

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.
37°40'05.8"N 7°29'28.2"W**

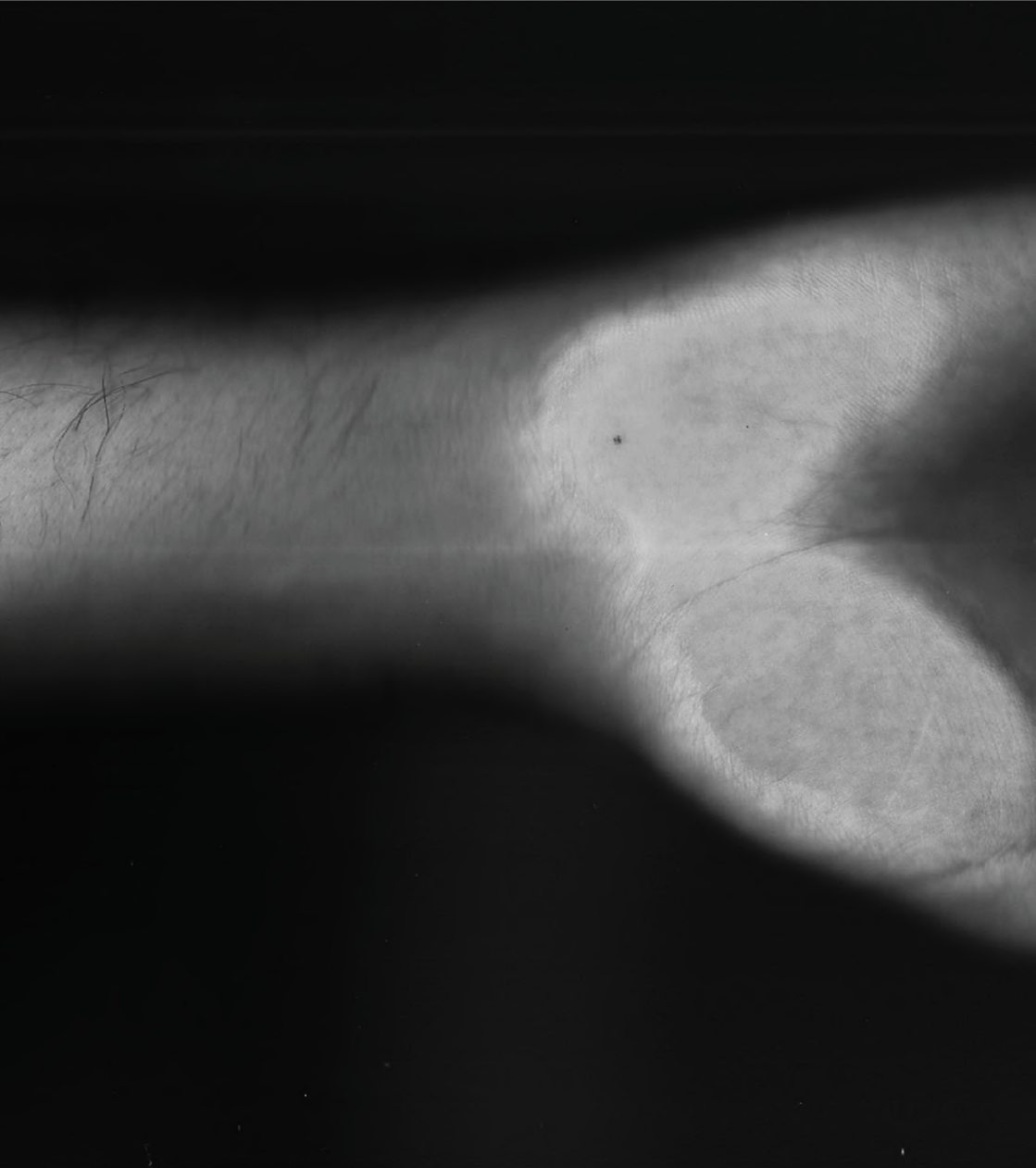
APPENDIX

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Orientador(es) | João Gabriel Soares

