's exhibition at GASAG Kunstpreis 2018 – Berlinische Galerie, Berlin which consists of a multimedia spatial installation that transports visitors under water in the Pacific Ocean. (Julian Charrière's work is inspired by sites such as Bikini Atoll, a cold war nuclear test site in the ocean whose radioactive contamination rendered it uninhabitable.)

446 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W

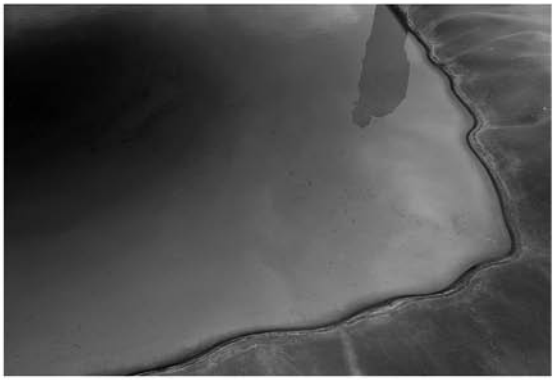


211 Smithson, Robert. *Yucatan mirror displacements (1-9) / Nine locations on a trail, Yucatan, Mexico, 1969*

212 Smithson, Robert. *Mirror / Salt Works, Installation View,* 1976



213 Detail of the S. Domingos open pit revealing the line of contrast on the walls of the open pit between where the toxic water (within the open pit) intersects with the mining slag deposit, creating a clear line of intersection between the toxic water and the walls of the pit.

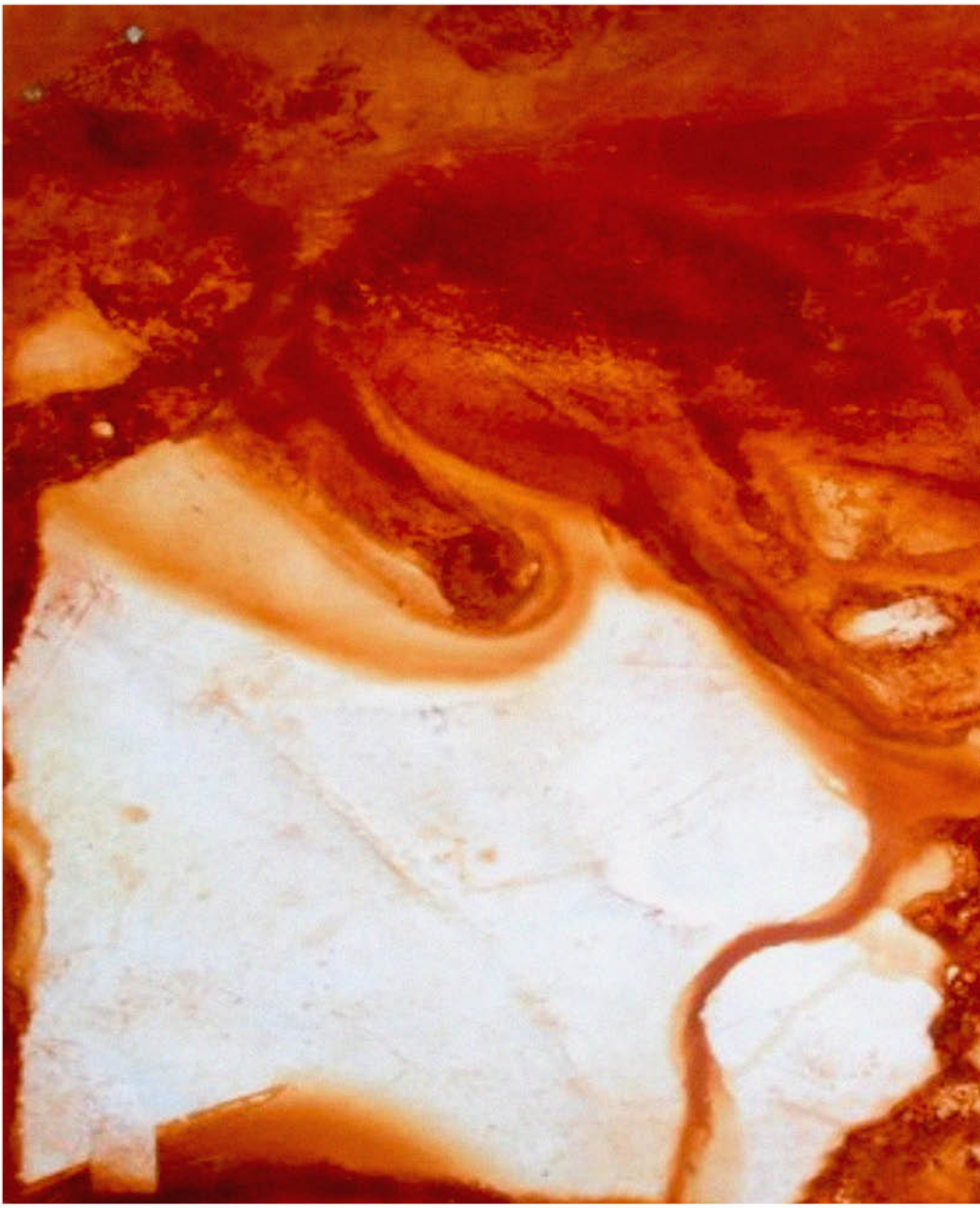


214 Translated caption of original image: "The reflection of the geologist José Mirão is mirrored in the acid drainage tank in the Tinoca mine, whose waters flow down to the reservoir of an irrigation dam. Deep down, solid deposits of toxic materials recall the urgency of treating these places." The still pond of acid mine drainage acts as a mirror - a mirror that when intersecting the recipient that contains it, creates a defined line between two contrasting surfaces.

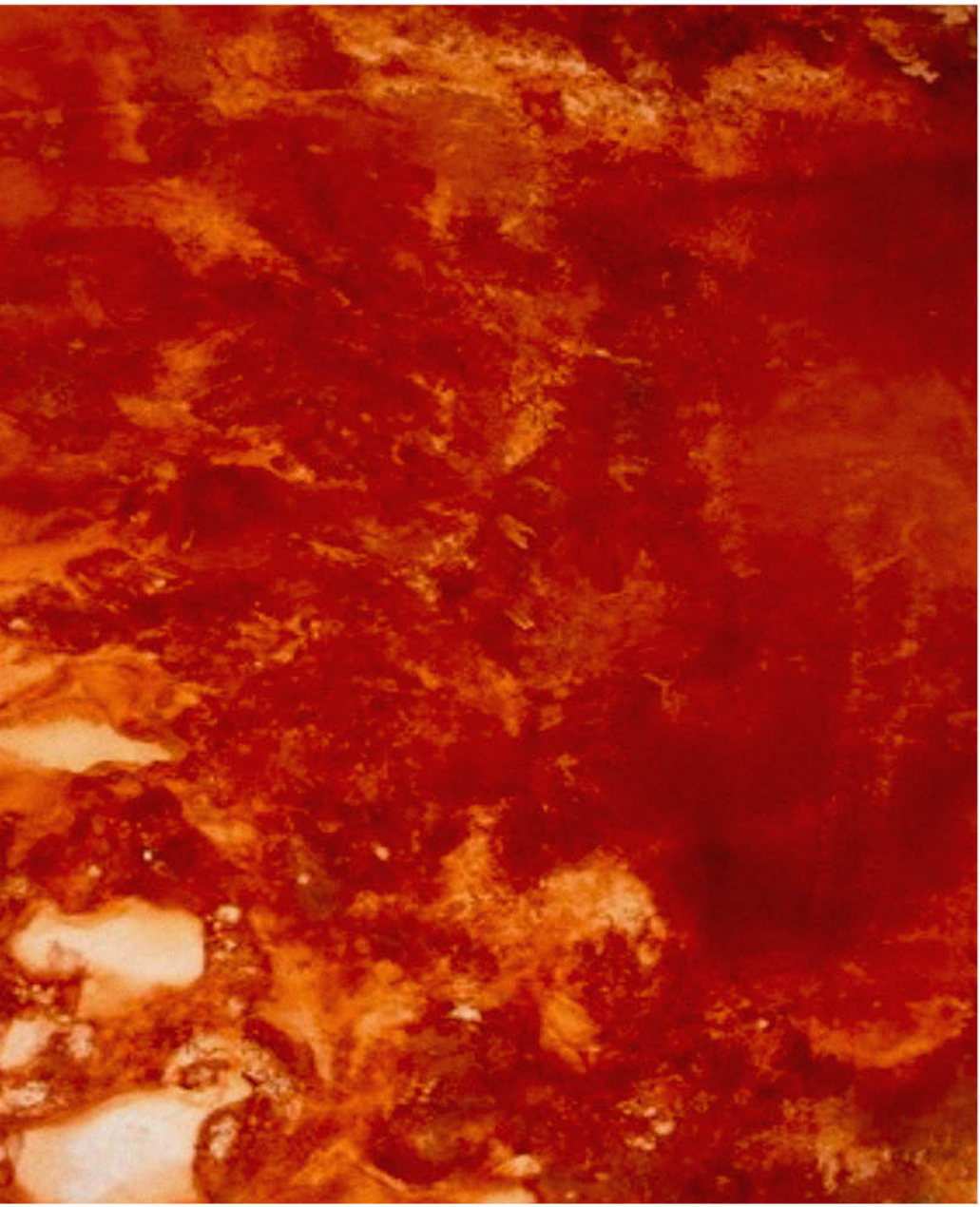
215 Astrophotographical images by Miguel Claro of the mining area of S.Domingos, Portugal showing the acid mine drainage lakes which at night become large surface mirrors that reflect the night sky.


Miguel Claro

216 Image showing the detail of the rough irregular texture of common mining slag - a by-product of smelting processes which floats on the surface of molten metal and is then discarded. Water passing through slag deposits creates the problem of acid rock/mine drainage causing environmental problems.



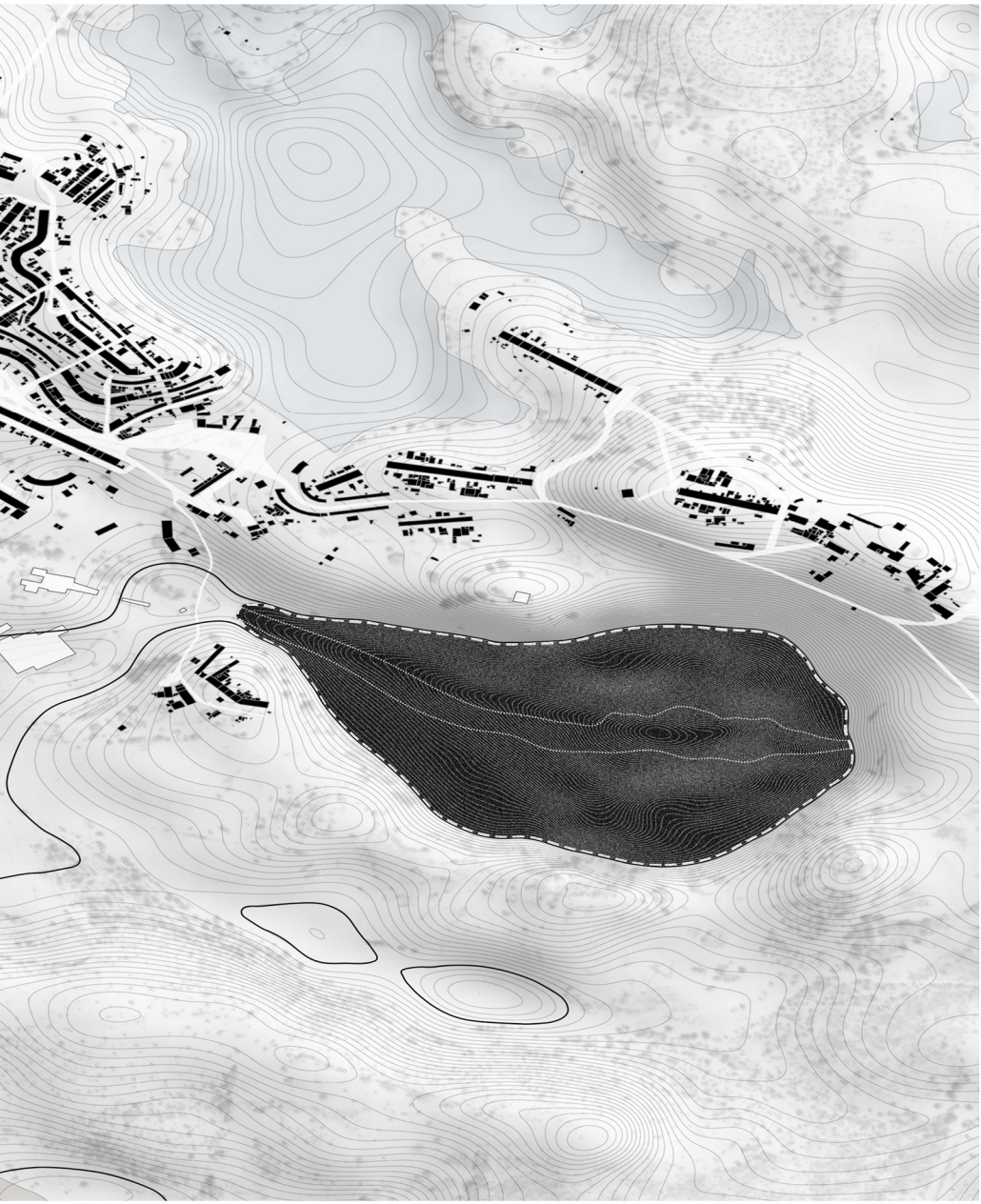
217 Janesko, Dave. *AMD 039* acid-mine drainage. Artist, Janesko's work with acid mine drainage involves placing a canvas in the stream of acid mine drainage and letting the dissolved minerals precipitate onto the canvas. The acid is of a profound orange colour due to the chemical reaction. Acid mine drainage is the result of the oxidation of sulphides, found in heaps and ore slag, from their interaction with water and air. The chemical reaction at its origin is 4 FeS2 + 15 O2 + 14 H2O = 4 Fe (OH) 3 + 8 H2SO4. In this process, sulfates and other chemical elements are generated and released. (Source of chemical formula: Agostinho, Sara (2013) Reabilitação da área mineira de São Domingos através da utilização de corretivos e a resposta fisiológica de Cistus Salvifolius L.nos diferentes tratamentos aplicados, pg.3.)

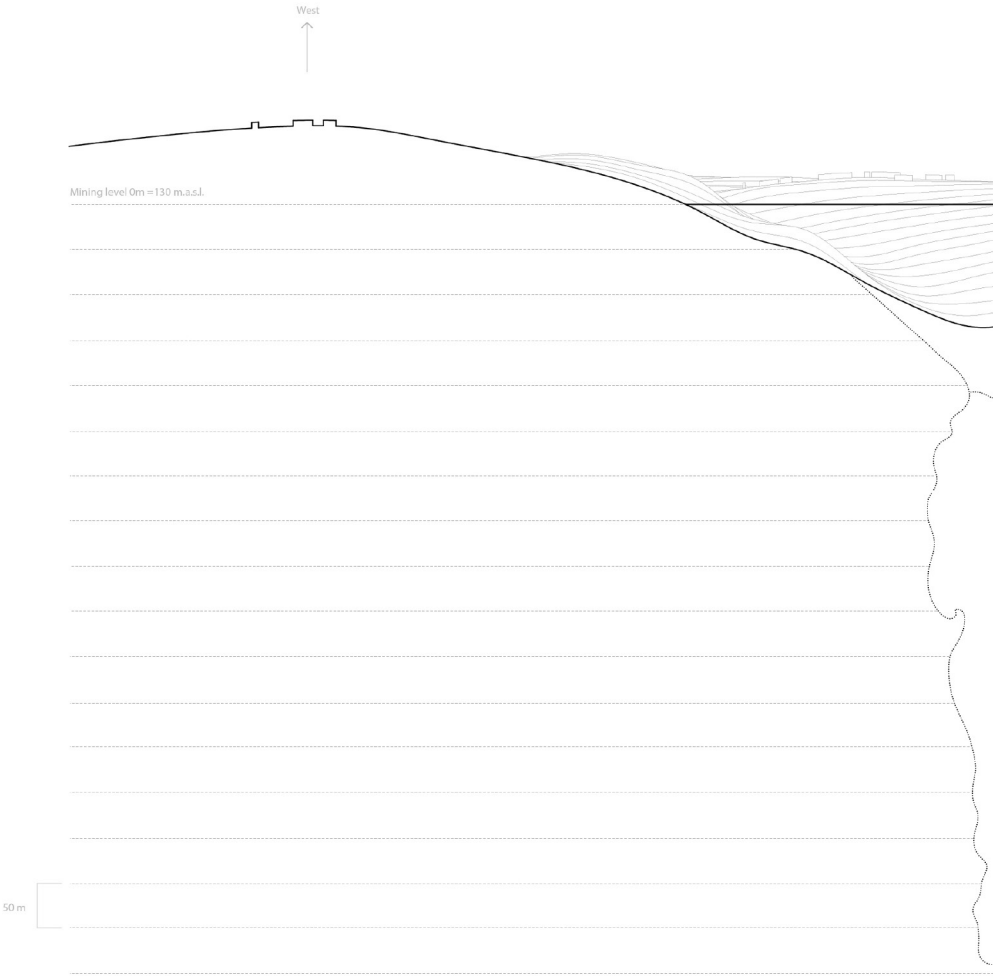


218 "Due to the extremely high concentrates of S-bearing minerals as well as sulphate salts, it is common to find carapaces made up of native sulphur crystals and neo-formed sulphates (melanterite, jarosite) at the edges of the various acid dams in the area. The sulphates are mostly visible in summer as they dissolve when it rains."(De Oliveira, D. 2018.)

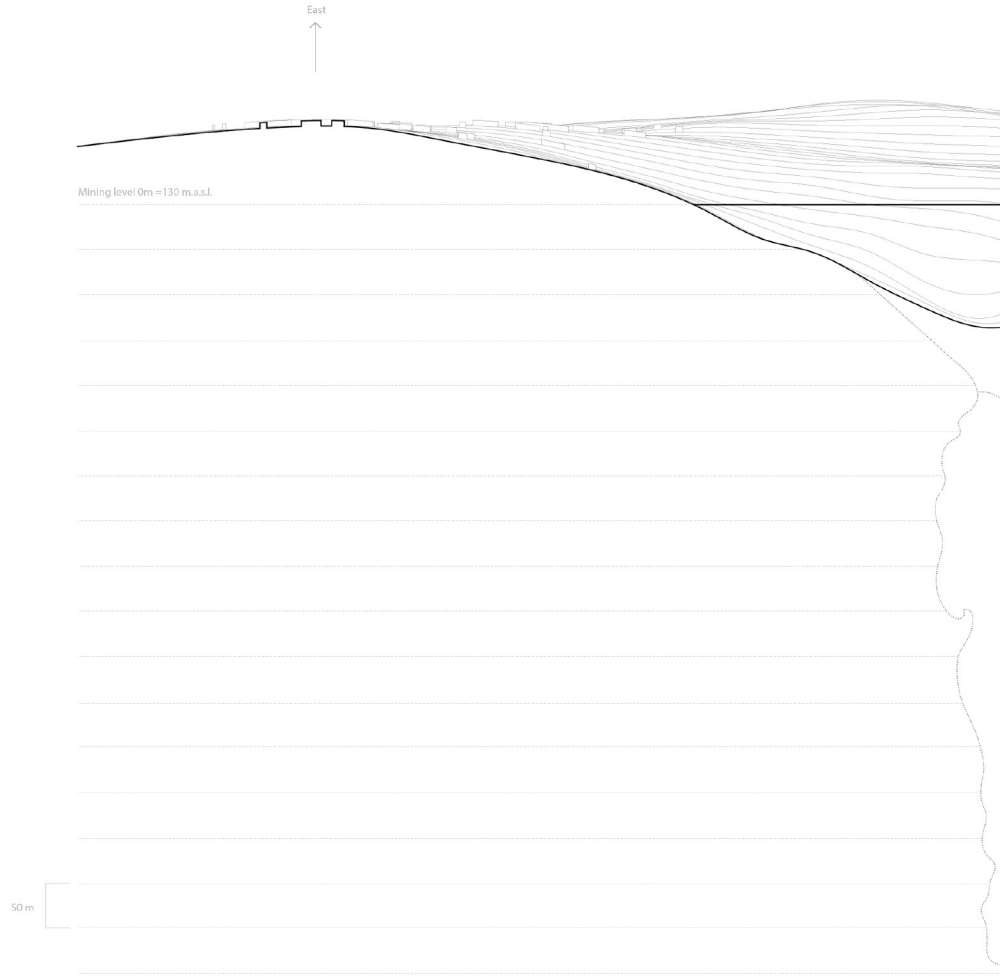
219 *Primitive Dye Painting* (in construction), Michael Heizer, 1969. The covering and waterproofing of the open pit in this reclamation project at S.Domingos Mine aims to transform the open pit into a canvas of colour. In much the same way that Michael Heizer used the desert as a literal canvas that one can paint on with pigments of multiple colours, the covering of the open pit will also be a canvas; when the water accumulates or evaporates, the coloured carapaces of metallic salts deposited on its surface will look like a canvas of colours from above.

220 Map showing the project consisting of the backfilling of the S. Domingos open pit to the mining level of 130m above sea level (equivalent to the 0m mining level). © Jared Miguel Fantasia. 2018

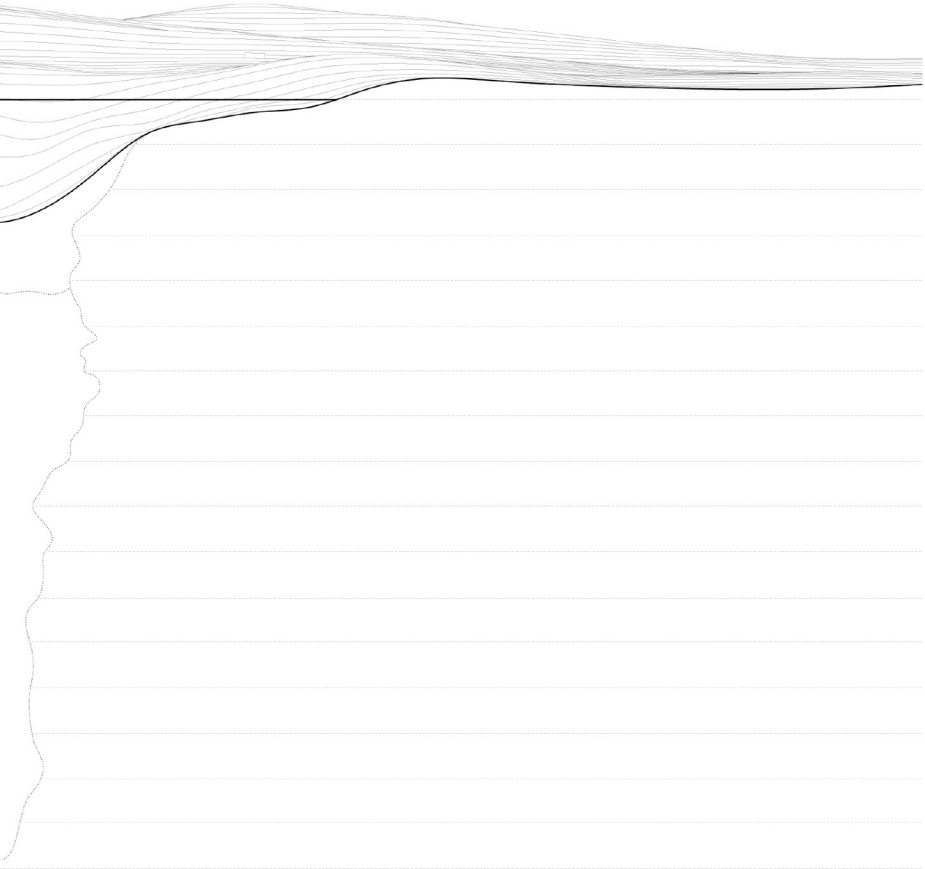




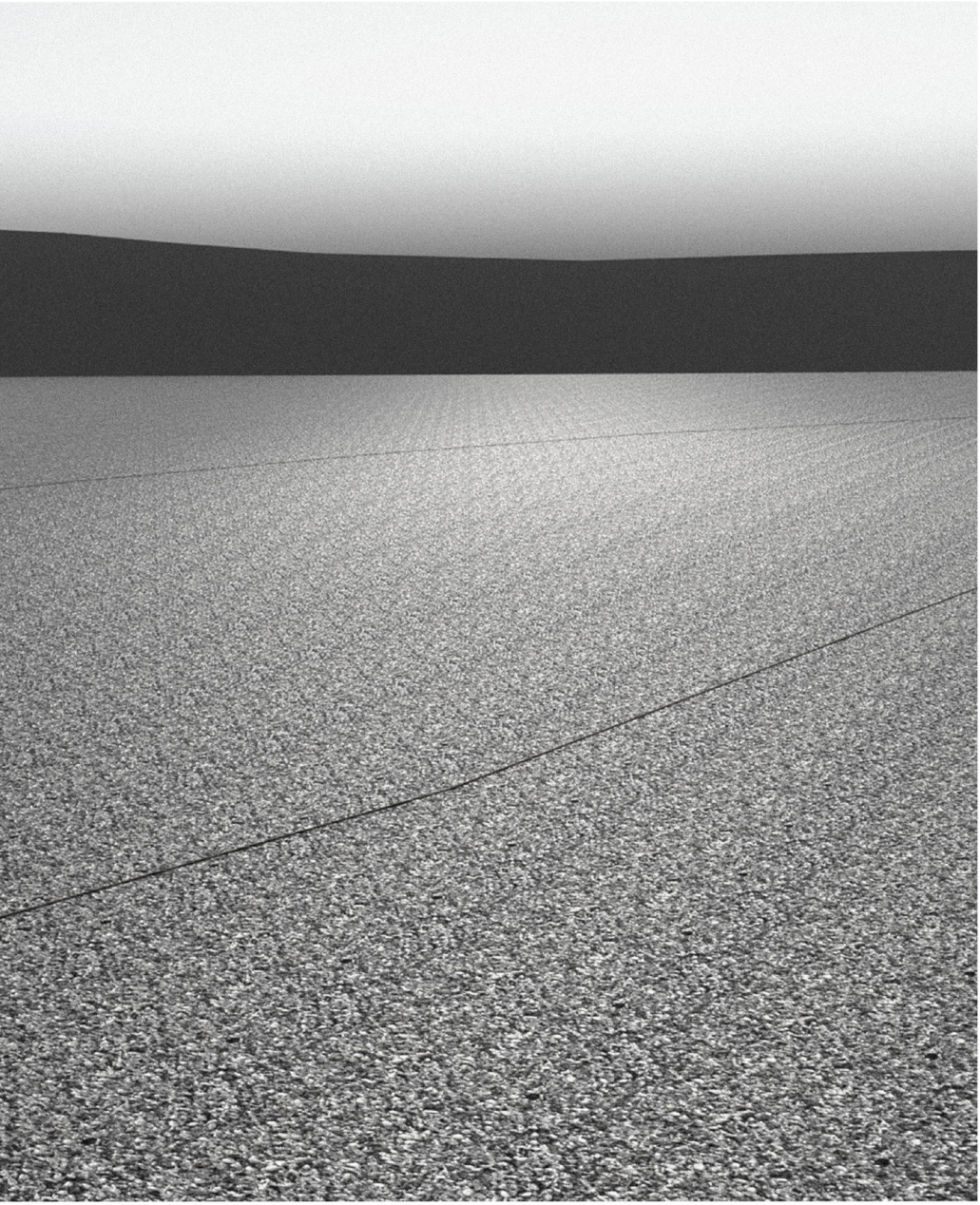
221 N - S cross section of the S. Domingos open pit facing west showing the proposed backfilling of the open pit to the mining level of 130m above sea level (equivalent to the 0m mining level). This section is based on the N-S cross section through the S. Domingos orebody. (In Mateus et. al. 2011, 139).



222 N - S cross section of the S. Domingos open pit facing east showing the proposed filling of the open pit to the mining level of 130 meters above sea level equivalent to the 0m mining level. This section is based on the N-S cross section through the S. Domingos ore body (In Mateus et. al. 2011, 139)

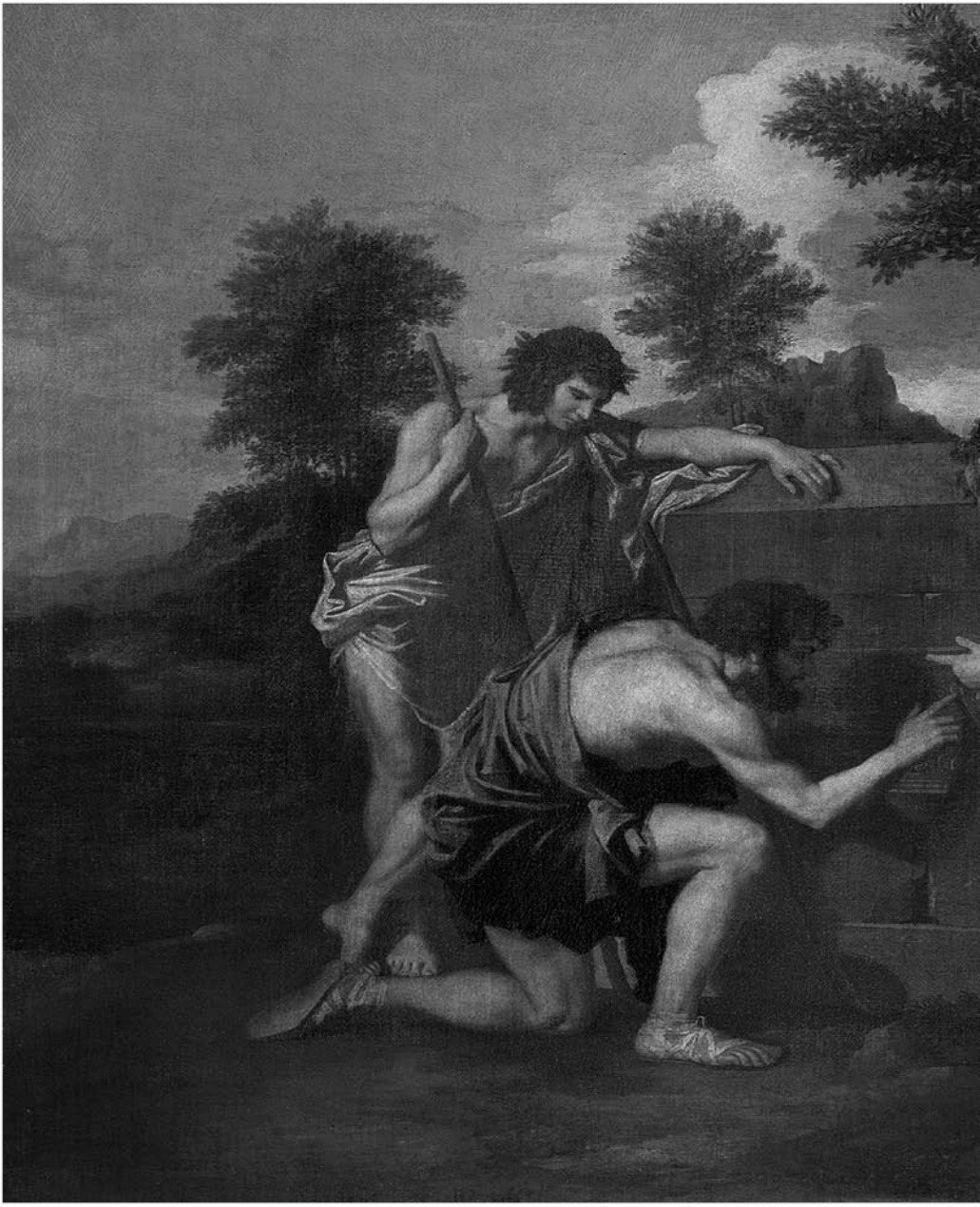


223 Rendering (© Jared Miguel Fantasia. 2018) of the project showing the proposed open pit filled to the 130m a.s.l. contour. In this render, a man walks upon the impermeable overlay of the filling in the phase of evaporation. With no water, it is possible to walk on the slag and see the outline of the orebody that once existed at this height. The orebody points from east to west in the middle of the Iberian Pyrite Belt and it is possible to walk along lines created by inlays of copper which mark out the direction of this formation on the surface. With frequent filling of water, and evaporation, the inlaid copper oxidizes and turns green over time as can be seen in image 239 on pages 498 to 499.



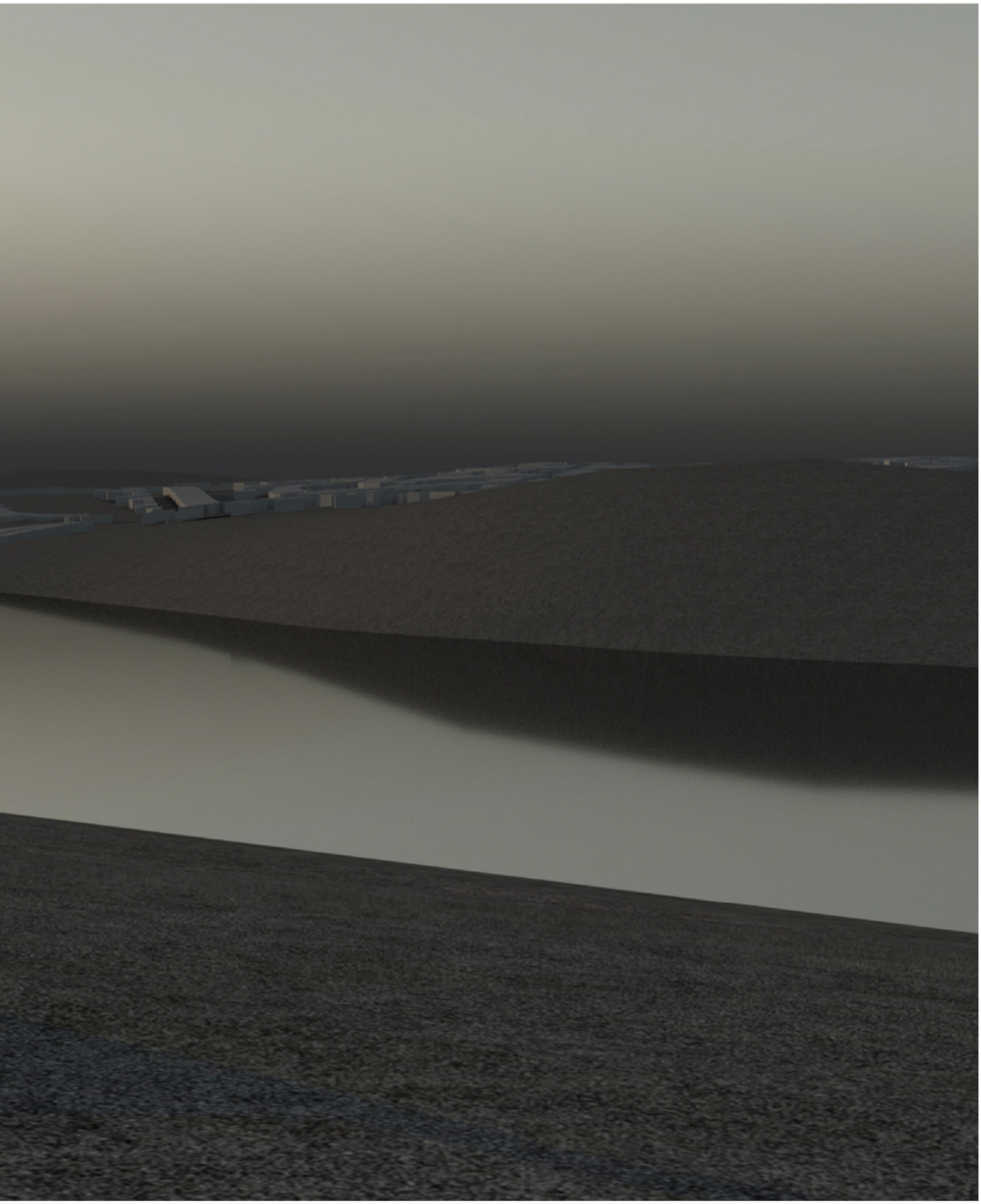
224 Rendering (© Jared Miguel Fantasia. 2018) showing a man accessing the open pit when filled with 20 mm topping of water over the impermeable overlay. The mirror of water contrasts with the surrounding walls of the open pit. The open pit can be accessed from any angle and so it is up to the individual to decide how they want to access the piece. When the piece fills with water, the mirrored surface intersects with the surrounding walls of the open pit creating a line of contact a line an antechamber (perimetral *pomerium*) that separates two "worlds" one must venture, to cross this line and walk on the surface of water.

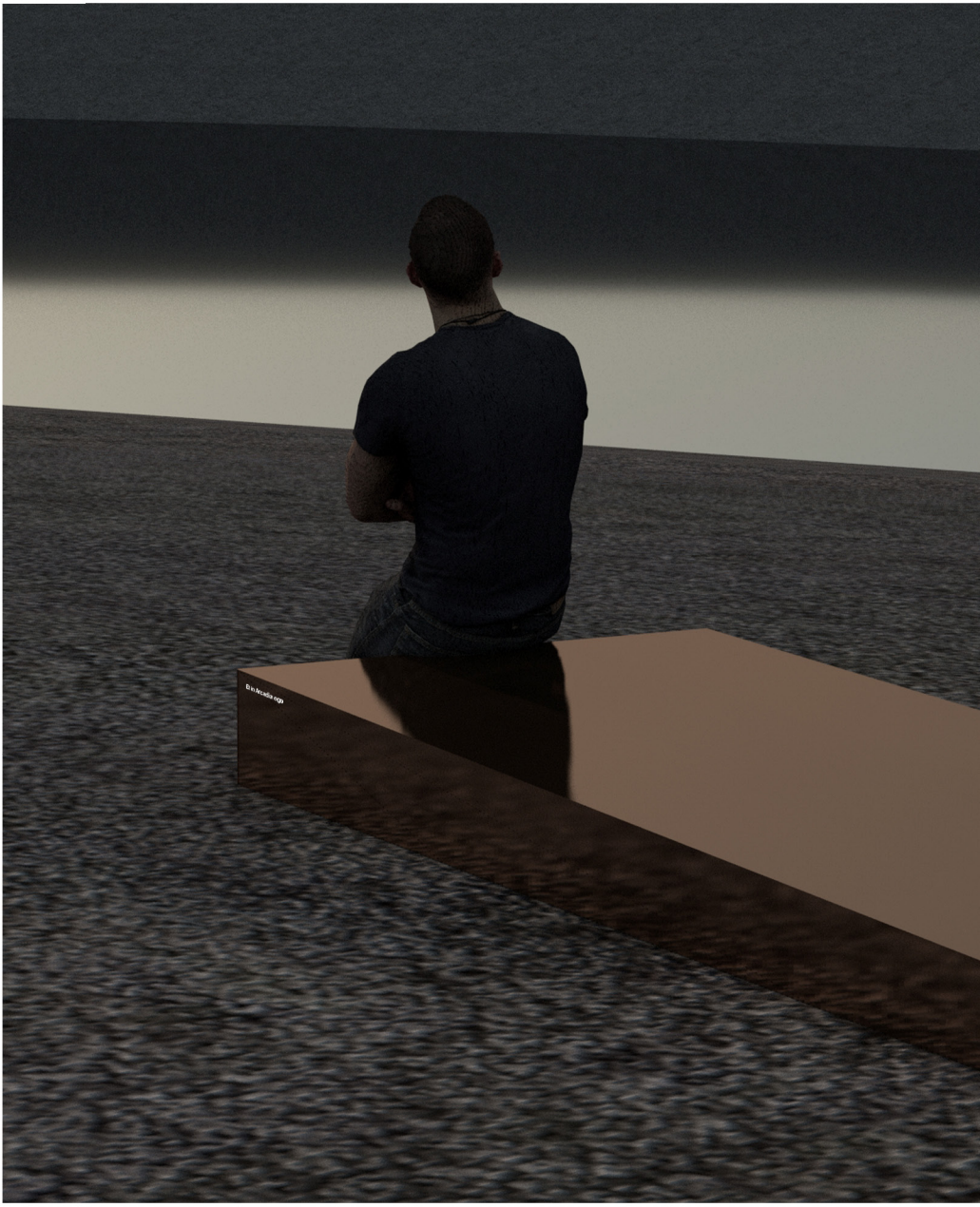
225 Rendering (© Jared Miguel Fantasia. 2018) showing two people walking on top of the open pit. The thin layer of water acts as a mirror reflecting the stars at night - much like in the work of Miguel Claro on pages 450 to 451. This reflection reminds the viewer of the ephemerality of their existence , that precious metals originated from the beyond this planet through the making and death of stars - a process that will continue long after our existence.



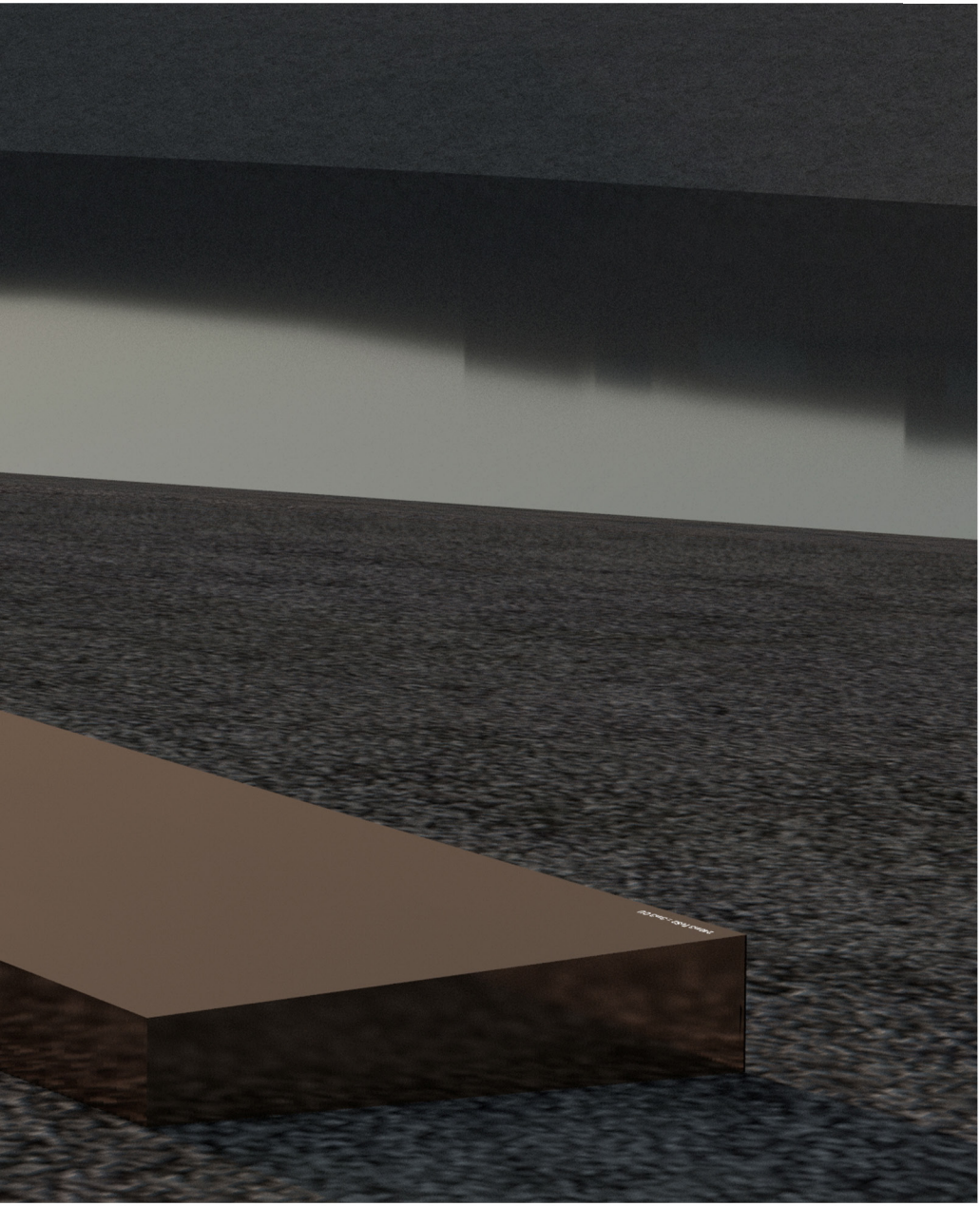
226 Poussin, Nicolas. *Et in Arcadia ego* (1637–38)

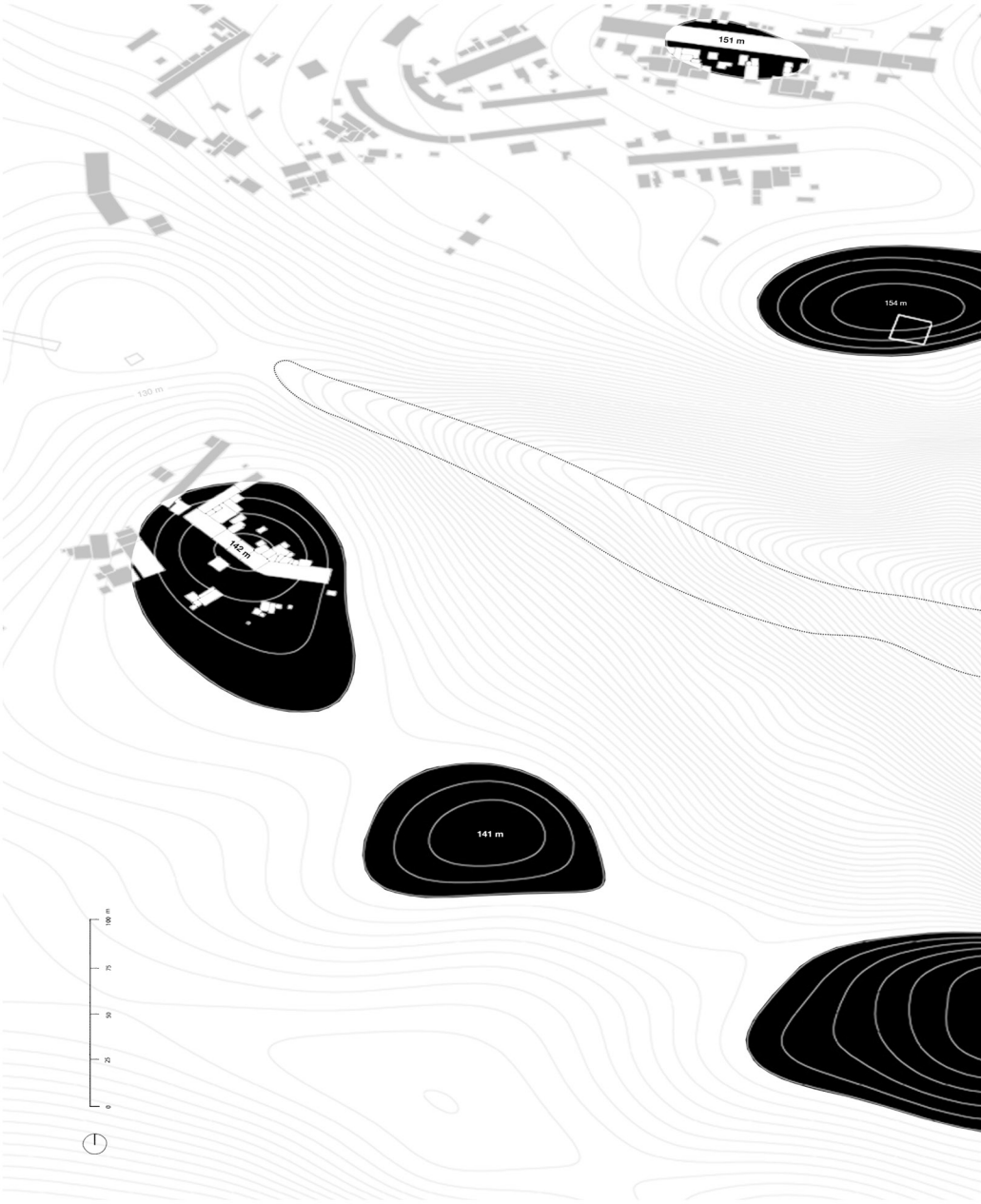
227 Rendering (© Jared Miguel Fantasia. 2018) showing the 3m^3 cuboid copper bench placed on top of the terrils. The elongated bench is pointing in the direction of the village and overlooks the open pit. To the left side of the rendering, we can make an inscription "20m3 FeS2 = 3m3 CU" engraved into the bench which shows it was necessary to mine twenty cubic meters of S. Domingos pyrite ore to produce the equivalent of the bench equivalent to three cubic meters of solid copper.



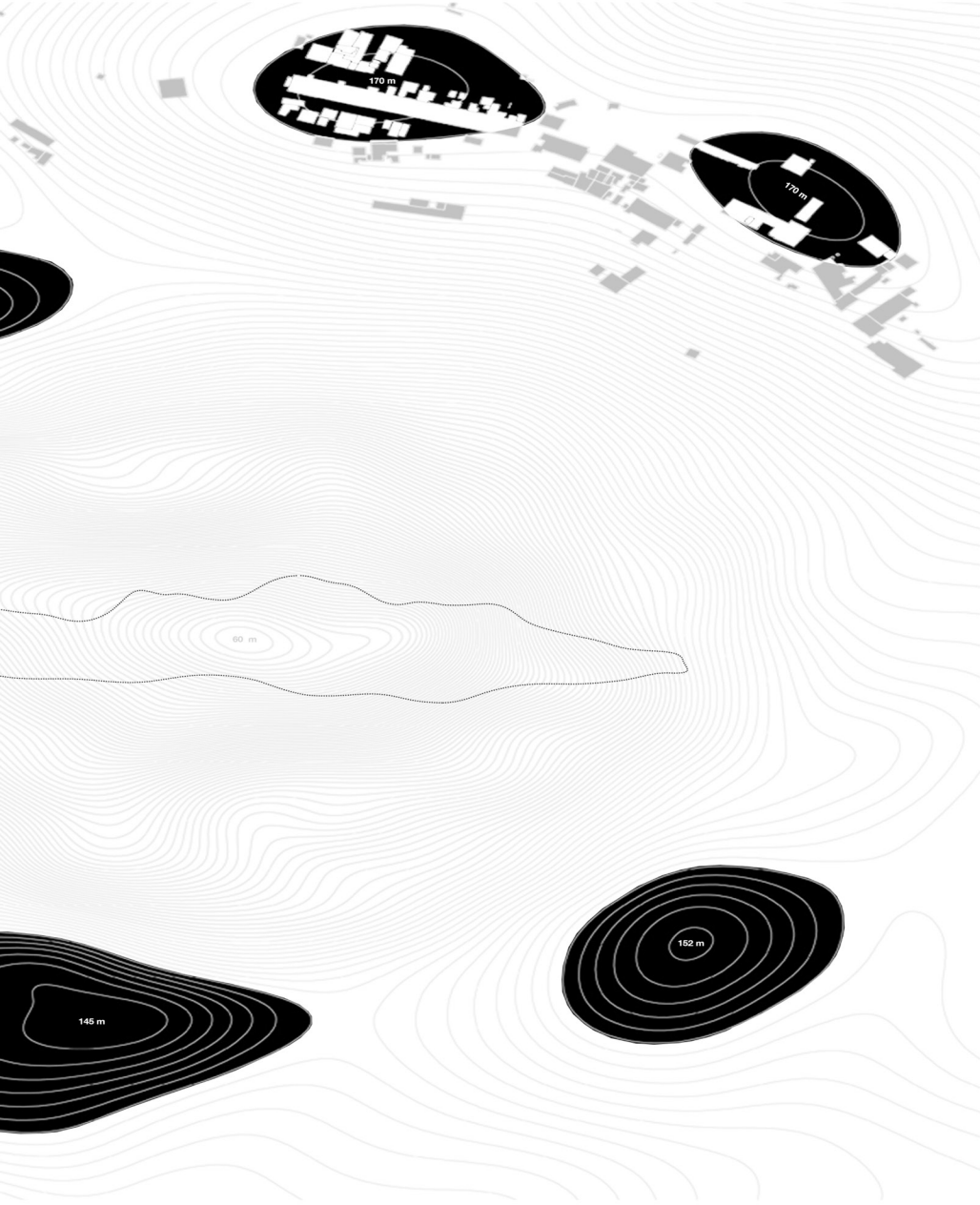


228 Rendering (© Jared Miguel Fantasia. 2018) showing the $3m^3$ cuboid copper bench placed on top of the terrils pointing in the direction of the village and overlooks the open pit. In this rendering we can see the two inscriptions planned for the copper bench: to the left, " 20m3 FeS2 = 3m3 CU" (seen in the previous rendering on pages 474 to 475) and to the right we can see an inscription, "Et in Arcadia ego".

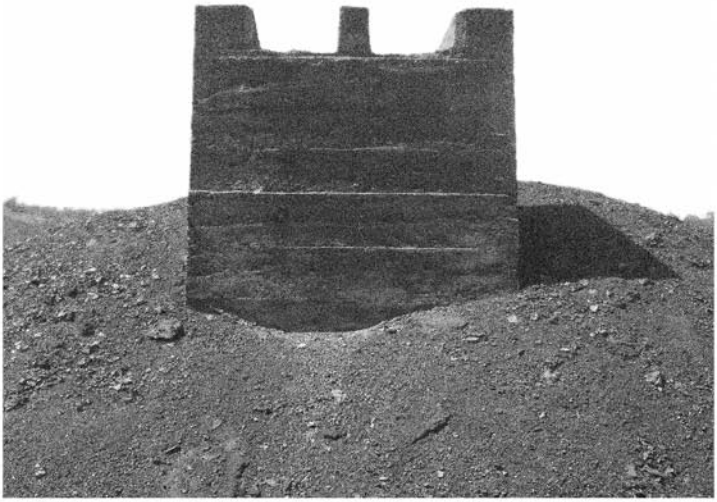


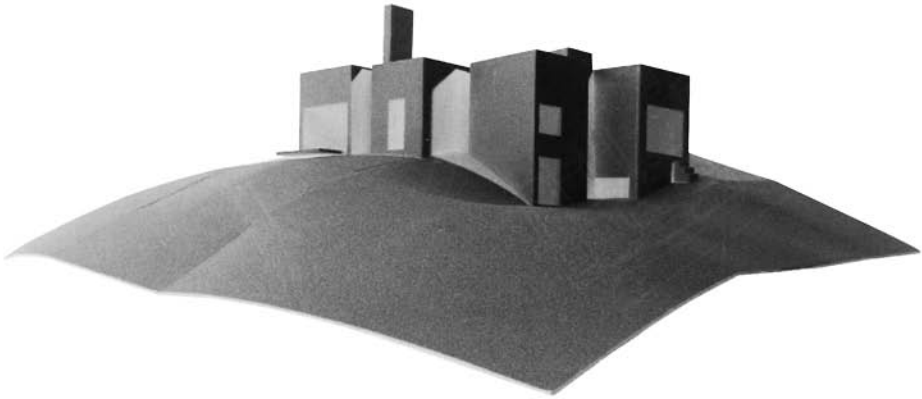


229 Map, generated by cartography from the SRTM Worldwide Elevation Data, showing the peaks of various terrils that surround the S. Domingos open pit encompassing the orebody. (© Jared Miguel Fantasia. 2018)

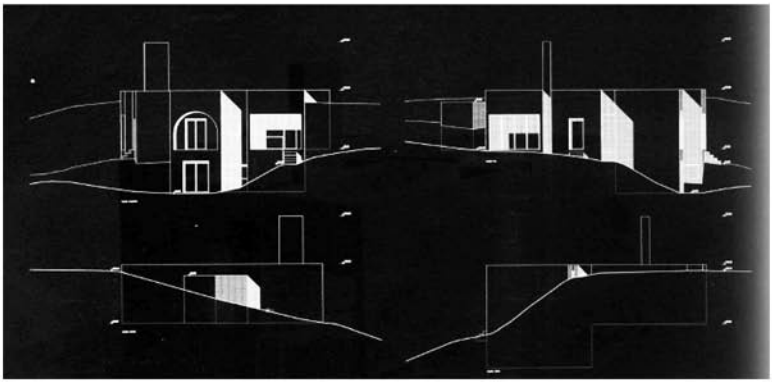

170 m
170 m
60 m
152 m
145 m

230 Comparison of two photographs showing construction on terrils at the S. Domingos mine. Left: The first S. Domingos industrial mine settlement in 187? where we can see the construction of mining houses on top of the S. Domingos VMS deposit and how these slag heaps inhabit the same territory as the recently constructed mining houses at the time. The terrils start to take over, encompassing the houses. Right: (© Jared Miguel Fantasia. 2018) Remains of concrete structure embedded within a slag heap. Construction in the mine had a strong identity with the waste produced from mining extraction. Most of the buildings are volumes built on terrils and are embedded in them.

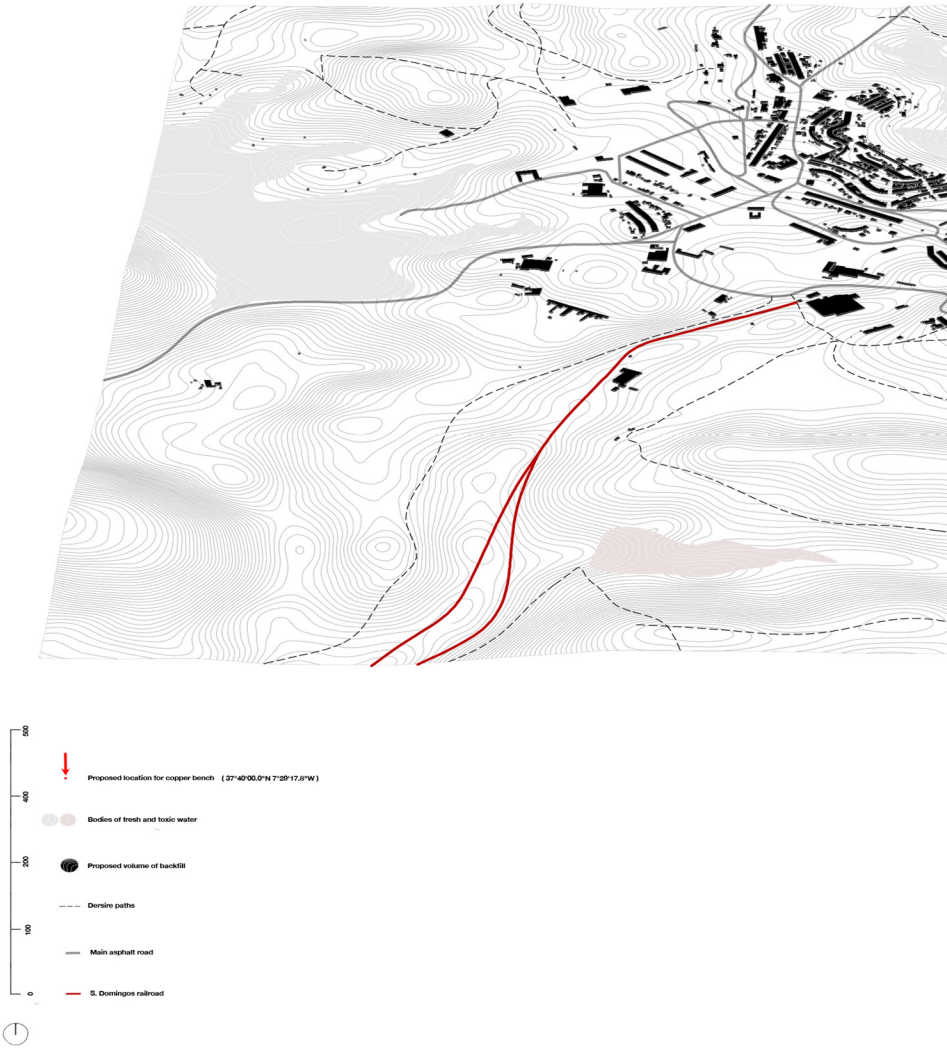




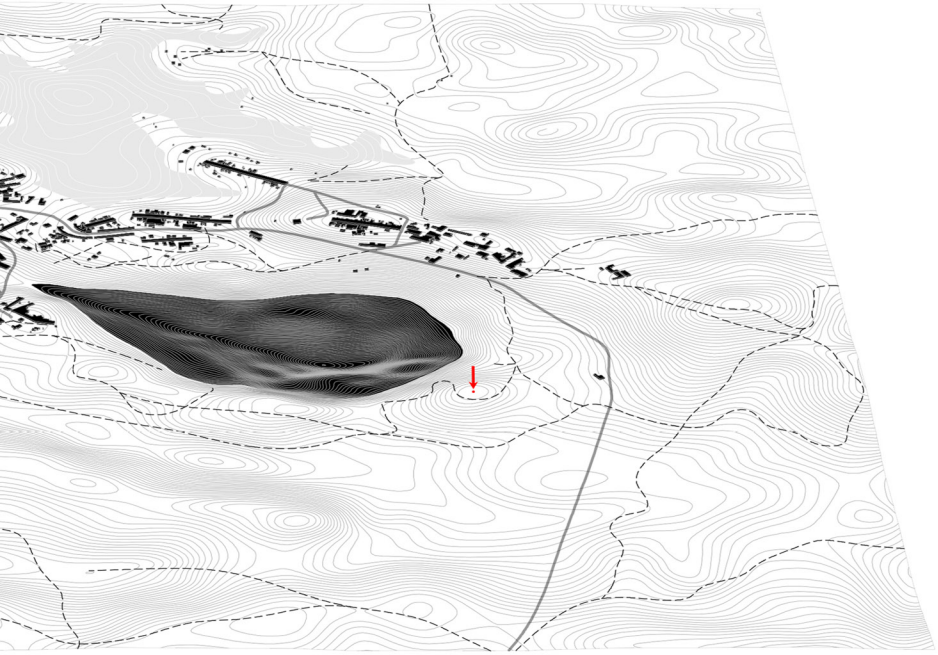
231 Model (left) and sections (right) for House in Serra da Arrábida, Setúbal, Portugal by architect Eduardo Souto de Moura,1994–2002. This architectural project is a fine example of how to place an edifice or a volume on top of a hill that overlooks a territory. The house does not look to fight the pre-existing topography but instead, merges with it. The man-made volumes of the house buried into the hill contrast with the pre-existing site and serve as lookout points from which to survey the surrounding landscape. Although the house is anchored into the hill, the walls that intersect with the ground are subject to the marks of the slow entropic movement of the surrounding soil and inevitable erosion over time; it is as if houses foundations are waiting to be revealed fully over time. Eduardo Souto de Moura's project was inspirational in the thought process of how to place the copper bench on top of the terril as it posed the question, "Should the bench be randomly placed on the terril, or should it have a foundation and be partially buried thus emerging from within the terril?"

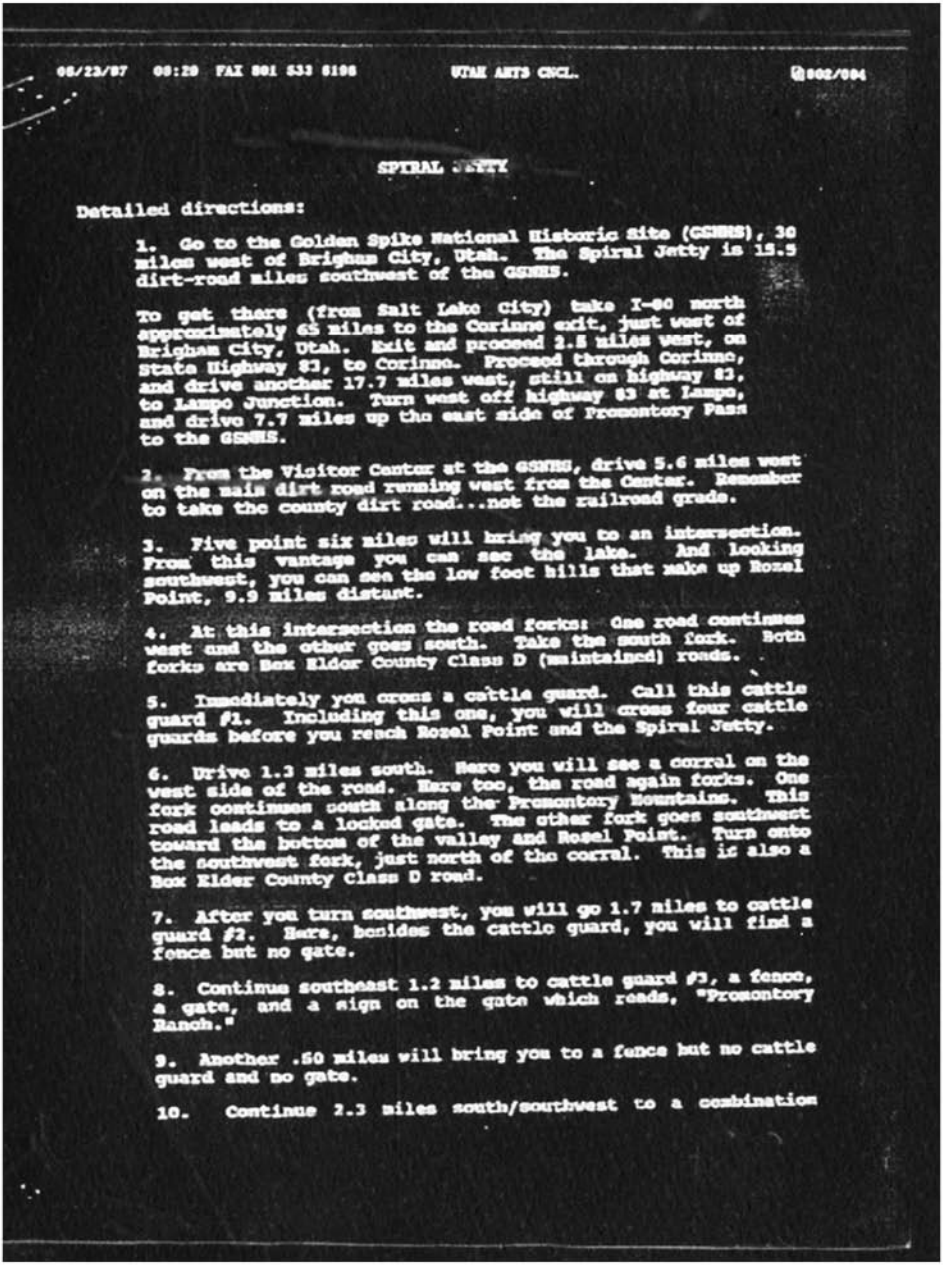


Nicolas Poussin's painting *Et in Arcadia Ego* (1637–38) (pp. 472-473) was also thought provoking in this respect for an element of surprise is conveyed on the finding of the tomb in the painting; similarly, should the copper bench stimulate the questioning of passage of time? The tomb in the painting is an element of the past brought by the painter into the context of the present – a 'bridge'. The copper bench could similarly be stumbled upon along the desire paths - depicted in the axonometric projection (shown on pages 484-485), and which would evoke an experience akin to finding of a buried archaeological structure. The volume of the bench must therefore be intentionally placed in situ. It will reveal itself but, in doing so, also reveal the 'longue durée' of erosion of the spoil heap which slowly deposits itself into the open pit – with the backfill project done or not. The bench, like Eduardo Souto Moura's house, is not simply placed on top of the hill but instead rises from within it, while the hills they are on erode and change over time. This reflection can be observed in the two images on pages 480-481 and, in the drawings on pages 488-489.



232 Axonometric projection (© Jared Miguel Fantasia. 2018), generated by cartography from the SRTM Worldwide Elevation Data, showing the proposed location for the copper bench overlooking the S. Domingos open pit. This axonometric projection shows: the territory encompassing the open pit; the layout of the mining village of S. Domingos with its main asphalt roads; the previous railroad, surrounding desire paths resulting from erosion caused by human or animal foot traffic in the area; bodies of fresh and toxic water. The main idea for the proposed location of the copper bench, is to place it on the point of the highest terril that overlooks the open pit and faces the village (refer to map on pages 478-479 where we can see that he approximate height predicted for the mining terril in question, is 152 meters above sea level). The site is accessible by foot on the pre-existing desire paths that surround the open pit.





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SPIRAL JETTY

Detailed directions:

1. Go to the Golden Spike National Historic Site (GSNHS), 30 miles west of Brigham City, Utah. The Spiral Jetty is 15.5 dirt-road miles southwest of the GSNHS.

To get there (from Salt Lake City) take I-80 north approximately 65 miles to the Corinne exit, just west of Brigham City, Utah. Exit and proceed 2.5 miles west, on State Highway 83, to Corinne. Proceed through Corinne, and drive another 17.7 miles west, still on highway 83, to Lampo Junction. Turn west off highway 83 at Lampo, and drive 7.7 miles up the east side of Promontory Pass to the GSNHS.

2. From the Visitor Center at the GSNHS, drive 5.6 miles west on the main dirt road running west from the Center. Remember to take the county dirt road...not the railroad grade.

3. Five point six miles will bring you to an intersection. From this vantage you can see the lake. And looking southwest, you can see the low foot hills that make up Rozel Point, 9.9 miles distant.

4. At this intersection the road forks: One road continues west and the other goes south. Take the south fork. Both forks are Box Elder County Class D (maintained) roads.

5. Immediately you cross a cattle guard. Call this cattle guard #1. Including this one, you will cross four cattle guards before you reach Rozel Point and the Spiral Jetty.

6. Drive 1.3 miles south. Here you will see a corral on the west side of the road. Here too, the road again forks. One fork continues south along the Promontory Mountains. This road leads to a locked gate. The other fork goes southwest toward the bottom of the valley and Rozel Point. Turn onto the southwest fork, just north of the corral. This is also a Box Elder County Class D road.

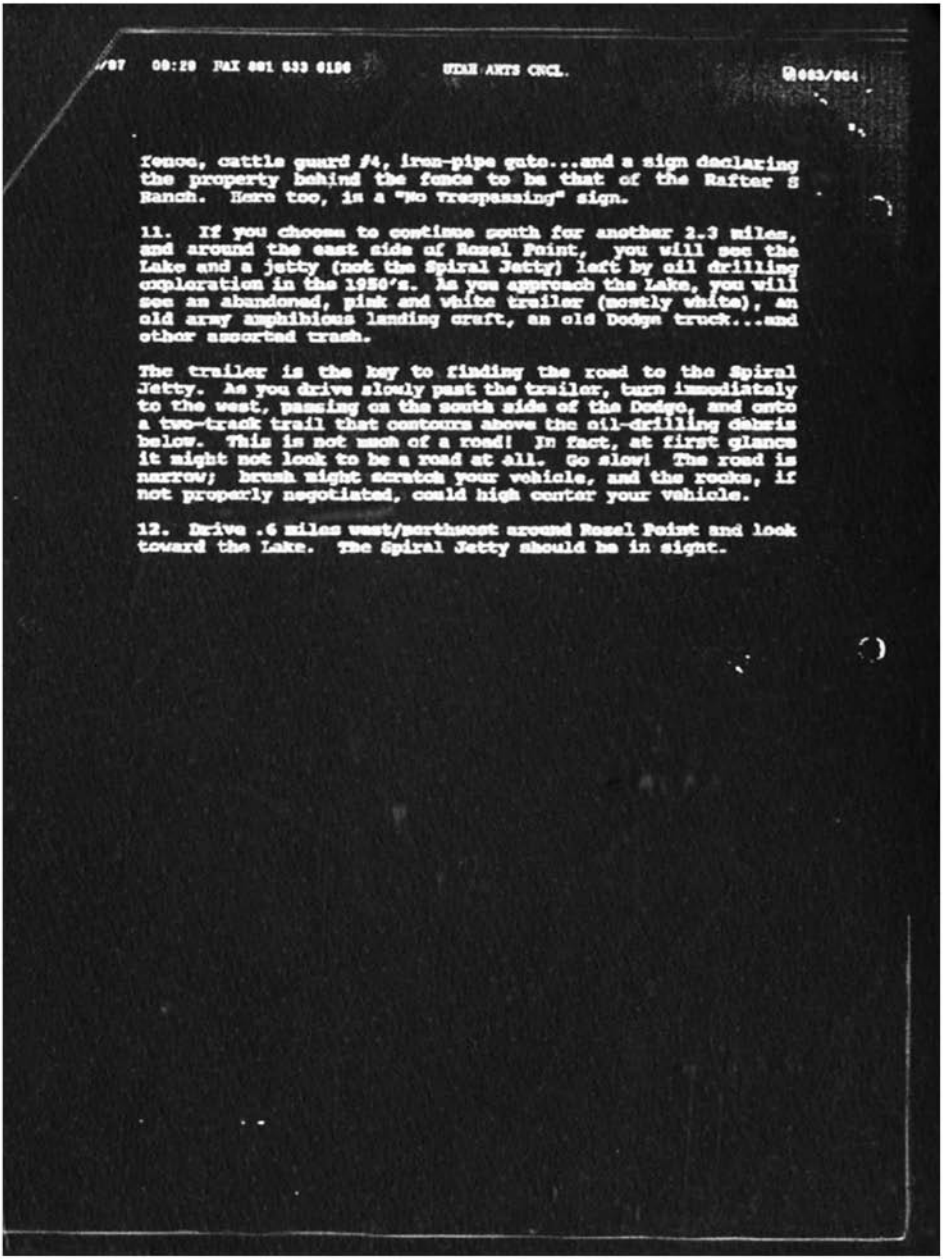
7. After you turn southwest, you will go 1.7 miles to cattle guard #2. Here, besides the cattle guard, you will find a fence but no gate.

8. Continue southeast 1.2 miles to cattle guard #3, a fence, a gate, and a sign on the gate which reads, "Promontory Ranch."

9. Another .60 miles will bring you to a fence but no cattle guard and no gate.

10. Continue 2.3 miles south/southwest to a combination

233 Instructions for Trying to Find Robert Smithson's Spiral Jetty Faxed to Tacita Dean by the Utah Arts Council in June 1997. Robert Smithson's Spiral Jetty (1970) was elusive, being subject to immersion by rising water of the Great Salt Lake on which it was made. With this set of directions Tacita Dean set out by car to document the work using a tape recorder and 35mm stills camera. Spiral Jetty was submerged when Dean reached the location but more importantly, it was evident that the quest to find it contributed more to an understanding of the work, than just the work itself. As the journey to reach it was obscure and difficult, finding the work became less important. In the quest, the pilgrim experiences landscape in which the work was created – the piece and the landscape being one. Similarly, it is the journey off the beaten track (where the copper bench may be discovered) that is as important as the bench itself because the walker enters in contact with the reality of landscape and senses the atmosphere of the place which is vital to obtain an understanding of the work itself.



/87 08:29 FAX 801 533 0196 UTAH ARTS CNCL. 003/004

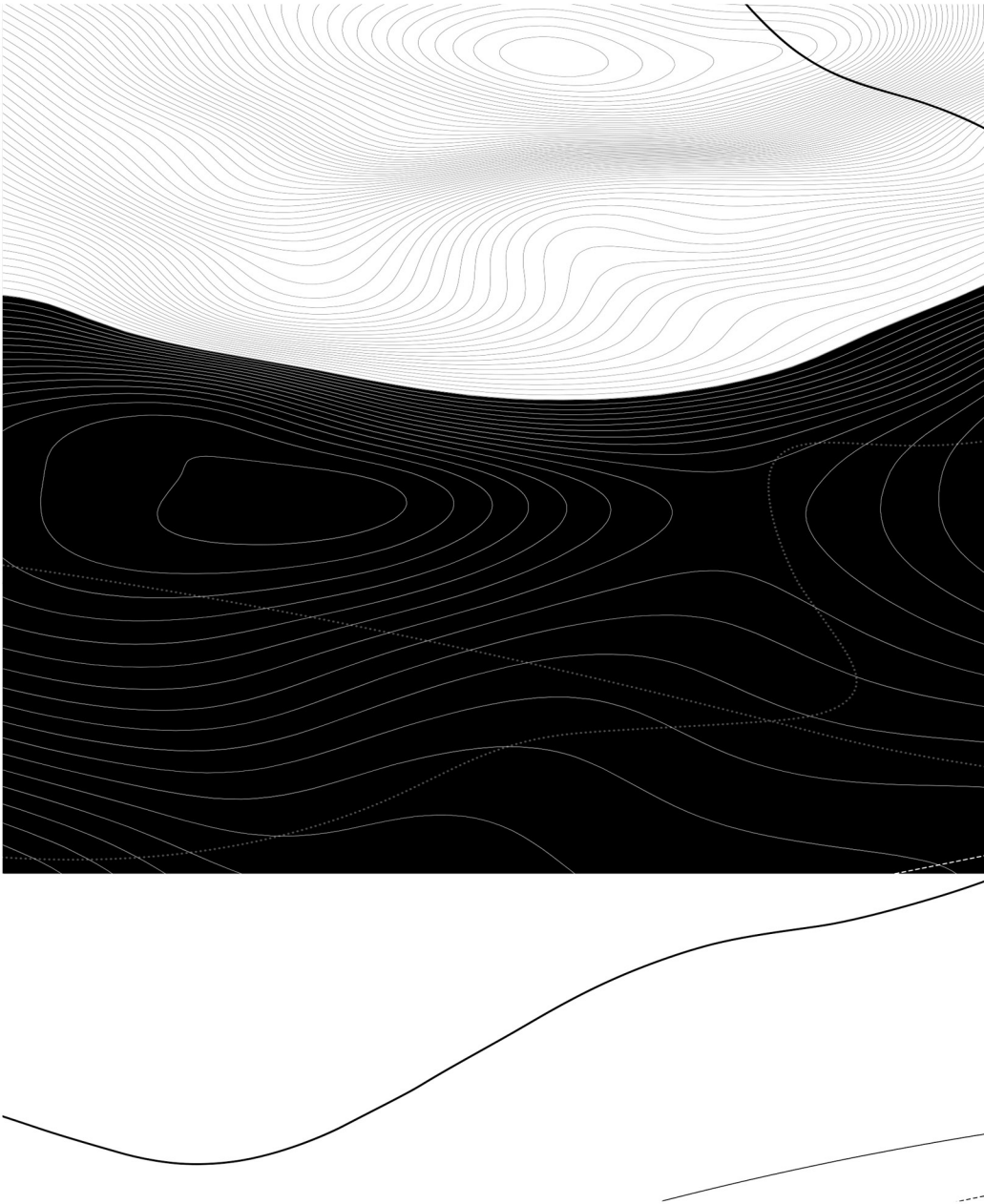
fence, cattle guard #4, iron-pipe gate...and a sign declaring the property behind the fence to be that of the Rafter 8 Ranch. Here too, is a "No Trespassing" sign.

11. If you choose to continue south for another 2.3 miles, and around the east side of Rozel Point, you will see the Lake and a jetty (not the Spiral Jetty) left by oil drilling exploration in the 1950's. As you approach the Lake, you will see an abandoned, pink and white trailer (mostly white), an old army amphibious landing craft, an old Dodge truck...and other assorted trash.

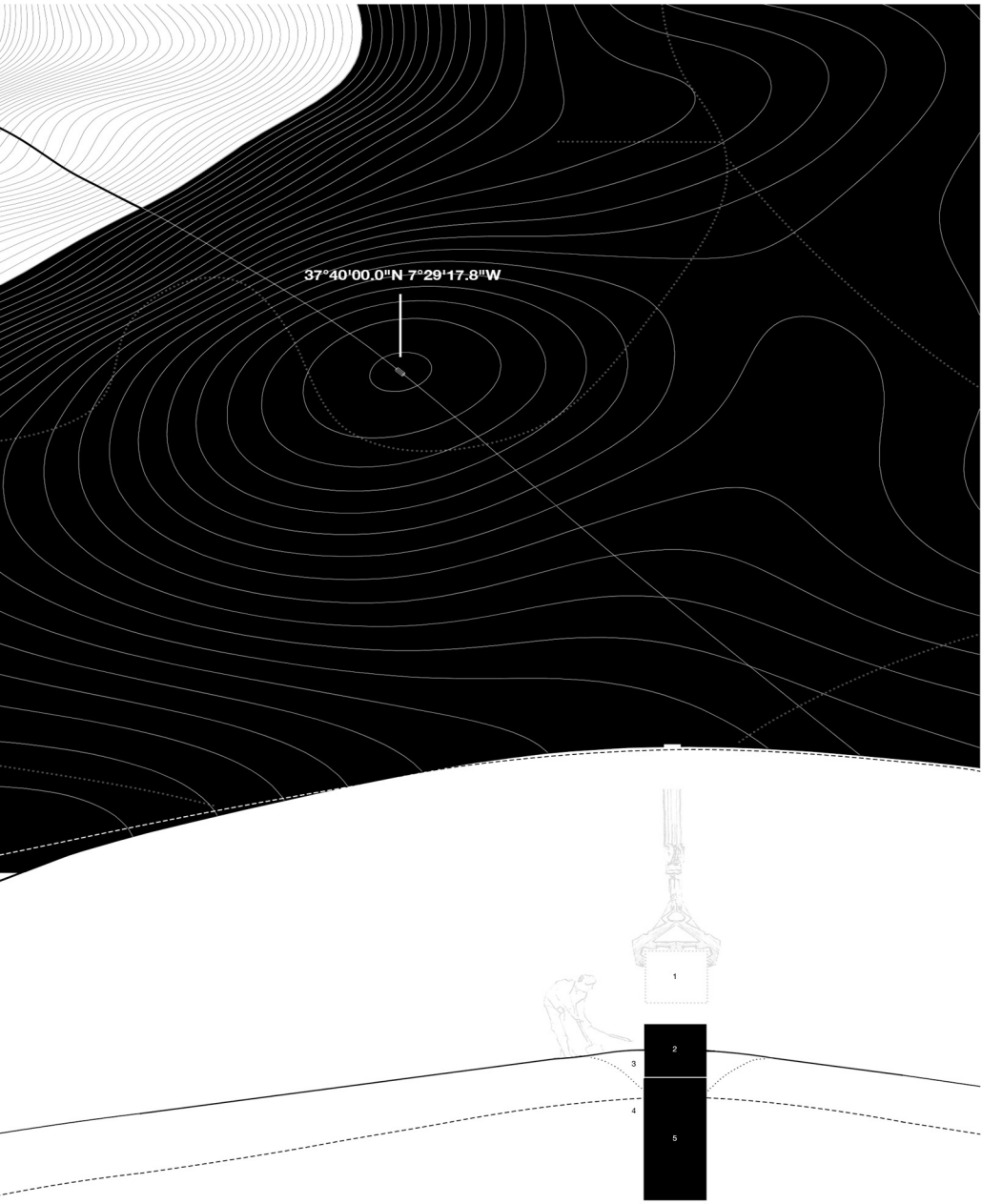
The trailer is the key to finding the road to the Spiral Jetty. As you drive slowly past the trailer, turn immediately to the west, passing on the south side of the Dodge, and onto a two-track trail that contours above the oil-drilling debris below. This is not much of a road! In fact, at first glance it might not look to be a road at all. Go slow! The road is narrow; brush might scratch your vehicle, and the rocks, if not properly negotiated, could high center your vehicle.

12. Drive .6 miles west/northwest around Rozel Point and look toward the Lake. The Spiral Jetty should be in sight.

Given Dean's experience, we can understand that art work, environment and our physical perception are intertwined. This is summed up by Merleau-Ponty when he states, "Visible and mobile, my body is a thing among things; it is caught in the fabric of the world, and its cohesion is that of a thing. But because it moves itself and sees, it holds things in a circle around itself." Maurice Merleau-Ponty, "Eye and Mind," in Art and its Significance: An Anthology of Aesthetic Theory, 3d ed. ed. Stephen David Ross (Albany: State University of New York Press, 1994), 284.



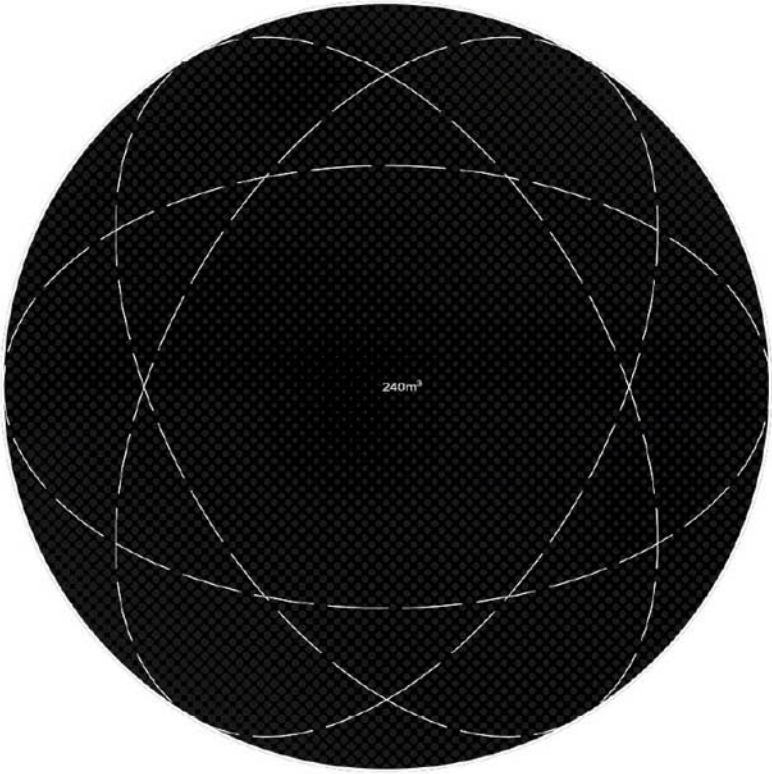
234 Axonometric projection and sections (© Jared Miguel Fantasia. 2018), generated by cartography from the SRTM Worldwide Elevation Data, showing the proposed location for the copper bench overlooking the S. Domingos open pit. In this axonometric projection and sections we can see the idea of placing the copper bench on top of the terril. The idea is first to place a concrete pile foundation and after that lay the copper bench on top. This is then covered up until half way up the copper bench. The idea is that with time the terril will erode exposing the copper bench upon the foundation (as depicted on pages 482-483). The bench then changes its function and is perceived as a cuboid.



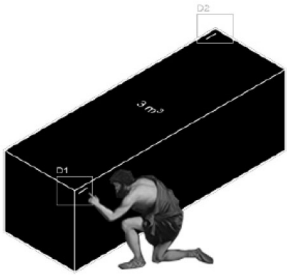
Legend for the diagram above showing the installation of the copper bench and its foundation:

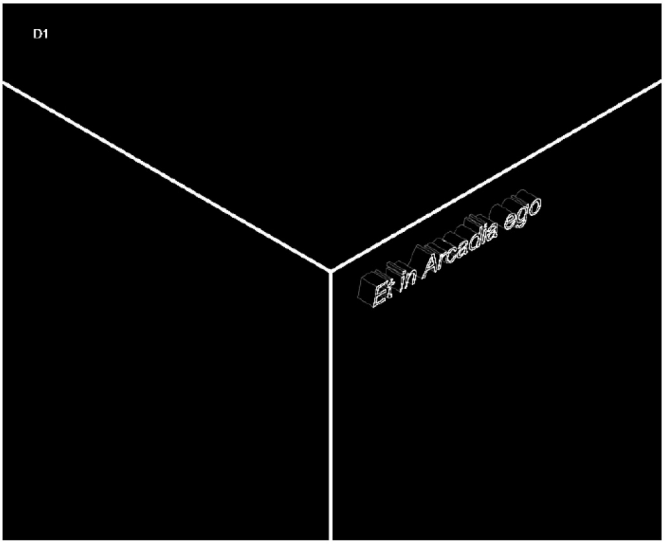
1 - Placing of the copper bench on top of the concrete pile foundation;
2 - Copper bench 3m^3;
3 - Covering up of the pile foundation and copper bench until half the height of the copper bench;
4 - Line suggesting the next surface due to the erosion of the terril into the open pit;
5 - Concrete pile foundation.

235 Comparison of two images showing a pile of scrap copper metal from everyday water systems (left) and the melting down and pouring of molten scrap copper into molds (right). The idea of the copper bench being made out of the melted down of scrap copper reinforces the fact that the element, copper is always in circulation and that it can always be melted down and transformed into something else.

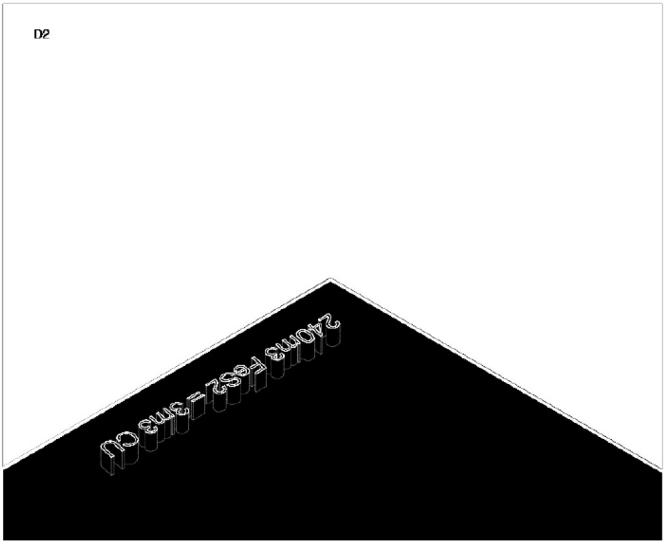


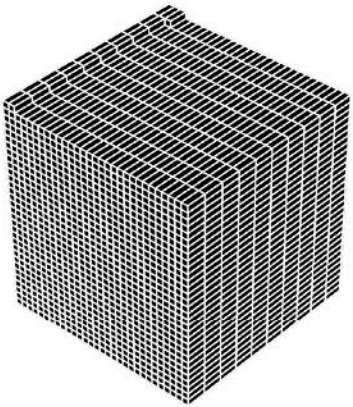
236 Left to right: Conceptual drawings (© Jared Miguel Fantasia. 2018), scale 1/100, showing how much of S. Domingos ore is needed hypothetically to create a 3m³ solid copper bench.


D2
3 m³
D1



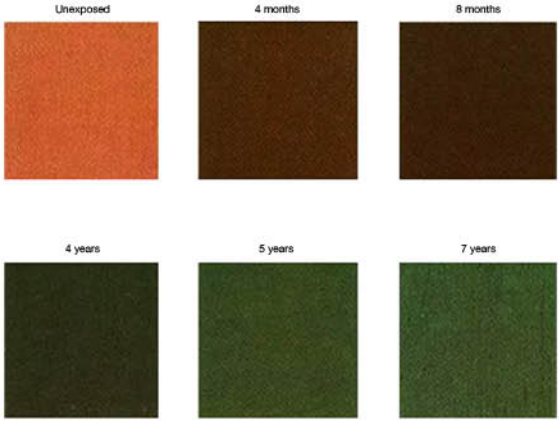
237 Left and right: Two drawings (© Jared Miguel Fantasia. 2018), scale1:2, showing the intention of engraving on the two corners of the proposed 3m^3 solid copper bench which can be seen in renderings from pages 474 to 477. The size of the engraving can be compared to a Euro 5 cent copper coin in the right hand corner.


D2
240m3 FeS2 = 3m3 Cu

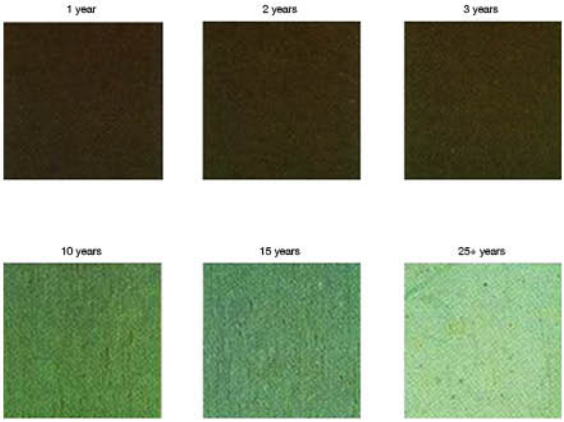


9321 x 3m³ of CU

238 Knowing that approximately 20 million tons of pyrite ore was extracted from the S. Domingos mine site since its opening and, that the percentage of copper in that ore was that of approximately 1,25 %, we can speculate that the total amount of copper removed is equivalent to approximately 9321 bars of 3m³ solid cuboids. This image compares the hypothetical quantity of copper extracted, with the statue of liberty.



239 Copper changes its colour over time from brown to blue and then green when it is exposed to the natural elements and oxidizes as a result. The idea of the copper changing colour with oxidation is implicit in this thesis - in the idea of the copper bench and the copper inlays in the covering of the S. Domingos open pit.


1 year
2 years
3 years
10 years
15 years
25+ years

500 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W

240 Marsh, Dillon. *west o'okiep mine, okiep, "1862 to the early 1970s* over 500m deep, 284,000 tonnes of copper extracted." Dillon Marsh combines photography and computer generated technologies to create copper spheres in arid mining landscapes.

241 Image from the exhibition of Julian Charrière at GASAG Kunstpreis 2018 – Berlinische Galerie, Berlin

Inherent process of construction

It is important to underline that the architectural project relating to the S. Domingos open pit, in this thesis, is a project of conceptual art/ conceptual architecture[98] relative to the research questions within the framework of this thesis (pages 034 to 037). More specifically it can be related to what the architect José Capela (Capela 2012, 76). says about Leon Battista Alberti's view of the architect. Alberti implied that embedded in the architectural creative process is that of a works' construction and because of this, the builder can take the architects' project and carry out the work required to create it. The Architect's project is an independent work - a concept to be constructed by the builder. The architect's role then becomes merely to act as an intermediary between the project and its execution.

Also, this project proposed for the S. Domingos open pit, is of a conceptual nature because it conveys an idea and initiates discourse. Being conceptual in nature however, does not mean that the process of its construction is irrelevant in its conception – rather the contrary. The idea, and the consciousness of its construction, are born simultaneously - as we can be seen in the conceptual drawings of Brazilian architect, Paulo Mendes da Rocha. His conception is a result of the inherent process of construction. Paulo Mendes da Rocha when talking in an interview [99] about his non-commissioned architectural project to transform the Praça da República, in São Paulo, by means of planning a public swimming pool on site, refers to the project's conceptual nature due to the fact that it conveys an idea. (This is also the case for the project designed for the S. Domingos open pit in this thesis.) Rocha points out that essentially his project, in a literary sense (for example as in the creation of a literary work) facilitates an open-ended discourse of possibilities. Also, by not being commissioned, the architect (as an artist) has complete freedom to create the work as they want. But, built into the creative process is the inherent formula or specifications for the creation of such a work which allow it to be what is. For example if we were to write a poem, we would have creative freedom but the poem would be formulated by a methodological process pertaining to the writing of poetry. The same could be said for Rocha's project for Praça da República because the knowledge of material and process of construction inherently exists in his process of thought and has resulted in the creation of the drawings and plans for it. The same be said about the conceptual process of construction in the drawings for reclamation earthworks by lands artists referred to in this thesis - for example, Robert Smithson's drawings for *Spiral Jetty* (1970) and Broken Circle/ Spiral Hill (1971) and Robert Smithson's *para architectural* drawings (which are amongst others elaborated on in the reference situations in this thesis).

In Giovanni Battista Piranesi's etching entitled, "*Means by which the large blocks of travertine and marble were lifted during the construction of the large Tomb of Caecilia Metella",* Piranesi looks to understand and represent the inherent process of construction undergone in the depicted mausoleum through his knowledge of ancient engi

neering accomplishments to defend the creative genius of the Romans.[100] It is the ingenuity (the means) by which the large blocks and travertine and marble are hoisted, lifted, laid and consolidated that determines the work (as can be observed in image on page 515) much as in the same way the ingenuity behind the constructive process of the dome of Brunelleschi's Catedral de Santa Maria del Fiore (1296 -1436) that determined its form[101] (see image on page 514). Similarly in a piece of conceptual art, such as Land Artist Lawrence Weiner's *A 36" x 36" Removal to the Lathing or Support wall of Plaster or wallboard from wall* (1968), we can understand that the work can be replicated nearly anywhere and that the work is unique because the idea implied in its construction is a formula per se (as has been discussed on page 63).

The current project is an analogy for a recipe; a recipe that can be executed by other people in different places and adapted (with some changes due to specific requirements and place) but, the process of its construction (the idea/ the formula) has fundamental elements i.e. the idea is inherent in the reproduction - no matter how pure or distorted the piece is in relation to the original formula. By understanding this, we can equally understand the reclamation project within this thesis, as a conceptual form of art or architecture; although it is designed for the open pit of S. Domingos, Portugal, it can be in fact replicated anywhere in the world as all open pits share basic common characteristics due to the inherent process of their construction and their need for reclamation due to abandonment and decay. Certainly, the form will differ from place to place as it would have to be adjusted. However, it is the idea which is more important than the actual piece for it can be replicated and adjusted through time and in place by following a set of instructions for the process of its construction. The "recipe" could be considered to be composed of actions.

Artist Richard Serra said, "drawing is a verb," and in his work, *Verblist* (1967-1968) he linked "actions to relate to oneself, material, place and, process." Drawing is the action and the lines on the page are conceptual process for other works which perform the same action i.e. "twist and curve but also enclose, surround, and encircle," and for example, the process of dancing.[102] Serra claimed that his early works from the mid 1960s expressed the actions of "process". He engaged in the procedure of understanding the essential qualities of a material (as would take place in industry and construction) and used these to create his works. For example, in his splash/cast installation works, e.g. *Splashing* (1968), he clearly understood how the material changed its nature from the liquid and solid forms in reversible processes. The work was a concept of matter and process, had no further symbolic meaning and didn't necessarily exist for long. Pieces of lead torn off from industrial rolls, heated in ladles and methodically poured into the junction of the walls and floors of the studio bonded these surfaces and unified space by sealing it as a container before the lead was sometimes pulled apart and displayed as the work. The work is the gesture

and action e.g. the splash which leaves particles across the wall and floor. Serra was given the potential to work with lead, by his studio assistant (who would later become a musical composer) Phillip Glass, whose profession at that time had been a plumber and who showed him how to cut and join lead piping and moreover, to seal joints with molten lead. It is this constructive knowledge that permitted Serra's understanding of the workings of these materials.[103]

The methodology of the following project was determined by two major factors: the first being the necessity to fill open pits in order to cover and impermeabilise them and prevent their waste from leaching into the water table; the second being the consideration of the techniques used in such filling and impermeabilisation processes. The understanding of the processes and the technique of construction is necessary in the same way Richard Serra executed his splash/ cast installation (referred to above) because the works were only possible with the construction knowledge imparted through Philip Glass. Thus, we can come to an understanding that the gestures, the 'verbs'/ actions to take place for the current project, is 'to backfill'/ to engage in the action of backfilling and 'to cover'/ to engage in the action of covering. How can one take something that purely belongs to the realm of the functional and embrace it and turn it into a piece of art architecture? How can one make or perceive a work of art/ a work of architecture as the backfilling and covering of an open pit?

The mining operations related to open pits are much larger than what they would appear on the surface as they intersect with dykes from which mineral extraction also took place. In some cases, these areas have to be sealed off in addition to the waterproofing of the pit before the filling can take place. Any potentially toxic sources within pits have to be dealt with - as well as the possibility of toxic seepage arising from the material deposited into the pit. At S. Domingos Mine, the exploitation of radioactive minerals and of polymetallic sulphide minerals must be considered and would make the sealing of the pit necessary.

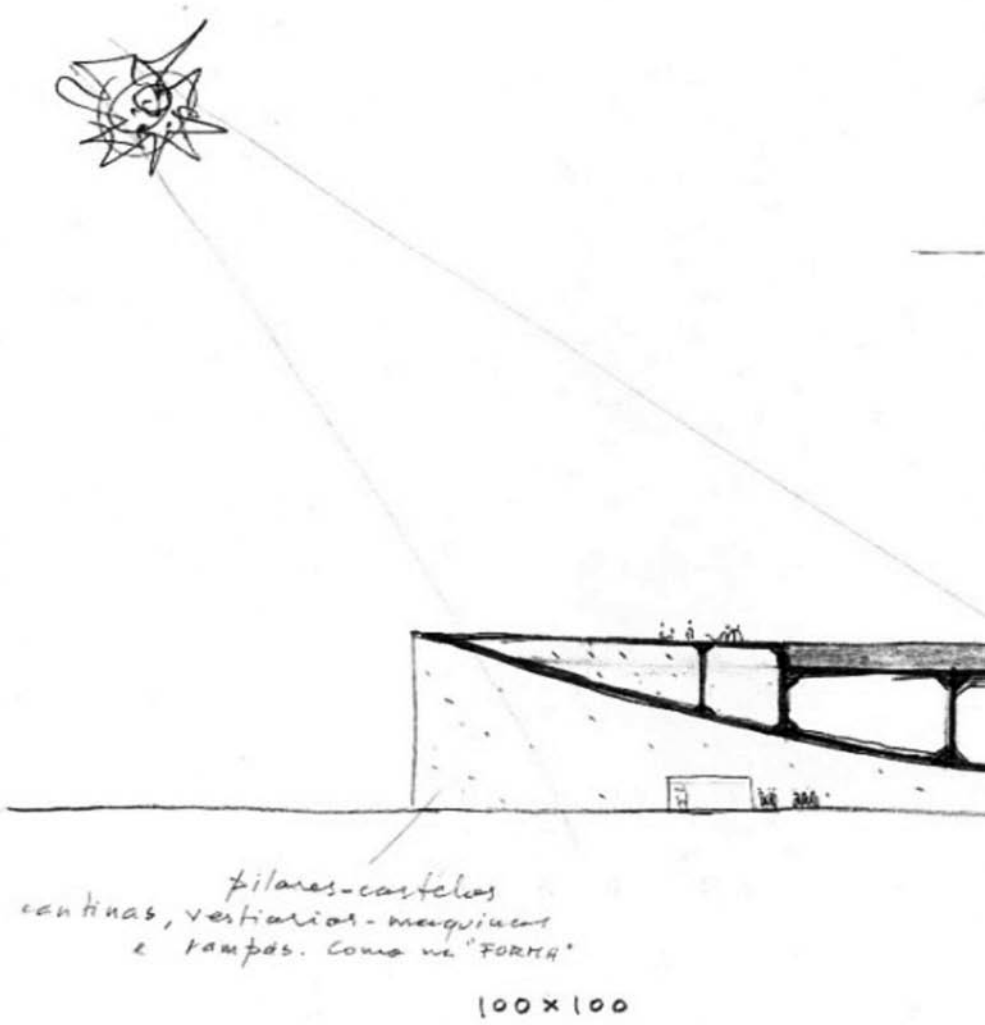
The environmental company, EGMASA of the Regional Government of Andalusia undertook (September 2005 - April 2006) the reclamation of the Sotiel Coronada mining complex at Calañas in Huelva Province, Spain [104]. As at S. Domingos Mine, pyrite had been extracted with the processing of copper, lead and zinc and the production of sulphuric acid. The surface of the main pyrite tailings pond, which extended for approximately 35ha, was packed with the tailings and finally fill. To solve the problem of heavy earthmoving equipment moving over the soft tailings (with a depth of 18m), a 1.0m thick stone wall platform was constructed over a layer of high tensile Polyfelt®PEC400 geocomposite reinforcement which prevented the mixing of soft tailings with stone fill. Polyfelt® PEC400 geocomposite was used to line the tailings pond, starting from the sides and working inwards, down

towards the centre and ensuring that runoff did not affect the working platform. Stone fill was then back-dumped and bulldozed onto the geocomposite reinforcement so as to minimise disturbance of the tailings below and a 0.5m thick layer of clay was placed over the working platform before a composite geomembrane/compact clay liner (consisting of 1.5mm thick HDPE geomembrane between two layers of Polyfelt®TS80 geotextile protection) was added. A 0.5m thick compacted clay layer was placed on top. To prevent intermixing of subsequent layers, a 0.2m thick drainage blanket with the composite liner system was placed on top, with a Polyfelt®TS20 geotextile separator being used. On top of this, a granular drainage layer was placed before the Polyfelt®TS20 geotextile filter. Finally, the area received a 0.5m thick covering of soil with a surface run-off drainage system and vegetation.

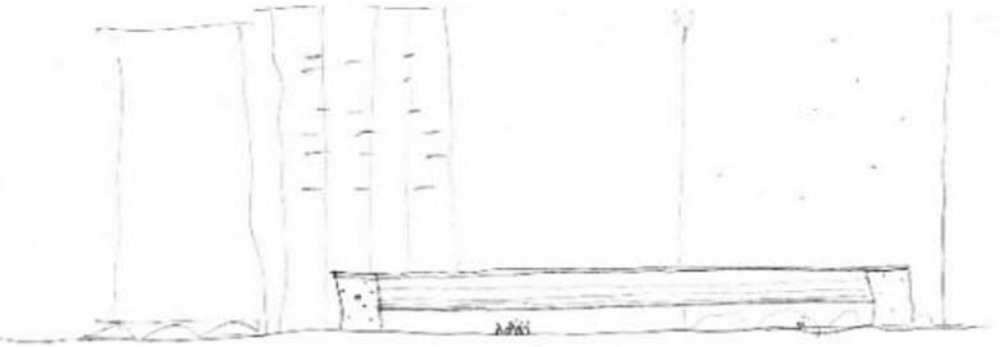
The reclamation project for the open pit at S.Domingos is an adaptation of the above-mentioned construction process for the reclamation of the Sotiel Coronada mining complex at Calañas in Huelva Province, Spain. However, rather than covering the area with soil and vegetation, the project at S. Domingos embraces the post-industrial nature of the site substituting the granular draining blanket and subsequent soil and vegetation. Instead, on top of the final compact clay layer, two overlays of asphalt mixed with surrounding mining slag are laid. A layer of Fortifix® and Rotaflex ® are laid in-between the two asphalt overlays providing crack control, reinforcement and waterproofing. The final layer - a 25mm topping composed of mining slag trowelled and bound with resin - creates a flat surface on which to accumulate rain water, acid mine seepage (to the height of 20mm) and, subsequent evaporation (which leaves behind metallic salts). The flat surface contrasts with the deposition of debris from the eroding walls of the open pit over time.

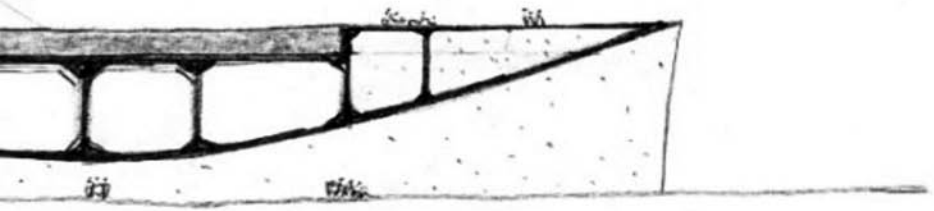
Sustainable reclamation as stabilisation of earth and contaminants and greening over is the most logical solution for reclamation of mining pits – the more problematic of post-industrial sites. But we also need to see sustainable reclamation as the act of valuing and preserving our industrial heritage as they are testimony to “multiple layers of time and cultural activity” (Loures and Burley 2012, 223-226). Landscape can also be what Elizabeth Meyer describes as being interacted with and creating a “poly-sensual experience” (Meyer 2008, 7) - one that the role of art and architecture has much to contribute to make reclamation truly sustainable.

506 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W



242 da Rocha, Paulo Mendes. Proposal for public swimming pool. 2001





Piscina Pública

em qualquer lugar

9.2000

243 Two still images from *Incontri a cura di Gastone Favero: unora con Carlo Scarpa*, RAI documentary, (c. 1970) showing Italian architect Carlo Scarpa talking while drawing on a piece of paper. Scarpa's drawings are not only the technical elements of design for an architectural project, but they reveal the knowledge of its creation for they divulge his experience of manufacture (see following pages 510 to 513). Designer and craftsman are not separate entities but rather collaborators and this is revealed through the design - in both its concept and execution. (See pages 122-123 regarding the process of design for the construction of Robert Smithson's *Spiral Jetty* (1970) as a result of dialogue between Smithson and contractor Bob Phillips). Scarpa's drawings are conceptual because the inherent process of construction is embedded in them.

Paolo Portoghesi: «Observing Scarpa's drawings is the best way to understand how he designs, how he slowly comes to define every detail of his architectural works. They are fascinating designs because they are moments of research expressed through the lines. In them we find not only the geometric definition of the object, but also the attempt to understand what the spatial effect of the architecture will be. We see this through the use of shadows or especially the backgrounds that differentiate the materials from each other, which already define the atmospheric value of these architectures or at least foretell it. A very interesting aspect of his drawings are the written messages they contain, addressed to those who will be the makers. Often there are definitions of matter, or annotations that go beyond what can be said through the sign. In this case, even the word is invoked by the architect to better convey his message. Above all to define in detail what the task of the collaborators will be, who are not only for Scarpa distant characters, material executors, but are really collaborators - and often friends - to whom he addresses with that confidence that is typical of craftsman rooted in his craft. Of the craftsman who knows how to take on different garments, of an intellectual rank, but who never abandons this direct contact with the performers, with those they have to put into practice, who have to build in the sense that he knows how to give to this term "

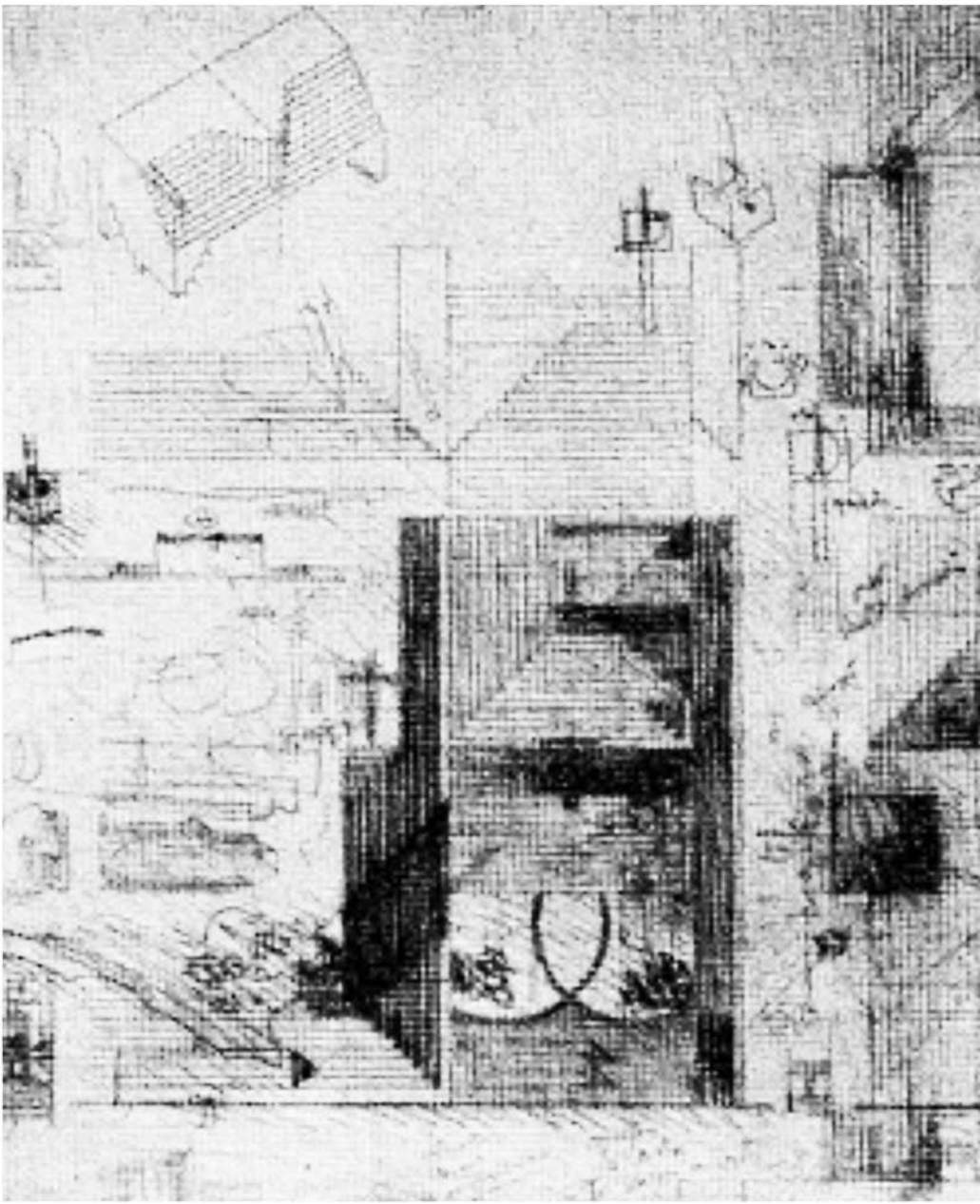
(From *Incontri a cura di Gastone Favero: unora con Carlo Scarpa*, RAI documentary, c. 1970)

244 Six still images, from *Incontri a cura di Gastone Favero: unora con Carlo Scarpa*, RAI documentary (c. 1970), showing interview with a craftsman building the wooden molds for the concrete canopy of the Brion Tomb designed by architect Carlo Scapa. Contrary to other architects, Scapa was renowned for leaving detailed annotations through sketches along the sides of the technical drawings that where handed to the constructors. These annotations consisted of additional information of what Scapra wanted to be done. As discussed previously (pages 608-609) Carlo Scarpa had a strong knowledge of the skills pertaining to craftsmen and builders in their work. We can therefore consider Scarpa's drawings to be of a conceptual nature as they have inherent in them, the thought process of their construction.

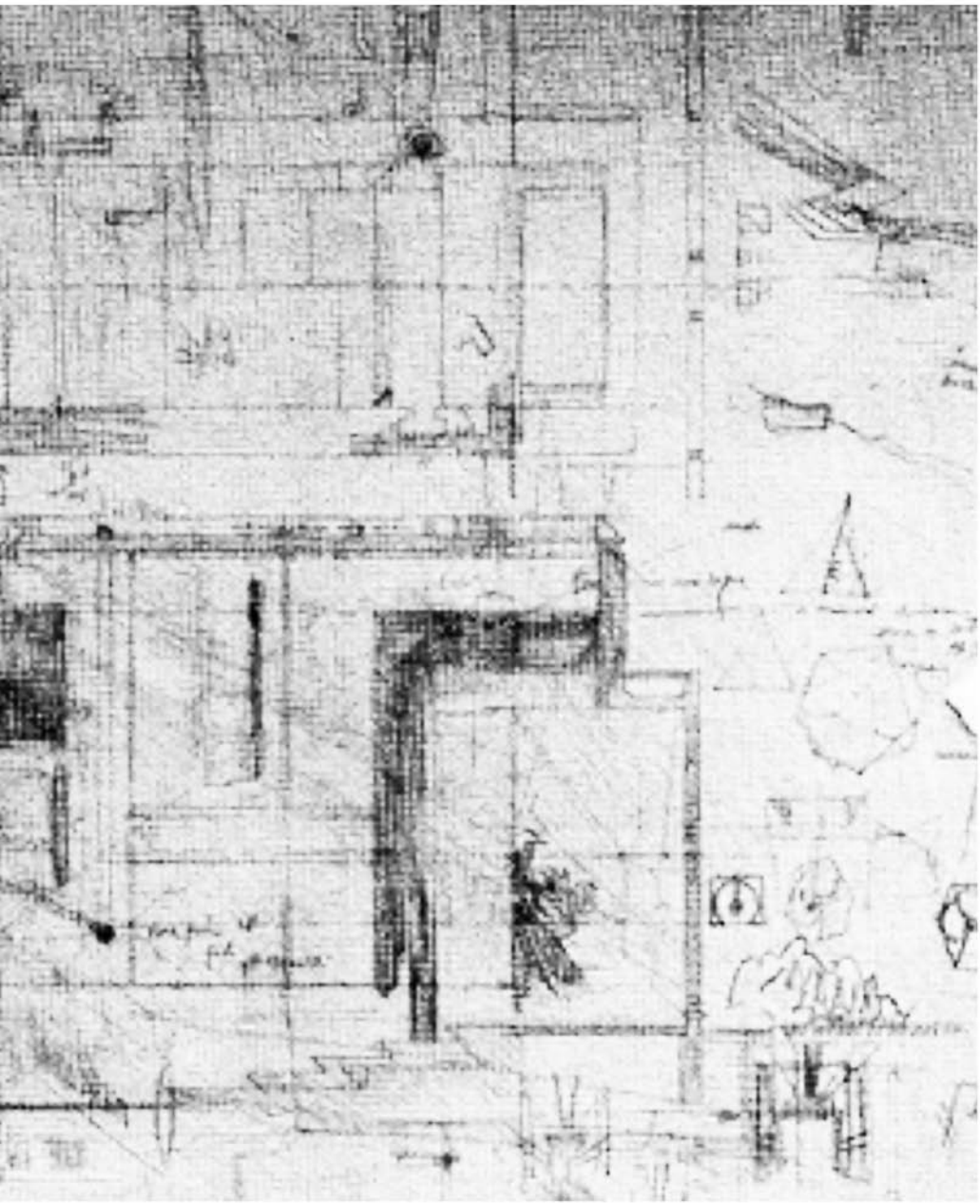

Here's the detail of the drawing
of the canopy. You can clearly...

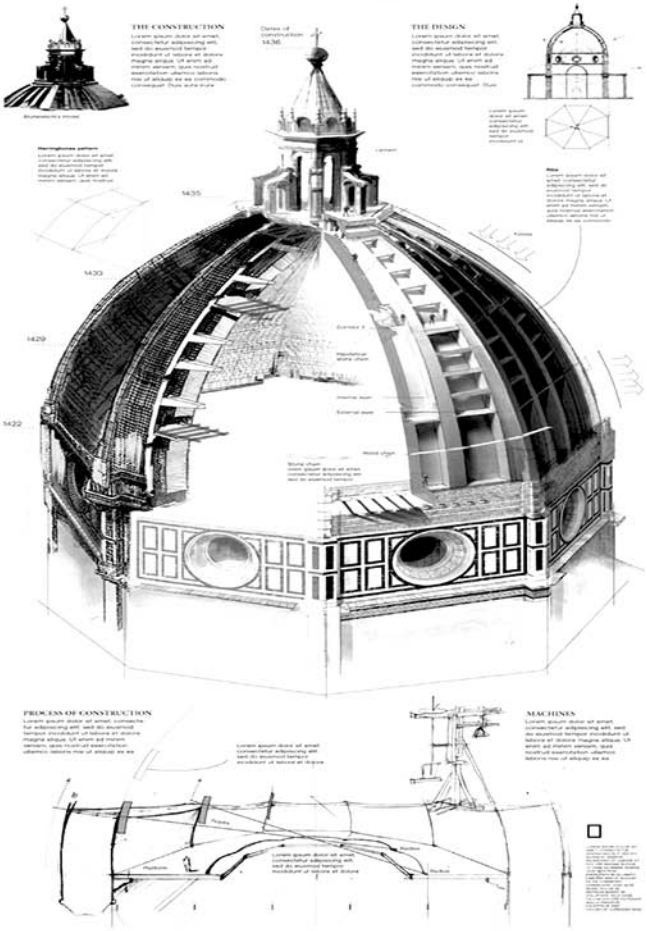

...one-tenth scale, but, when
we need some explanation,...


...he instantly gives us a sketch,
drawing it in real time.

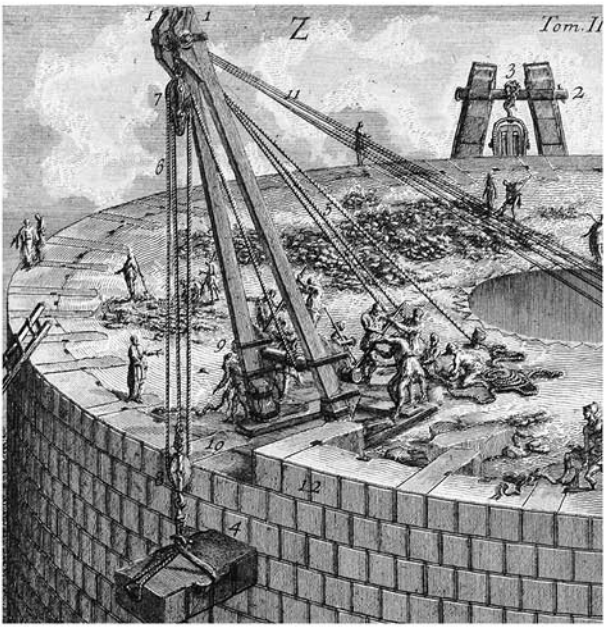


245 Drawings for the main entrance of Brion Cemetery, San Vito di Altivole (1970/75) by Carlo Scarpa. In these drawing it is clearly visible that architect Carlo Scarpa, while drawing the façade of the main entrance of the cemetery, was at the same time thinking of the inherent process of its construction - as seen in the top left hand corner and, the right hand side of the drawing where he provides information regarding the concrete inlays of the facade.





246 Left: Drawings showing the inherent process of construction behind process of the dome of Brunelleschi's *Catedral de Santa Maria del Fiore* (1296 -1436) National Geographic Visuals by Ferdinando Baptista. Right: Piranesi, Giovanni Battista. *Means by which the large blocks of travertine and marble were lifted during the construction of the large Tomb of Caecilia Metella*. From "Le Antichità Romane (Roman Antiquities)", tome 3, tavola 53 published 1756–57.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to roll
to crease
to fold
to store
to bind
to shorten
to twist
to dapple
to crumple
to shave
to tear
to chip
to split
to cut
to sever
to drop
to remove
to simplify
to dissect
to disarrange
to open
to mix
to splash
to knot
to spill
to droop
to float
to curve
to dist
to inlay
to impress
to fire
to flood
to smear
to rotate
to scrawl
to support
to hook
to suspend
to spread
to hang
to collect
of emission
of gravity
of entropy
of nature
of grouping
of layering
of felting
to grasp
to tighten
to kindle
to heap
to gather
to scatter
to arrange
to repair
to discard
to pair
to destructurate
to surject
to complement
to enclose
to surround
to encircle
to hide
to cover
to wrap
to tie
to bind
to weave
to join
to match
to laminate
to bond
to hinge
to make
to expand
to dilute
to light
to modulate
to distill
of wave
of elect-magnetic
of inertia
of conjugation
of polarization
of refraction
of simultaneity
of edge
of reflection
of equilibrium
of symmetry
of fluctuation
to stretch
to bounce
to erase
to spray
to systematize
to refer
to force
of mapping
of location
of context
of time
of carbonization
to continue

248 Serra, Richard. *Measurments of Time, Seeing Is Believing* (1996), Kunsthalle Hamburg, Germany

to backfill

verb

verb: **backfill**; 3rd person present: **backfills**; past tense: **backfilled**; past participle: **backfilled**; gerund or present participle: **backfilling**

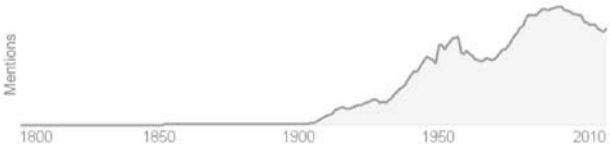
refill (an excavated hole) with the material dug out of it.
"they backfill the hole to street level"

noun

noun: **backfill**

material used for backfilling.
"archaeologists are attempting to understand the origin of the backfill found there"

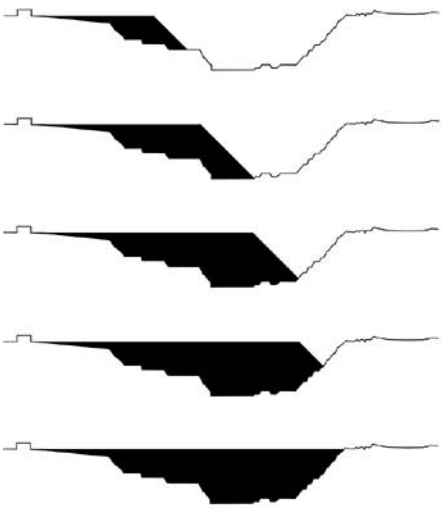
Use over time for: backfill



249 Top: Image showing truck backfilling. Bottom: Definition with a timeline. "To Backfill Meaning - Google Search." Google. Accessed September 02, 2018.

520 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W

250 Image showing the backfilling of a tailing pond, in Huelva Spain.



251 Sequence of conceptual images adapted to the longitudinal section of the S. Domingos orebody and mining exploitation drawn in 1945. These show the proposed progressive backfilling of the open pit at S. Domingos Mine, Portugal. © Jared Miguel Fantasia. 2018.

to cover

verb

verb: **cover**; 3rd person present: **covers**; past tense: **covered**; past participle: **covered**; gerund or present participle: **covering**

put something on top of or in front of (something), especially in order to protect or conceal it.
"the table had been **covered with** a checked tablecloth"

noun

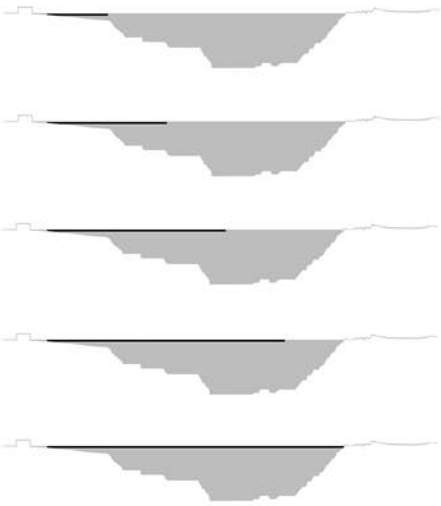
a thing which lies on, over, or around something, especially in order to protect or conceal it.
"a seat cover"

Use over time for: cover

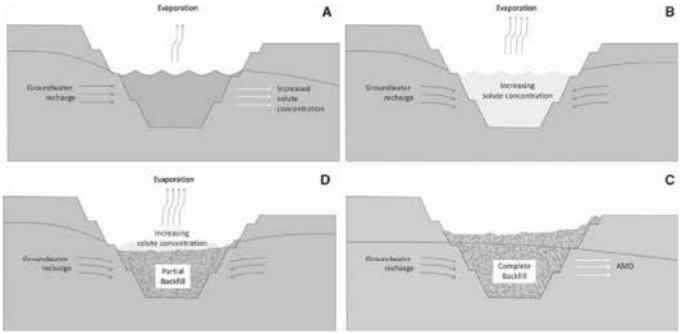
252 Top: Image showing the covering of a vast extension of terrain by geosynthetics. Bottom: Definition and graph. "To Cover Meaning - Google Search."

524 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W

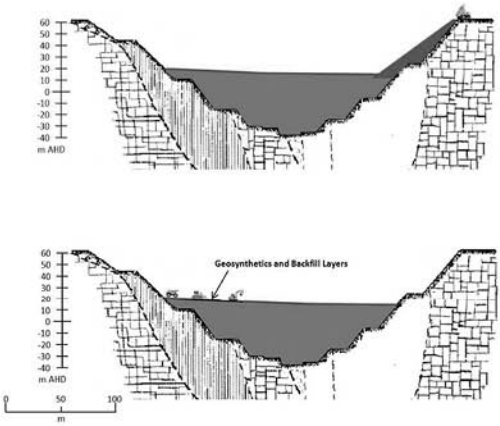
253 Image showing the laying of asphalt for the construction of a road.



254 Sequence of conceptual images (© Jared Miguel Fantasia. 2018) adapted to the longitudinal section of the S. Domingos orebody and mining exploitation drawn in 1945. These show the proposed progressive laying of layers for the impermeability of the backfilling of the open pit at S. Domingos Mine, Portugal.

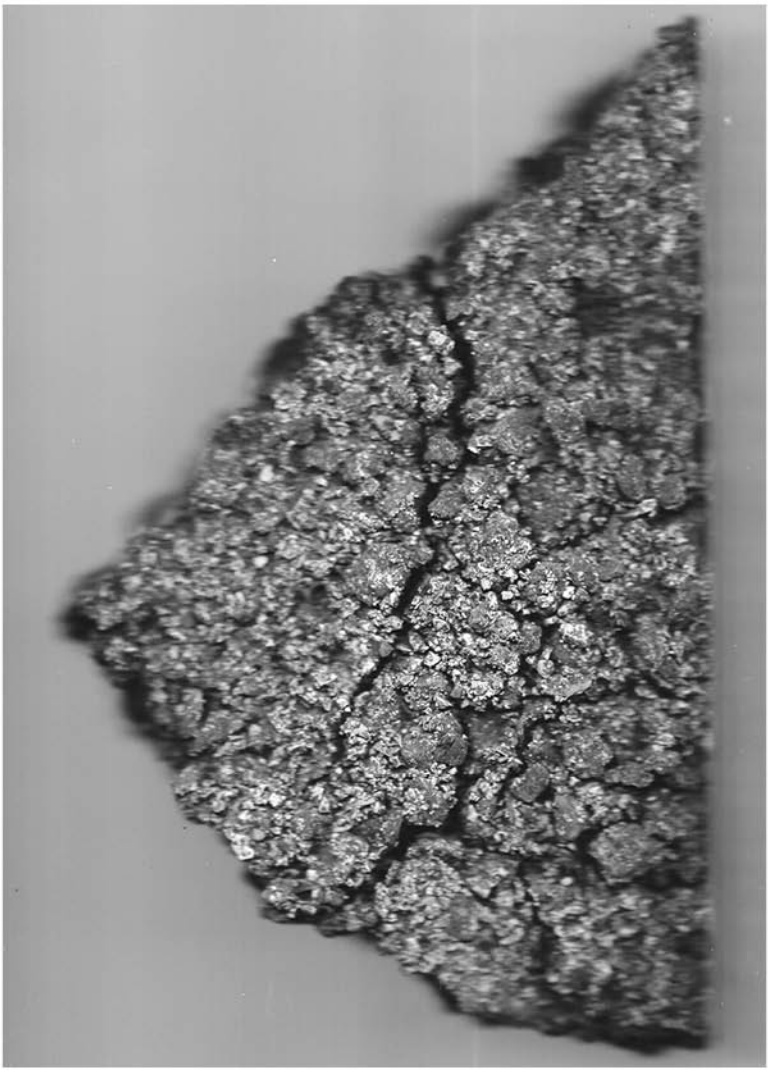


255 "Conceptual equilibrium hydrogeological regimes for an arid region pit lake. Clockwise from top left through-flow system, terminal sink, completely backfill through-flow system, partially backfill terminal sink" These images propose to mining companies (who are considering leaving pits open or backfilling them - partially or fully) four situations to consider, depending on their hydrological and climatic situations. The above situations do not consider sealing of the pit.

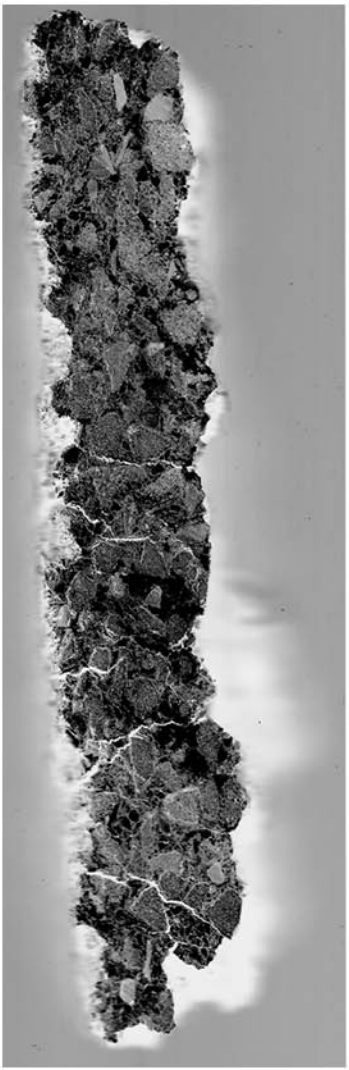


256 Sections showing schematic approaches for the backfilling of the main pit at the former Rum Jungle Mine Site, North East Territory, Australia. Top: Waste rock is dumped from the pit crest and then advancing machinery over it, progressively filling the pit. Bottom: This approach involves draining the pit entirely and placing waste rock in it by conventional earthworks. To access the pit floor with earthmoving machinery, the low strength tailings surface is strengthened.

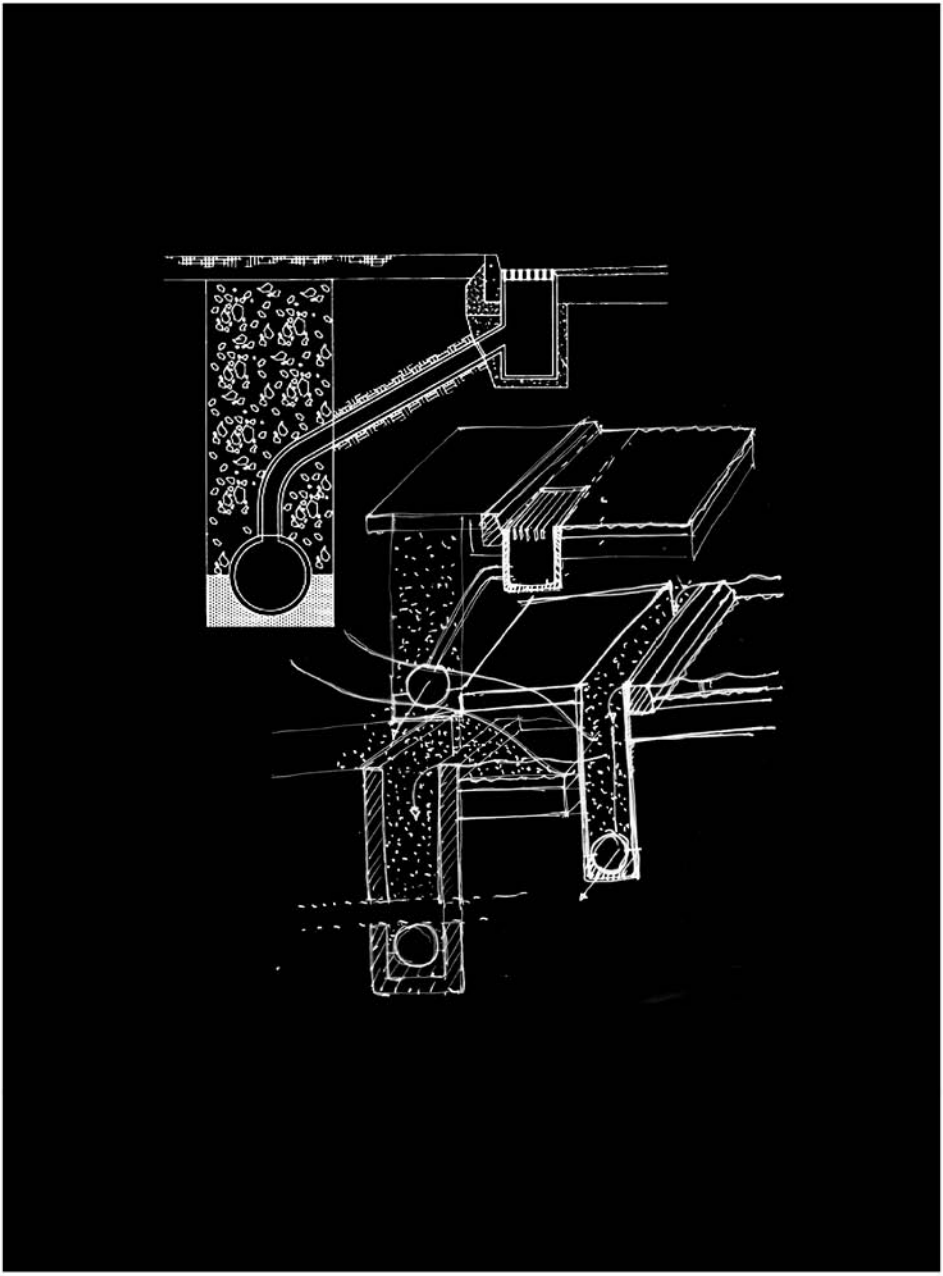
257 Two pictures (© Jared Miguel Fantasia, 2019) showing a removed part of asphalt from a road. We can observe rubble on the left and to the right stone paving. The asphalt has been placed on top to better impermeabilize the ground from water seepage and thus directing rain water to the side gutter. The application of asphalt is a protective layer that better impermeabilizes and protects the ground below.



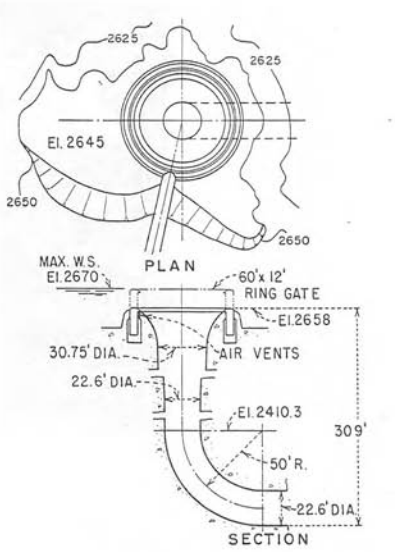
258 Two pictures (© Jared Miguel Fantasia. 2019) showing detail of asphalt cut from and removed from a road (see pictures on pages 528-529). This is the texture desired for the project of the covering of the backfill of the open pit at S. Domingos. From the section on the right we can see the composition of tar in relation to gravel.



259 Two images (© Jared Miguel Fantasia. 2019) of a street kerb with a road storm water filter drainage system. The study of standard asphalt roads and their storm water filter drains was crucial for the development of the architectural project. These drains are typically situated bellow the curb due to the necessity of draining water immediately before it accumulates and spills on to the walkway. The objective is for the road not to accumulate water and neither the walkway. In the architectural project the thought process employs the same construction technique but in the reverse because the architectural project desires to create a mirror of water by accumulating it below the curb. As the water level rises above the desired height of the kerb, equivalent to the height of the mirror of water, it will then spill into the drain. This avoids any spillage and filtering of the water under the protective layers and into the toxic backfill within the closed pit.

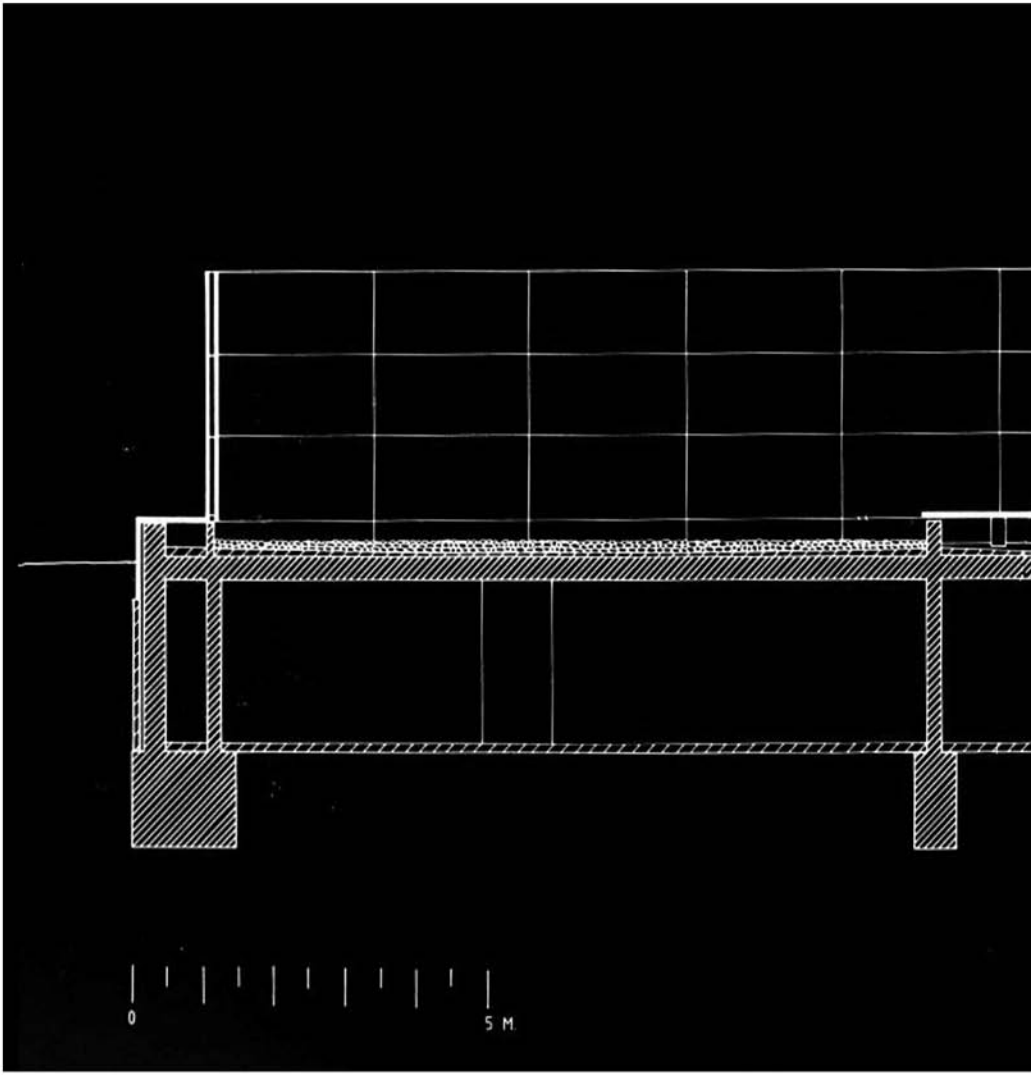


260 Study process sketches with standard cross-section of a storm water road drain that can be seen in the two images on the left on page 532. (Other standard designs were also taken into consideration and can be consulted in attachments on pages 90 to 95). This study was essential for the elaboration of the drawings on pages 546-547.

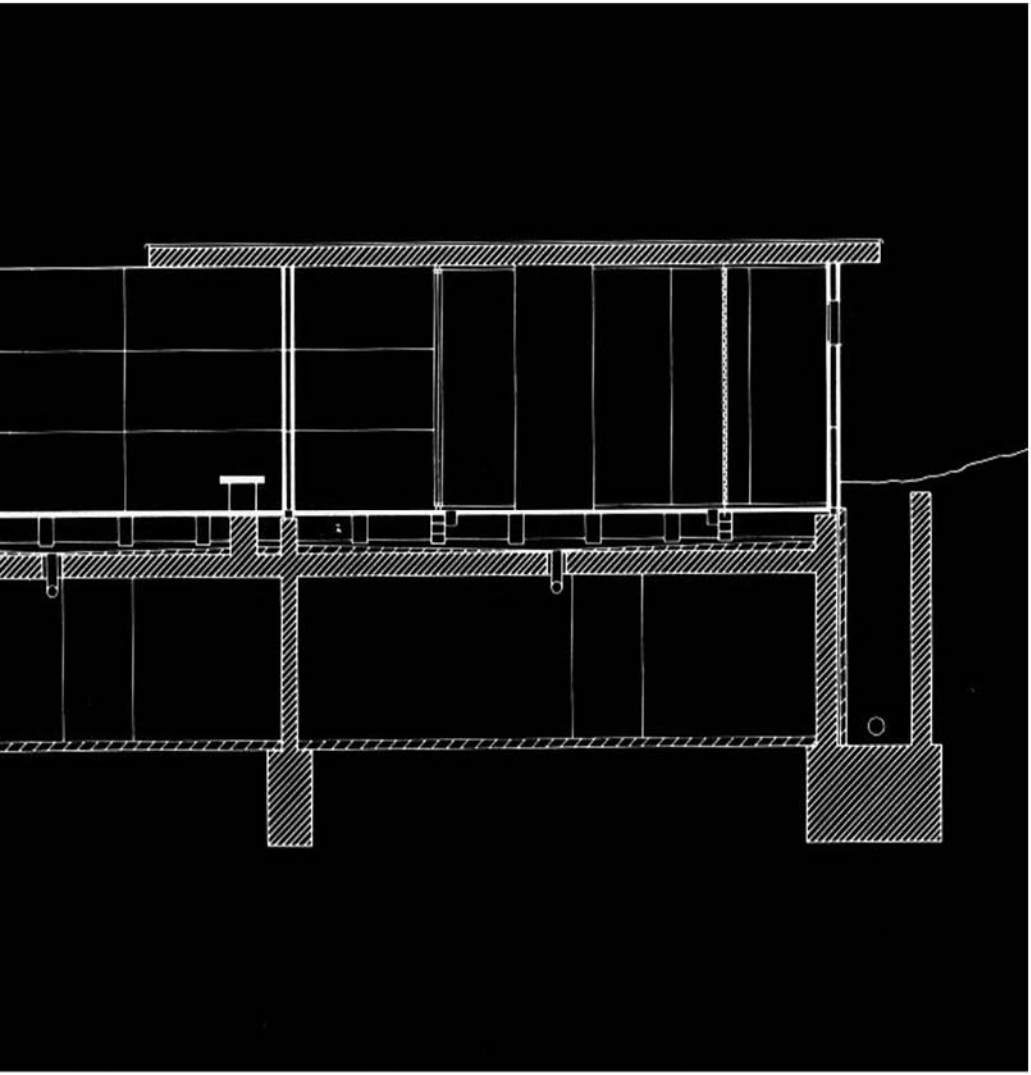


261 Plan, section and photograph of the Owyhee Dam spillway in eastern Oregon, United States. When water rises to a maximum level, these spillways control the release of the excess water from within the dam, diverting it to the river downstream. This architectural project acts as a recipient as it facilitates the collection of water. However, instead of the drainage of excess water from inside the structure - as in the case of a dam spillway, it facilitates water drainage over the outer perimeters of the asphalt layer that covers and waterproofs the volume of backfill.

262 Still image from *Mies on Scene,* a 2018 Spanish documentary directed by Pep Martín & Xavi Campeciós. The still image shows one of the two pools of water at the Barcelona Pavilion,by architect Ludwig Mies van der Rohe. The current image suggests what was intended in the current architectural project and was an influence in the method of design as the Barcelona Pavilion's water drainage system allows the mirror of water to reach close to the level of the travertine floor but does not allow the water to pour over it. This image is accompanied with the cross section on pages 538-539 and, the conceptual axonometric section on pages 540-541.



263 Cross section of the main building of the Barcelona Pavilion by architect Ludwig Mies van der Rohe. Here we can see the pool of water which is filled with pebbles and how, when the water rises - before touching the travertine floor slabs - its direction turns and it flows under the floor where it is then directed into the water drainage system. (The axonometric drawing can be consulted on pages 540-541.)



Legend:

1 - Concrete structure

2 - Lean concrete and waterproofing

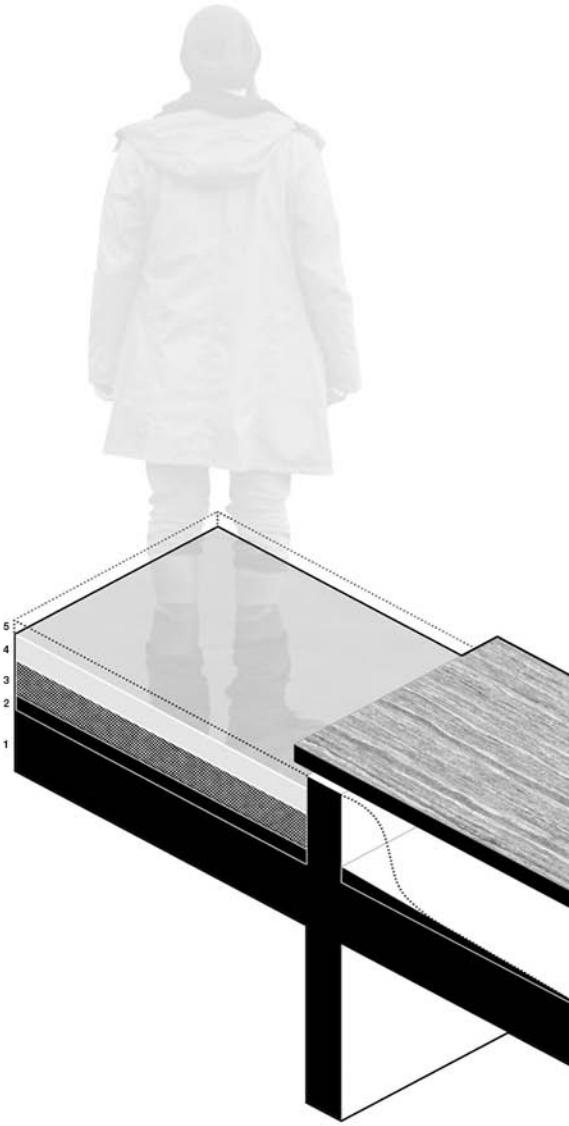
3 - Pool filled with pebbles

4 - Normal level of water in the pool before overflow into the drainage system

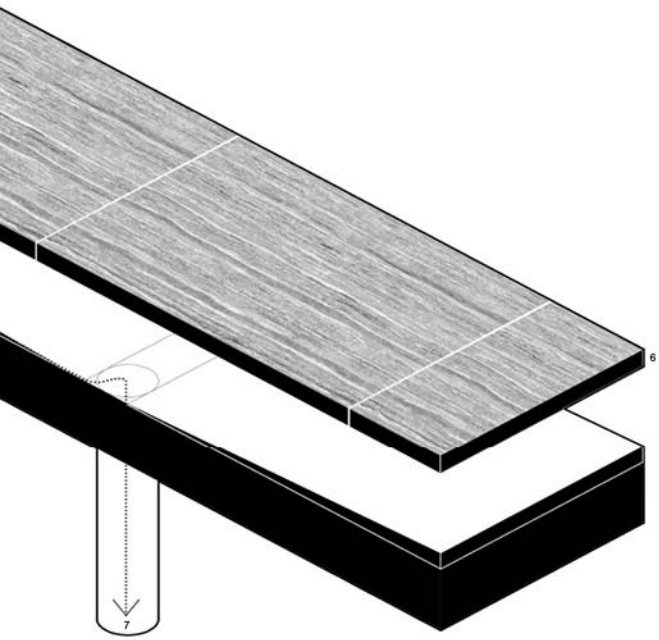
5 - Rising of water until overflow into the water system

6 - Travertine floor slabs

7 - Water drainage system



264 Conceptual axonometric cross section (© Jared Miguel Fantasia. 2019) showing the concept behind the drainage of the water pools in the Barcelona Pavilion. This section was drawn based on the knowledge of the section shown on pages 538 to 539. Note: The above drawing is for illustrative purposes only.


6
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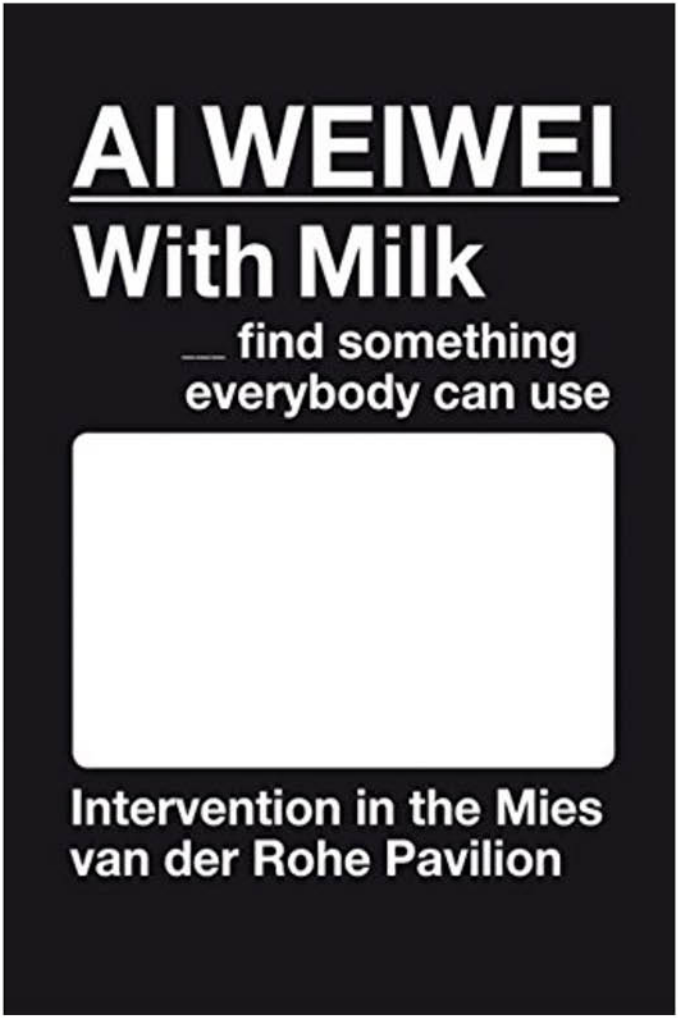
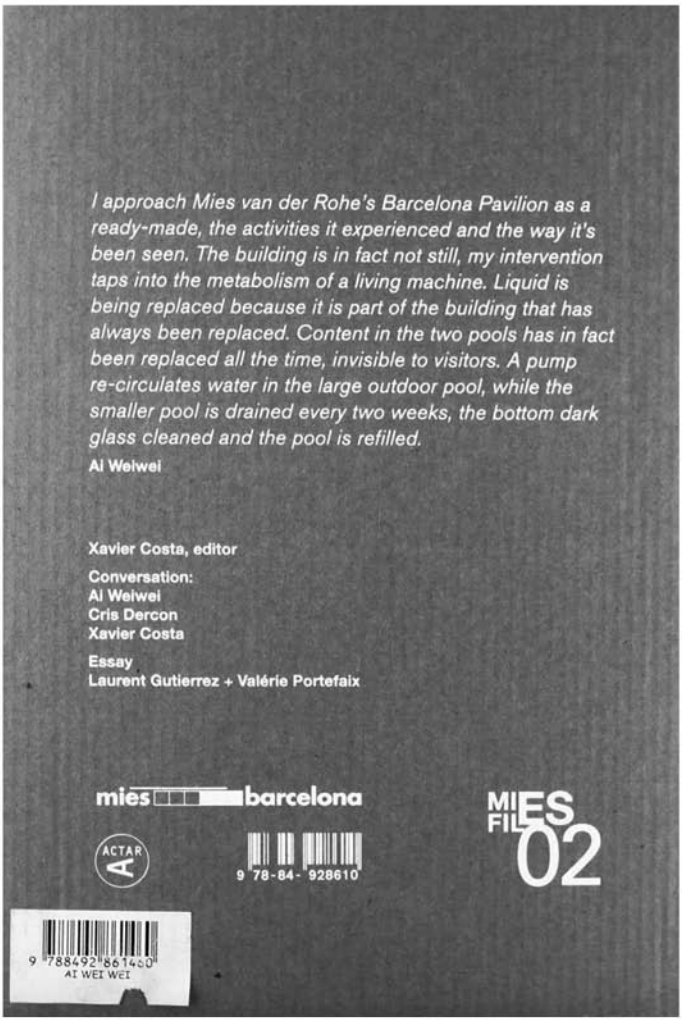
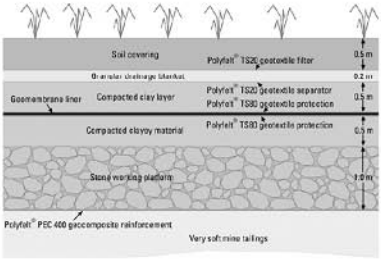


265 Copies of Front and back cover of *Ai Weiwei: With Milk, find something everybody can use (Intervention at the Mies van der Rohe Pavilion)*. Regarding this piece the Chinese contemporary artist and activist Ai Weiwei stated, "I approach Mies van der Rohe's Barcelona Pavillion as a ready-made, the activities it experienced and the way it's been seen. The building is not static, in fact, my intervention explores the metabolism of a living machine. Liquid is replaced because it is part of the building that has always been replaced. In fact, the content of the two pools is replaced all the time, unnoticed to visitors. A pump re-circulates water in the large outdoor pool while the smaller pool is drained every two weeks, the dark glass at the bottom is cleaned and the pool refilled.Regular work is done to ensure that the monument appears unchanged, timeless; not forgetting that the entire building stands as a perfect reconstruction. In milk and coffee intervention, the under layer of this monument surfaces and persists in consciousness; it refuses to be flushed away. Upkeeping the condition of milk and coffee is the same as preserving a body, a demanding effort against light, air, warmth… anything encourages growth and change. What is vigour or geometry, clarity of assembly, and enlightened optimism, combined with ordinary everyday life? In its endeavour to correct mistakes of the past, Modernism might have made new mistakes. Today's cultural attitude doesn't mind mistakes; it sets out to move forward unafraid of making new ones."[155]

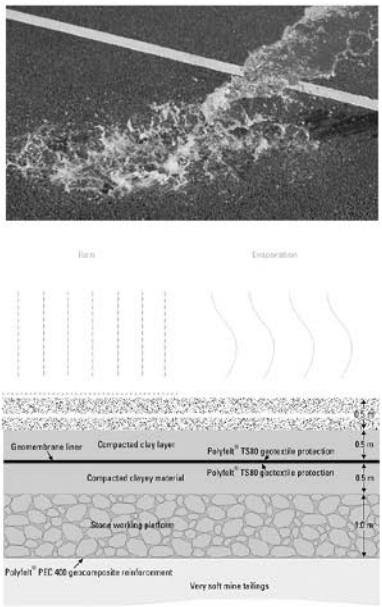


Ai WeiWei considers Mies van der Rohe's Barcelona Pavillion not to be static due to the fact that, unnoticed by visitors, there is a process of constant water removal in the two pools of the pavillion (which Weiwei observes is 'a living machine'). Similarly, the erosion and water seepage of the project for the S. Domingos open pit is imperceptible by the visitor. The aim of the architectural design and its inherent process of construction (as in Ai Weiwei's observation), explores metabolism as a living machine and thus results in a surface where this accumulation of water seepage and erosion will be visible. To consider the S. Domingos open pit as a living machine requires the study, reflection and understanding of how this machine works and, also how the intervention will work in its various aspects. It generates the questions: How do the walls of the current open pit erode within it? How does the water seep into the open pit ? How does one create a surface that can act as a contrasting dry surface, that intersects with the walls of the open pit and accumulates the surrounding erosion that falls onto it, but at the same time can also be transformed into a mirror of water when precipitation occurs? How does one design a structure of contrasts that shows the visitor the entropic decay over time in this territory? How can one intervene in a constant living breathing territory such as that of S. Domingos ? The design of the current architectural project and the notion of its inherent process of construction, requires the knowledge that it is not just a static object, subject to the elements surrounding it, but it is indeed a living machine due to the fact that its conception relies on the necessity of a fully functioning water drainage system.

544 S. Domingos, Portugal 37°40'05.8"N 7°29'28.2"W



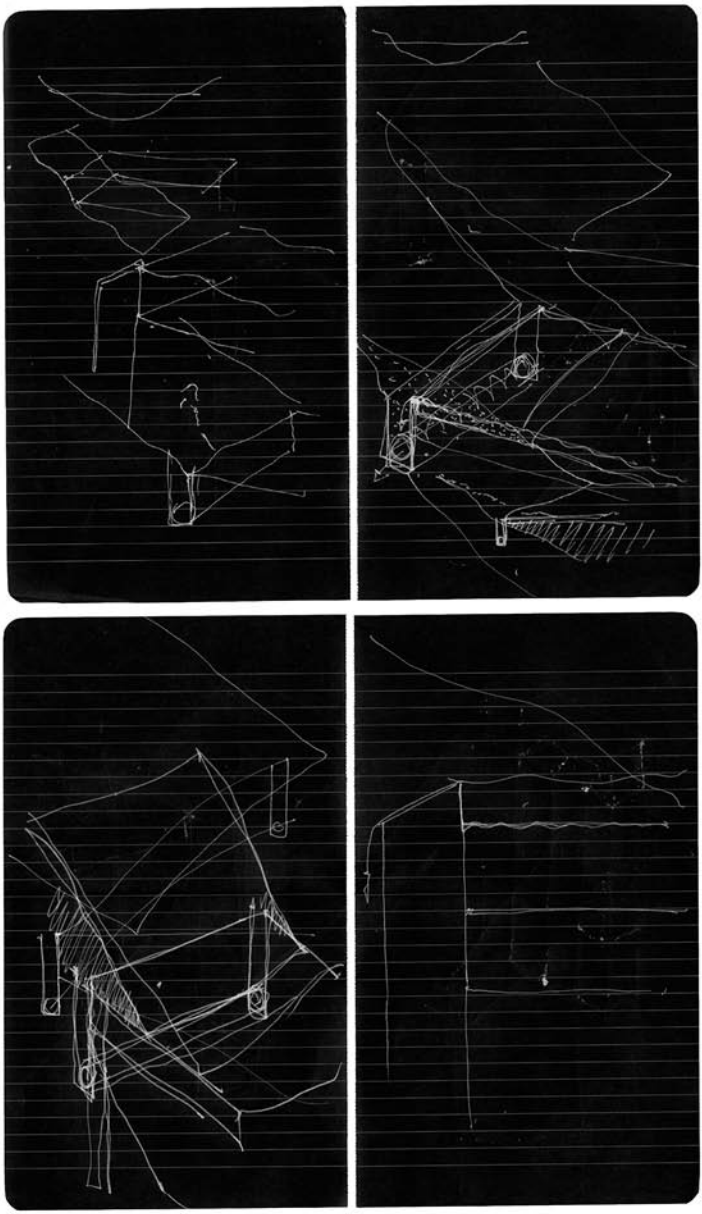
266 Detailed Section through the backfilling and covering of a tailing pond, in Huelva Spain.



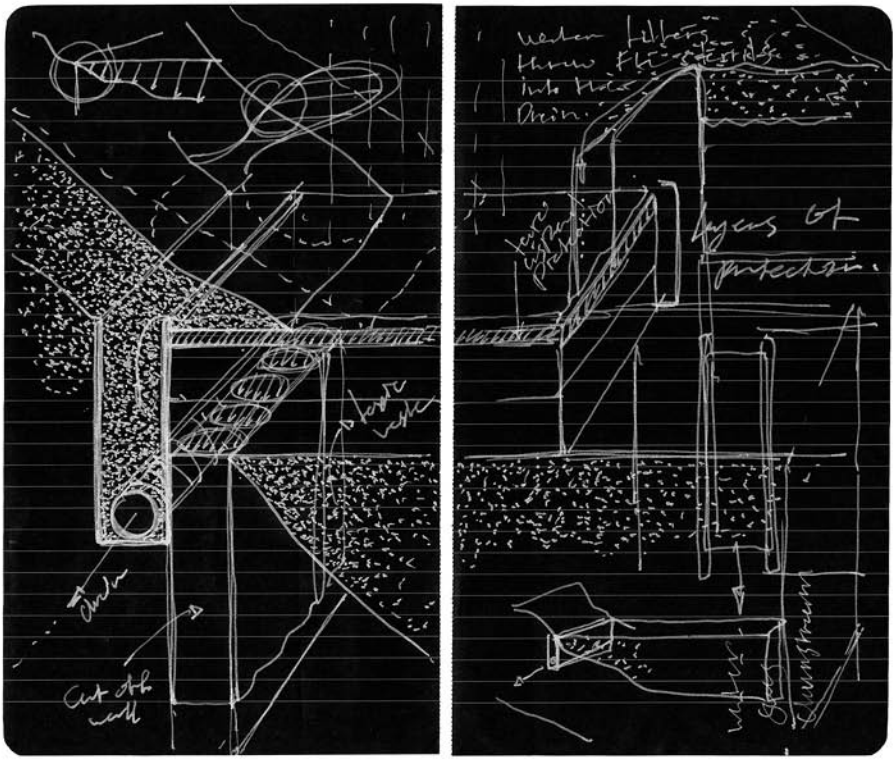
1 Two overlays of asphalt mixed with surrounding mining slag are laid. A layer of Fortifix® and Rotaflex ® are laid in-between the two asphalt overlays providing crack control, reinforcement and waterproofing. The final layer - a 25mm topping composed of mining slag trowelled and bound with resin - creates a flat surface on which to accumulate rain water, acid mine seepage (to the height of 20mm) and, subsequent evaporation (which leaves behind metallic salts). The flat surface contrasts with the deposition of debris from the wall of the open pit over time.

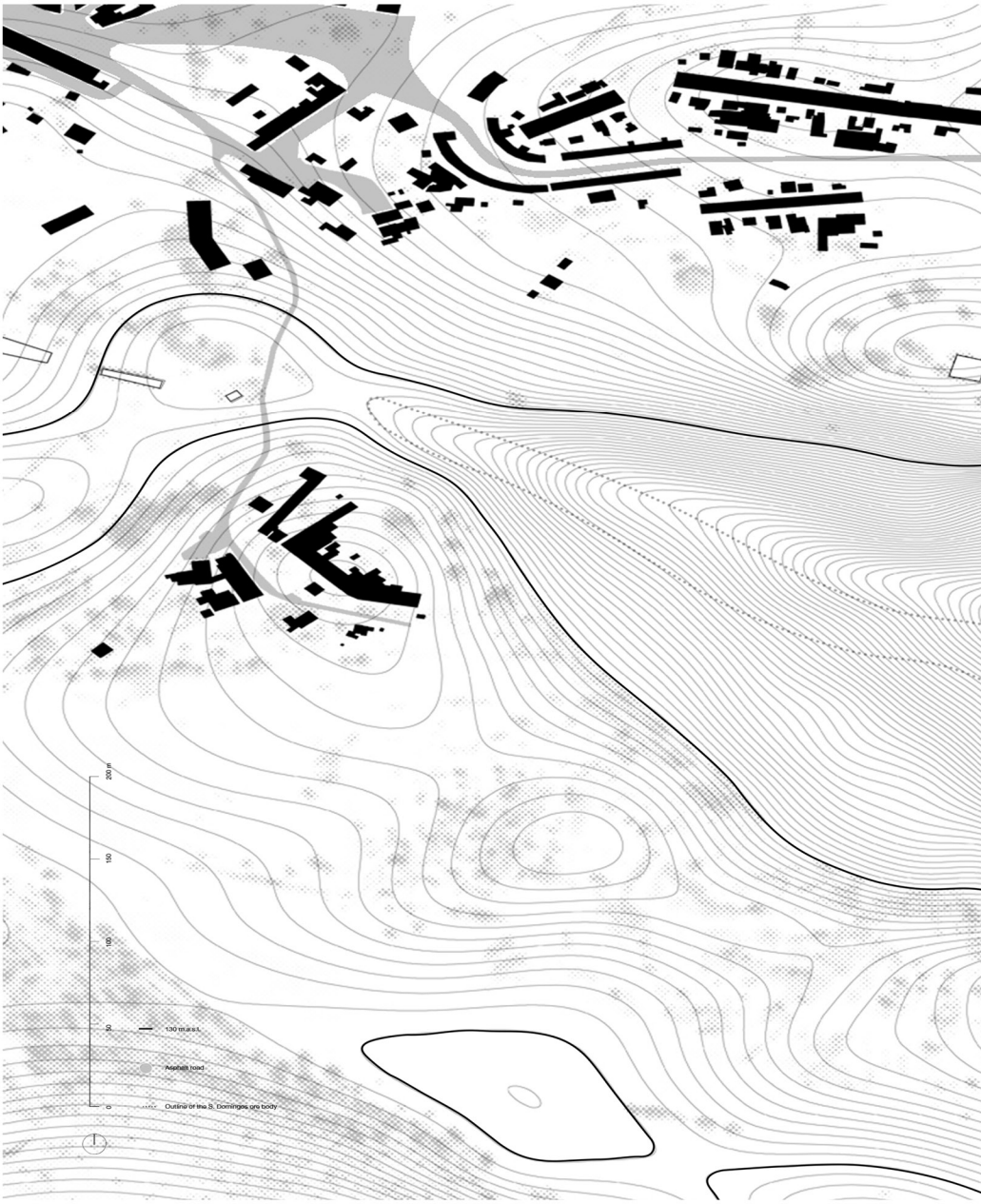
Adapted from Geosynthetic Solutions in Civil Engineering - TenCate Geosynthetics. and, "Asphalt Road Reinforcement | Reflective Cracking of Pavements | ABG Geosynthetics." ABG Geosynthetics | Geocomposites | Geogrids | Geocells | Geotextiles

267 Detailed section through backfilling of the proposed project for the open pit at S. Domingos, Portugal. This detail was adapted from a detailed sectio drawing made for the backfilling and covering of a tailing pond, in Huelva Spain. (img. 266) Note: The above drawing is for illustrative purposes only.

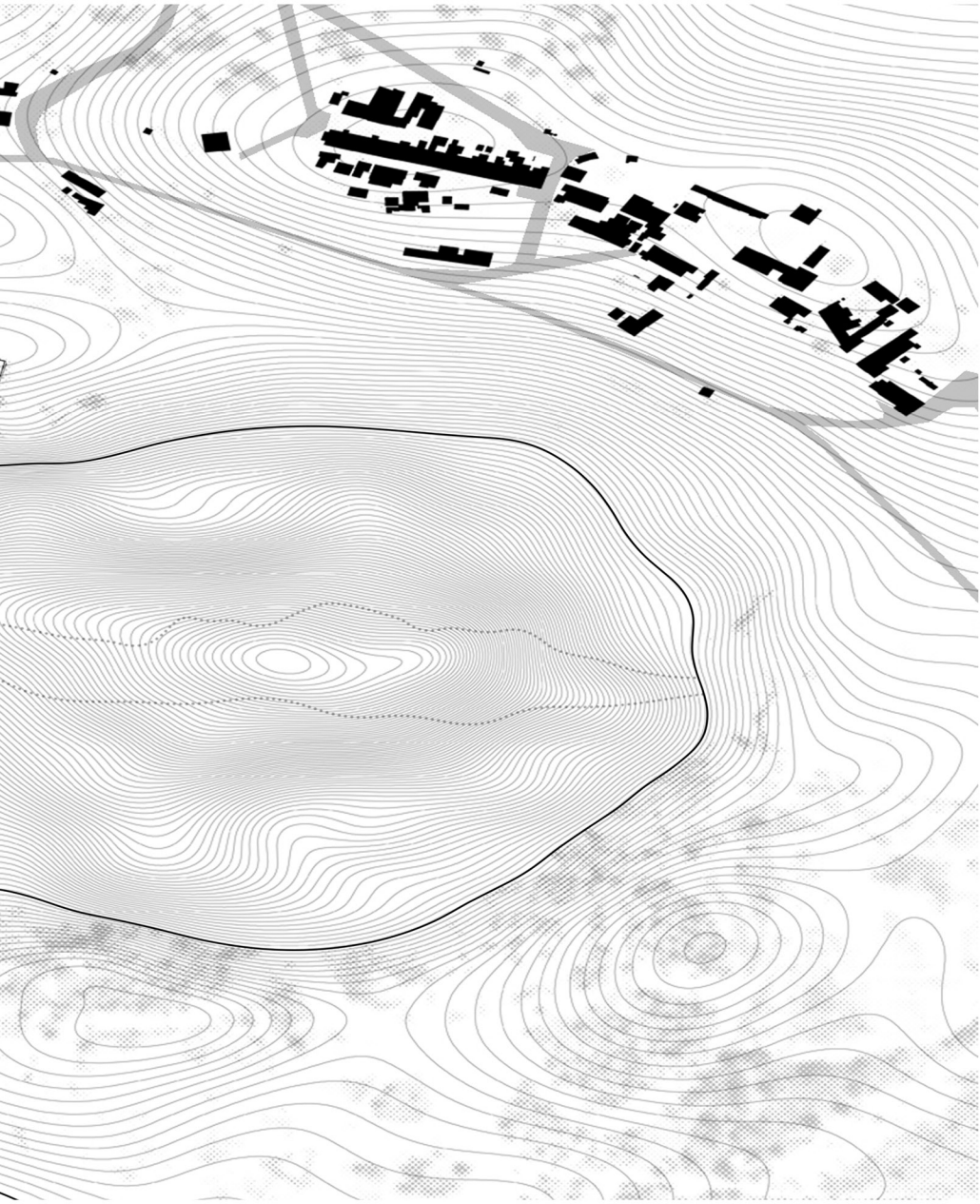


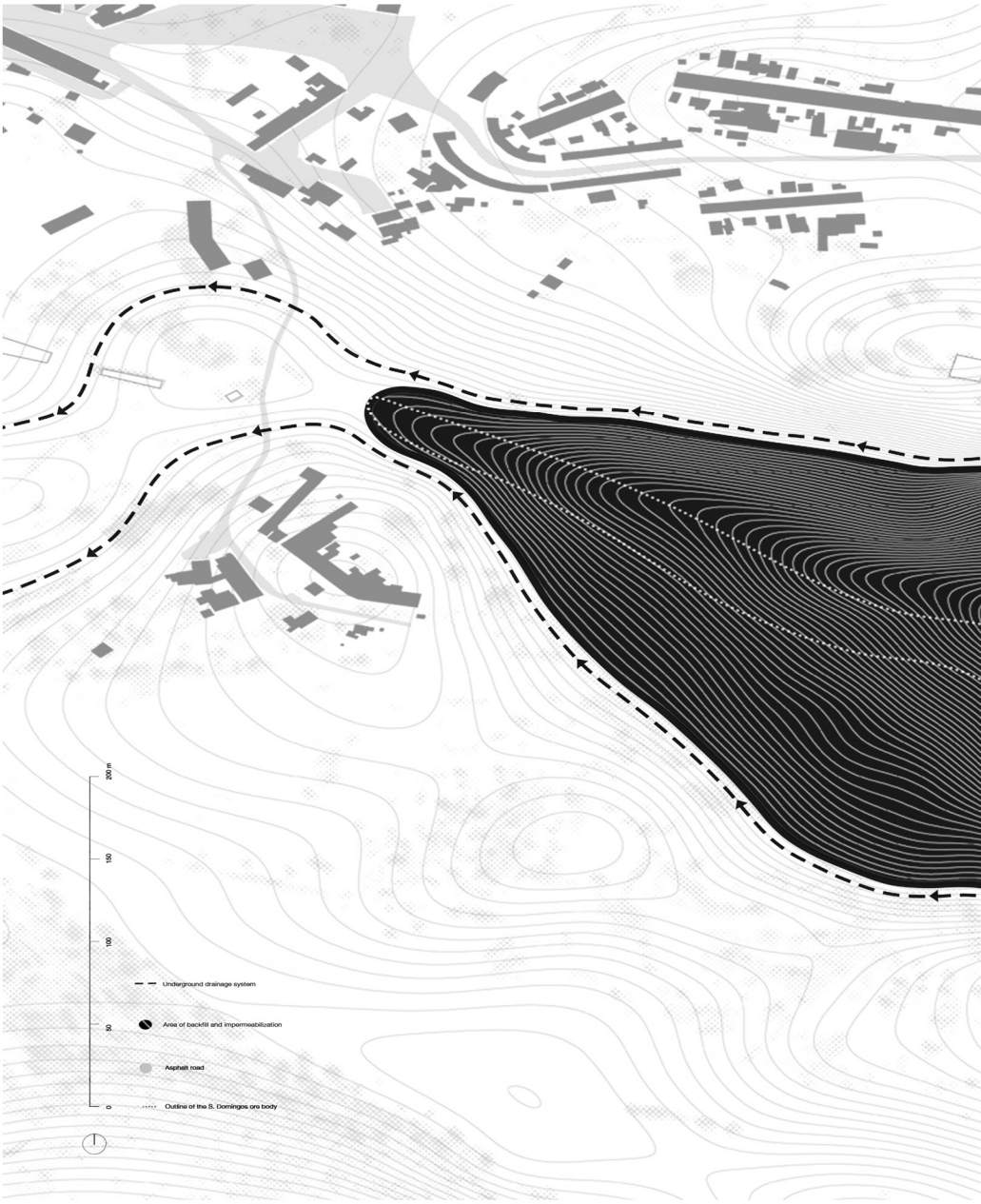
268 Compilation of conceptual drawings (© Jared Miguel Fantasia. 2018) relating to the design of the perimeter water draining system, from a notebook used during the development stage of the inherent process of construction of the architectural project in this thesis.


Layers of protection

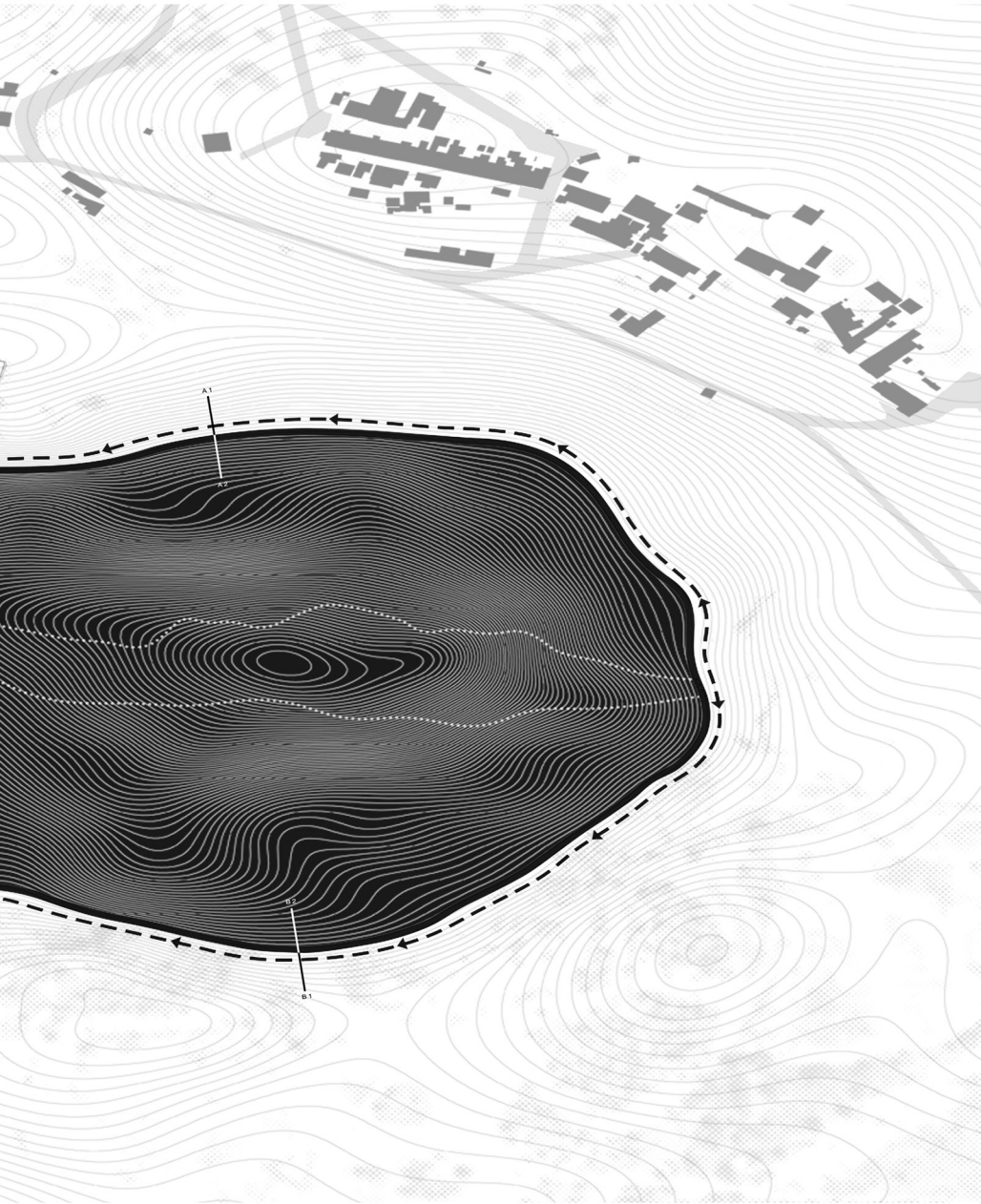


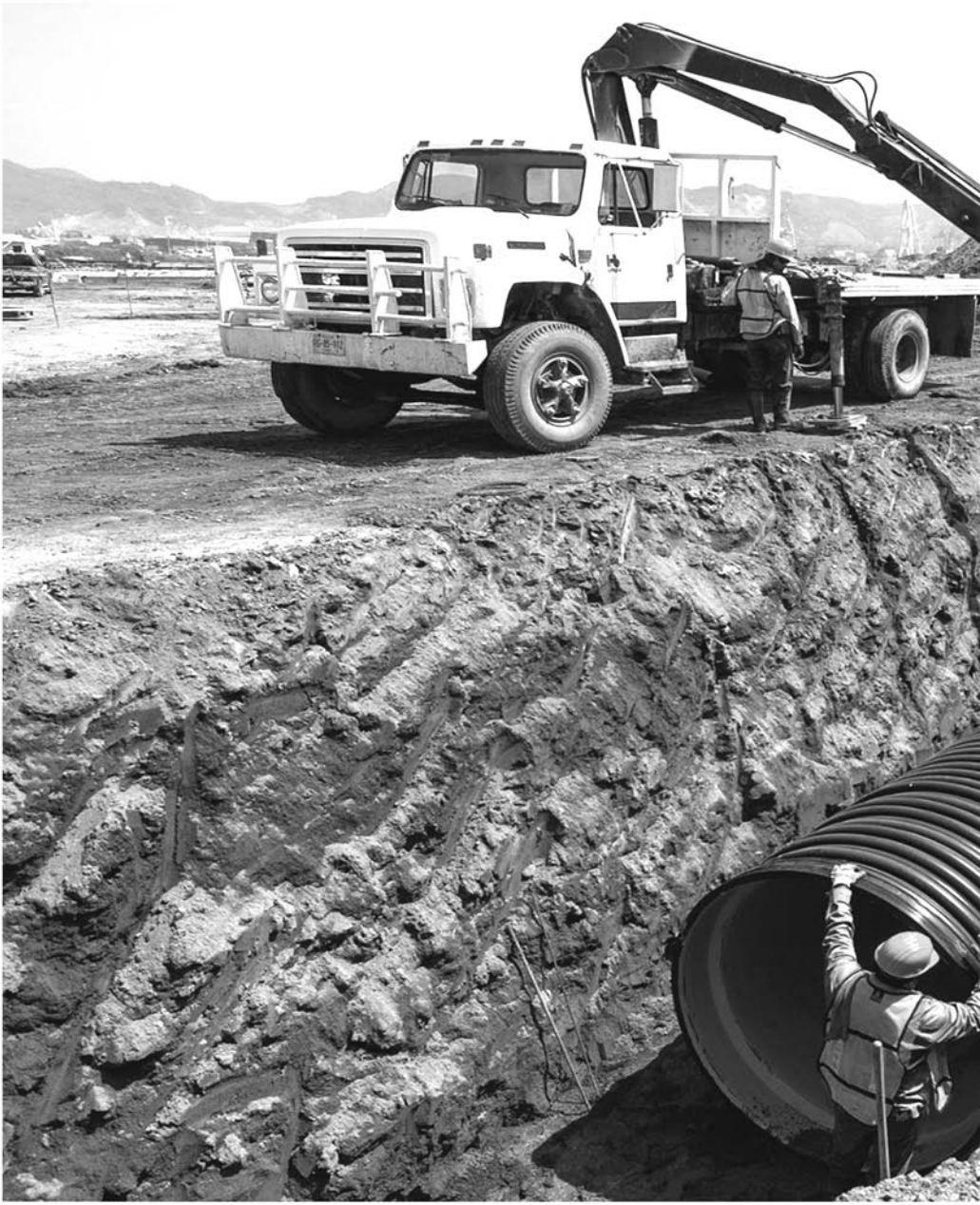
269 Map (© Jared Miguel Fantasia. 2018), generated by cartography from the SRTM Worldwide Elevation Data, suggesting an empty S. Domingos open pit and, within its interior the orebody. Here we can see the 130 meters above sea level contour and the main asphalt road that leads from the S. Domingos mining village to the entrance of the mining area and to the opening of the open pit. This map is to be compared with map with the proposed architectural project on the following pages 550-551.



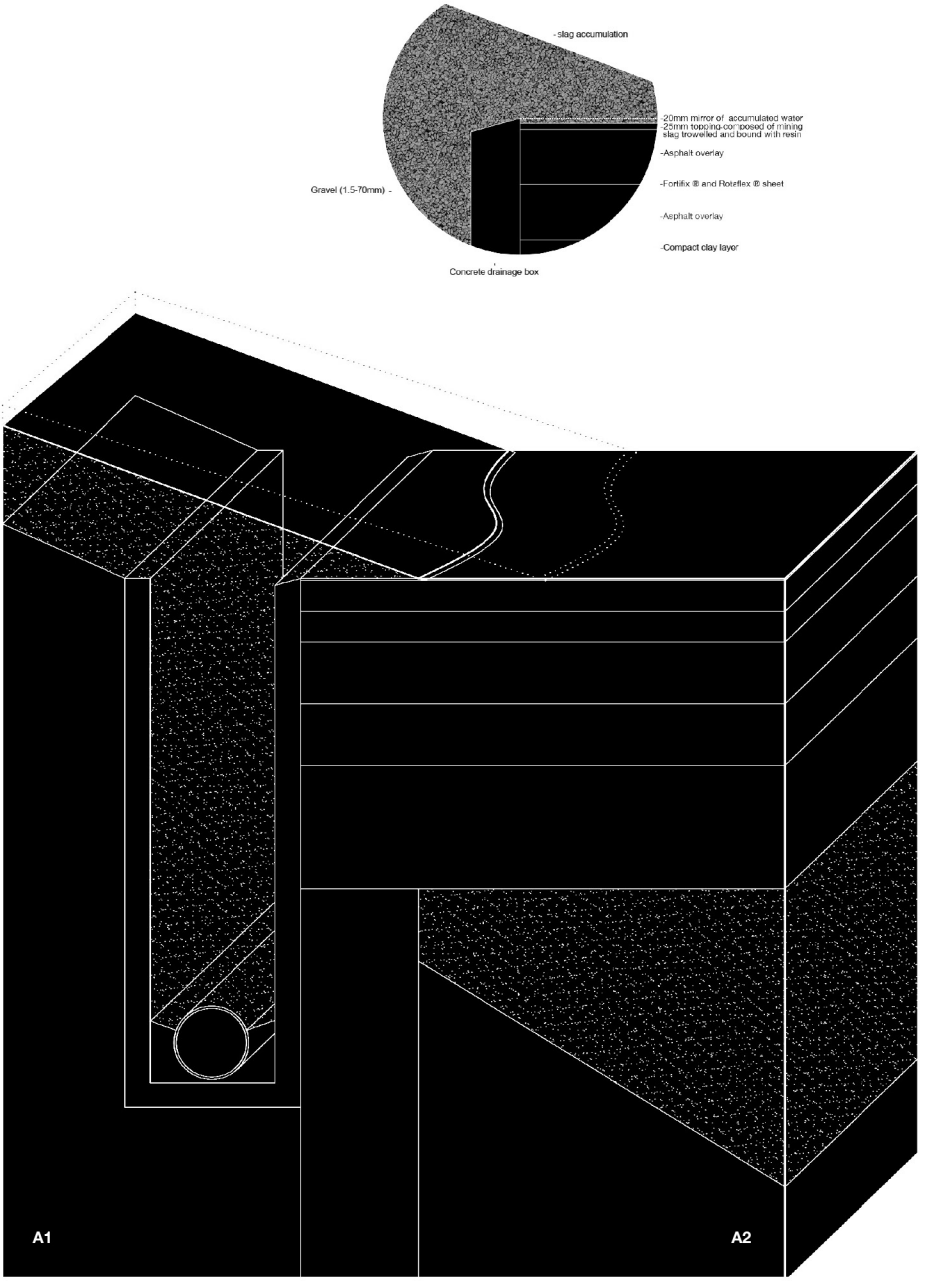


270 Map (© Jared Miguel Fantasia. 2018), generated by cartography from the SRTM Worldwide Elevation Data, showing the proposed architectural project of the filling and impermeabilization of the S. Domingos open pit. We can see in black, the area of backfill and impermeabilization and the proposed underground drainage system that follows the 130 meter above sea level contour. As the accumulated water overflows into the concrete drainage box, it then seeps into the HDPE perforated conduit where it is then directed to spill into the lower valley of the S. Domingos mining area. This map is to be compared with the map on previous pages 548-549 and, the sections on pages 554-555. Note: The above drawing is for illustrative purposes only.


A1
A2
B2
B1

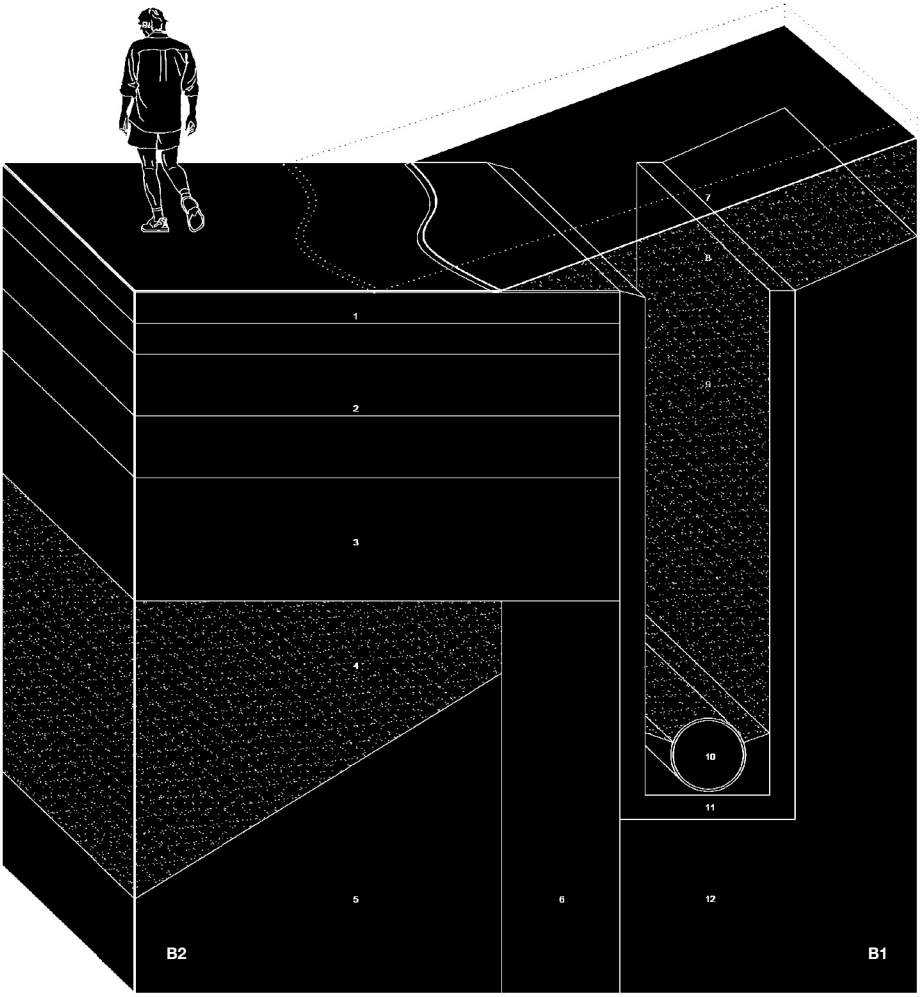


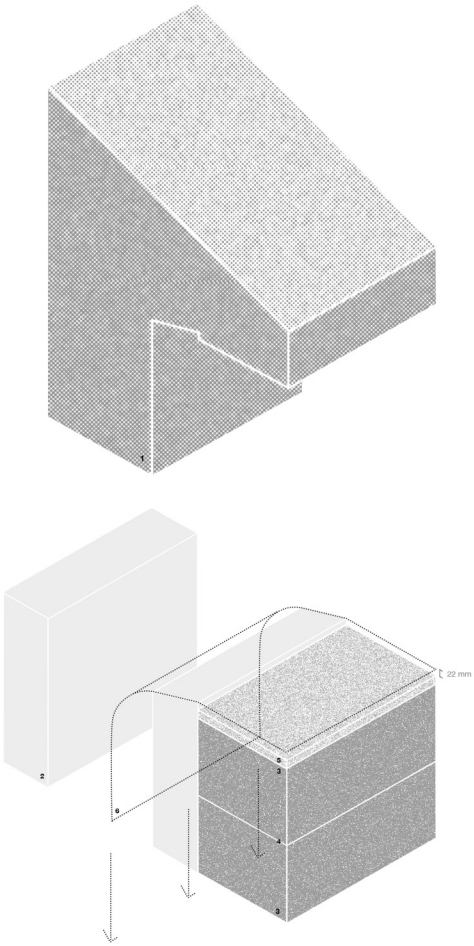
271 Photograph showing a high density polyethylene pipe installation in storm drain project in Mexico. This image reflects the idea present in the map showing the layout of the perimeter drainage system for the architectural project on pages 550-551 and the also the detailed sections on pages 554-555.



272 Detailed sections (© Jared Miguel Fantasia. 2018), depicted on the map on pages 550-551, of the proposed project for the backfilling and impermeable covering of the S. Domingos open pit.

1	-20mm mirror of accumulated water -25mm topping composed of mining slag trowelled and bound with resin -Asphalt overlay -Fortilix ® and Rotaflex ® sheet -Asphalt overlay	0.5 m
2	-Compact clay layer -Polyfelt ® TS20 geotextile protection -Geomembrane liner -Polyfelt ® TS20 geotextile protection -Compact clayey material	1.0 m
3	-Stone working platform -Polyfelt ® PEC 400 geocomposite reinforcement	1.0 m
4	-Backfill composed of very soft mine tailings	
5	-Pre-existing topography	
6	-Geolock cut-off wall with an internal HDPE membrane and integrated perimeter dewatering well	
7	-Deposition from the surrounding walls of the open pit over time	
8	-Surrounding slag accumulation	
9	-Gravel (1.5-70mm) -HDPE 2.00 mm geomembrane -Sand 0.07-10mm	
10	-HDPE perforated conduit -Lean concrete form	
11	-Concrete drainage box	
12	-Pre-existing topography	





Legend:

1 - Surrounding slag accumulation deposited onto the asphalt surface and into the concrete drainage box from the terrils above;

2 - Concrete drainage box;

3 - Asphalt overlay mixed with surrounding mining slag;

4 - Layer of Fortifix ® and Rotaflex ®;

5 - 25mm topping composed of mining slag troweled and bound with resin;

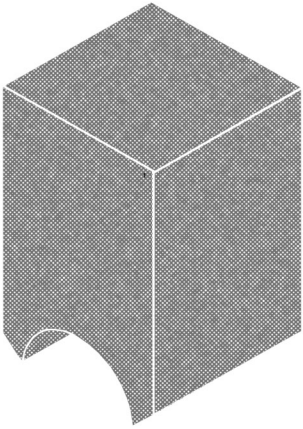
6 - 20mm mirror of water spilling into the drainage box;

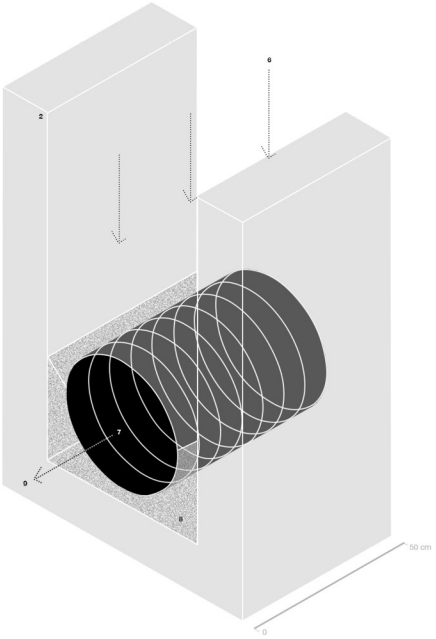
7-HDPE perforated conduit ;

8- Lean concrete form;

9- Downstream flow in HDPE perforated conduit directed to spill in the S. Domingos lower valley.

273 Detailed scheme (© Jared Miguel Fantasia. 2018) showing how the water flow will filter into the HDPE perforated conduit underneath the proposed project for the backfilling and impermeable covering of the S. Domingos open pit (see pages 554-555) Note: The above drawings are for illustrative purposes only.

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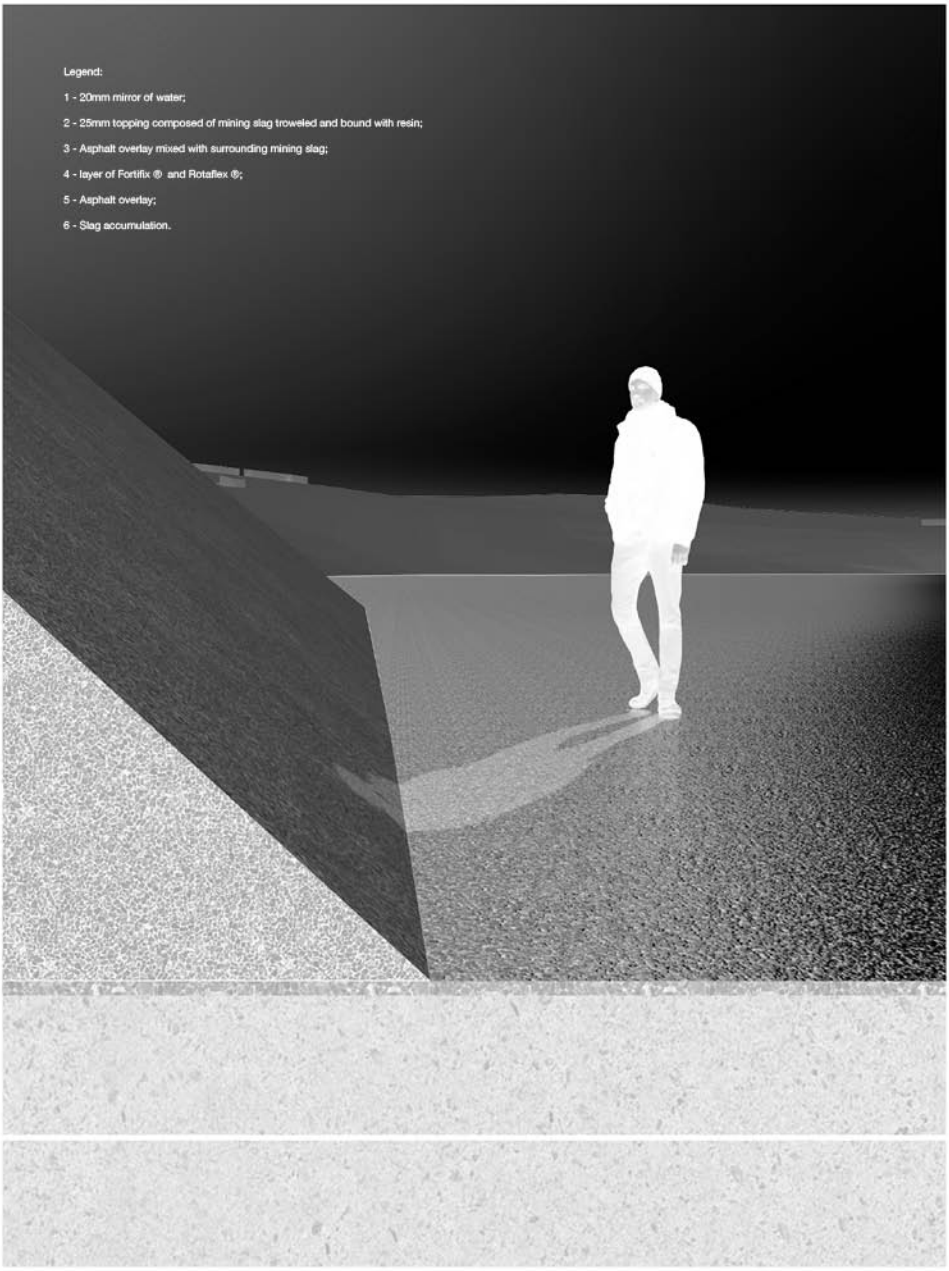

274 Detailed sections (© Jared Miguel Fantasia. 2018) showing the intersection of the impermeable covering of the proposed project with the mining walls of the open pit. Without water (left) and with water covering (right). Note: The above drawings are for illustrative purposes only.

1
2
3
4
5

275 Detailed section (© Jared Miguel Fantasia. 2018) showing impermeable covering of the proposed project with the inlaid copper plates that delimit the once visible S. Domingos orebody (left) without water (right) with water covering. Note: The above drawings are for illustrative purposes only.


1
2
3
4
5

Final considerations

Final considerations

This thesis is the out-put of a culmination of a 5 year integrated Masters course in Architecture initiated at the Department of Architecture at the University of Évora, Portugal which has not only allowed me to develop the necessary architectural skills but also to expand my interest in the discipline - especially those pertinent to the field at the outset of a new century. While studying architecture, I have had the opportunity to broaden my horizons through travel and to study abroad in Italy at the Sapienza Università di Roma and, Università Iuav di Venezia through the award of two European Union grants (thanks to the Erasmus programme). These Italian faculties of architecture enriched the subject of theory and the practice applied towards architectural restoration - an area not applied to this thesis but one of influence because it has led me to reflect on the values of cultural and architectural heritage in the landscape in Portugal and world-wide. Attendance of the *5th International Workshop of Landscape and Architecture* (2019) held in Iglesias, Monteponi (Sardinia, Italy) while undergoing this current Master's dissertation focused me further on the plight of the post-industrial mining landscape and the possibilities of its reclamation - an exciting area as it is open to a multitude of creative ideas.

It would be valid to have approached this thesis through a monograph or an ontological path, but a prevailing interest in the S. Domingos Mine in Portugal lingered and it led me back to consider a project for the mining pit on the site that I completed in my second year in the Department of Architecture at the University of Évora in the 2013/ 2014 academic year. I have always felt the necessity to use thought and reflection when considering ideas of intervention in a site specific place and therefore I chose a thesis within the discipline of architectural design with links to other paths of thought - such as land art/ earthworks and post-industrial mining reclamation.

Although this is a thesis of architecture, it considers examples of land art - not because architecture does not have anything to offer or any pertinent examples (rather the contrary). It is because these pioneering artists have much to offer the field of architecture. Their works are para-architectural and also relevant in their constructive process. The land artist had a fundamental or 'raw' relationship with their materials at the point of their origin and, the environment in which they are located. Moreover, these land artists reflected on the post-industrial wasteland when no one else was and they saw its potential . (This can be consulted in the introduction to the reference situations from pages 134 to 138).

The architectural work done in the above mentioned design project for an interpretation centre for the mining pit, at S. Domingos Mine, now developed into a more important topic of actuality. The history of the mine had been investigated (along with its abandonment) as well as the extent of ore extracted for export but the catastrophic scarring and irreversible pollution of the landscape - extending far beyond the mine and its plants - was alarming. Despite the indignation caused by the lack of accountability for its current state on the part of the previous mine

owners (ghosts of the distant past), the site begged the question of what could be done with it as such rural sites often receive little attention and are given little hope - besides necessary undertaking of ecological reclamation and decontamination - because, unlike urban sites, they are of low real estate value and are given little cultural importance. S. Domingos Mine is a metaphor for centuries old abandoned open-cast mines and processing plants world-wide from a time when destruction of nature was of little consequence in an ideology that financial gain was the greater good, and that Earth could withstand anything man did to her.

Ironically, I come from a family of four generations of intrepid mining men whose livelihoods were connected to mineral extraction - pioneers who prospected and surveyed and who designed, engineered and fabricated machinery for extraction and processing of ore. Mining in their lives was synonymous with technological advancement and the wealth and development of nations but it also was a means for the common man, who picked the rock face, to survive through earning an honest living. It seems that relatively little thought if any was given to the fate of mines, to rust belts and the scarred and the polluted earth that we have as a result today; it seemed that Earth could absorb all that was done to it in the name of progress. A later recreational visit to the S Domingos Mine, revealed a different landscape. I saw the abandoned mine as heritage from Portugal's past - a space that is testimony to lives who lived and worked there, and as a landscape of the soul - despite having been so criminally ravaged by man. When immersed in it, the site becomes a place of strange and overwhelming beauty striking the senses. And yet it is calm in its desolation with the potential for solitude, peace, creating reconciliation with its past.

This thesis aims to develop an interest in the post-industrial mining landscape by retaining a sense of identity from our past, but it also aims to impel environmental action. Scarred and toxic post-industrial landscapes of the past are ironically now necessary reminders of the irreversible consequences of what our disregard for the Earth can cause. Catastrophes of a far greater magnitude await us if we do not change our behaviour to Earth, our home, in the 21st century. We are Earth's custodians; Earth no longer is a resource to be plundered and abused for short-term commodities and wealth. The project proposed for S. Domingos Mine is a starting point for learning and healing.

The idea of the project, *Earthworks - An architectural essay for the reclamation of the post-industrial landscape*, is to intervene, through a process of reclamation, to make the post-industrial site a place of redemption. The idea of a museum project would have been an obvious choice for the reclamation of S. Domingos Mine pit as museums, in their traditional structural form are places of interest, information and education. Such a structure could also be considered sustainable with its use also extending to the activities of the community that lives in it vicinity,

for example in the village of S. Domingos. However, the landscape is a site with it *genius loci* which speaks to us through our senses and so it becomes far more powerful than a structure of the contemporary model of a museum. The concept to use the site as museum in the form of earth work came from the ideas and works of a group of pioneering land artists in the USA from the late 1960s to the 1980s. These sculptors chose to abandon the traditional gallery as exhibition space and create their works in the rural open spaces using the environment. Their sculpture also emerged in a climate of heightened environmental consciousness and activism, calling for change - as we are experiencing now (on a more heightened level) at the turn of the 21st century. As architects in a way, land artists sculpted earth on a monumental scale (adding and subtracting and creating positive and negative space). The ability to reveal that which has been removed as the object (as opposed to creation by building and filling) evoked memory of what was once there and its removal and, so such earthworks could have the potential to add meaning to post-industrial, open-cast mining sites. I have focused primarily on earthworks by these land artists, which were created on post-industrial mining sites, because the work (the site) shifts our aesthetic perception of what is considered to be 'beautiful' and therefore of value with regard to landscape; the sublime now becomes worthy rather than a landscape of shame. The works in the chosen case studies transport the viewer into the piece, the landscape becomes the work and, it demands our multi-sensory experience of it thus making the site a meaningful, restorative and a sustainable place of cultural value and identity. Moreover, these artists pioneered the idea of reclamation of the post-industrial mining sites in that they singled them out as areas with the potential to be transformed (whether or not they used incentives for reclamation to cover the costs of such art works).

Earthworks, using the medium of the site and its raw materials, have an important role to play in the shift of our aesthetic perception and an acceptance of these sites as important places of culture. The architectural model in the idea of reclamation as land art, has therefore more pertinence - not just for the site of S. Domingos Mine - but for many other mines like it on the Iberian Peninsula and beyond; it gives clarity and honesty to the place, placing the viewer in the work and allowing the site to create the relationship and the respect it deserves. A site-specific museum structure, with its museological facilities and programmes, can teach and be used by communities but it does not necessarily change people's attitudes. Rather, it could be argued that we are more likely to learn from, and develop bonds with, a place through direct active engagement with it in a multisensory experience. This in turn could create a deep-seated appreciation and value of the site and one that is likely to engender a behaviour that values the environment beyond the site. Because the use of earthwork as reclamation is a concept which can be replicated, it is felt that the proposed project for S. Domingos Mine would not only have value for this site, but for many such sites in the Iberian Peninsula and world-wide, thus facilitating changed perceptions of the post-industrial mining landscape.

276 Photograph (© Jared Miguel Fantasia. 2018) from on top of the abandoned mining terrils at Achada do Gamo, S. Domingos, Portugal.

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