Évora 2020





UNIVERSIDADE DE ÉVORA
ESCOLA DE ARTES
DEPARTAMENTO DE ARQUITETURA

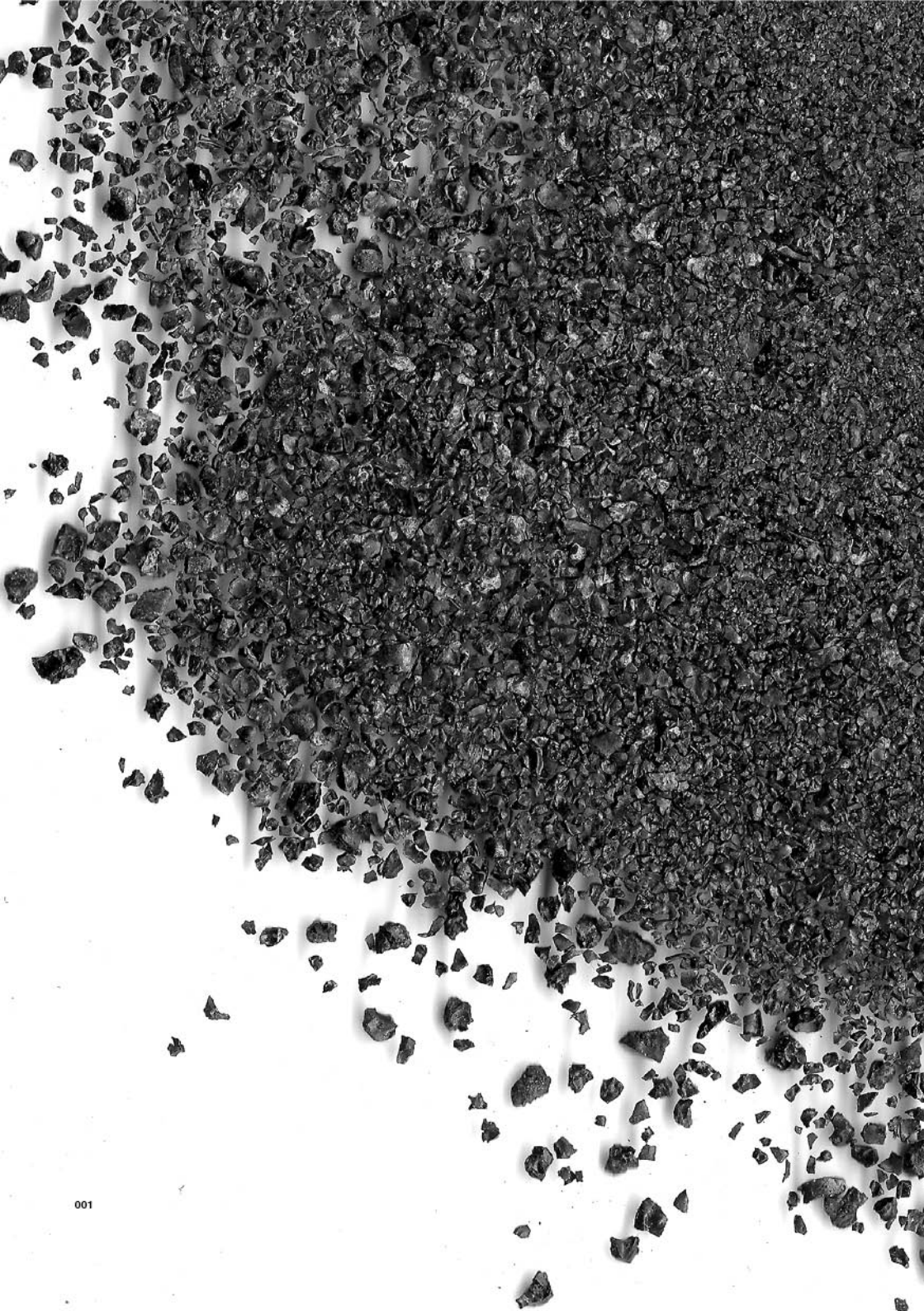


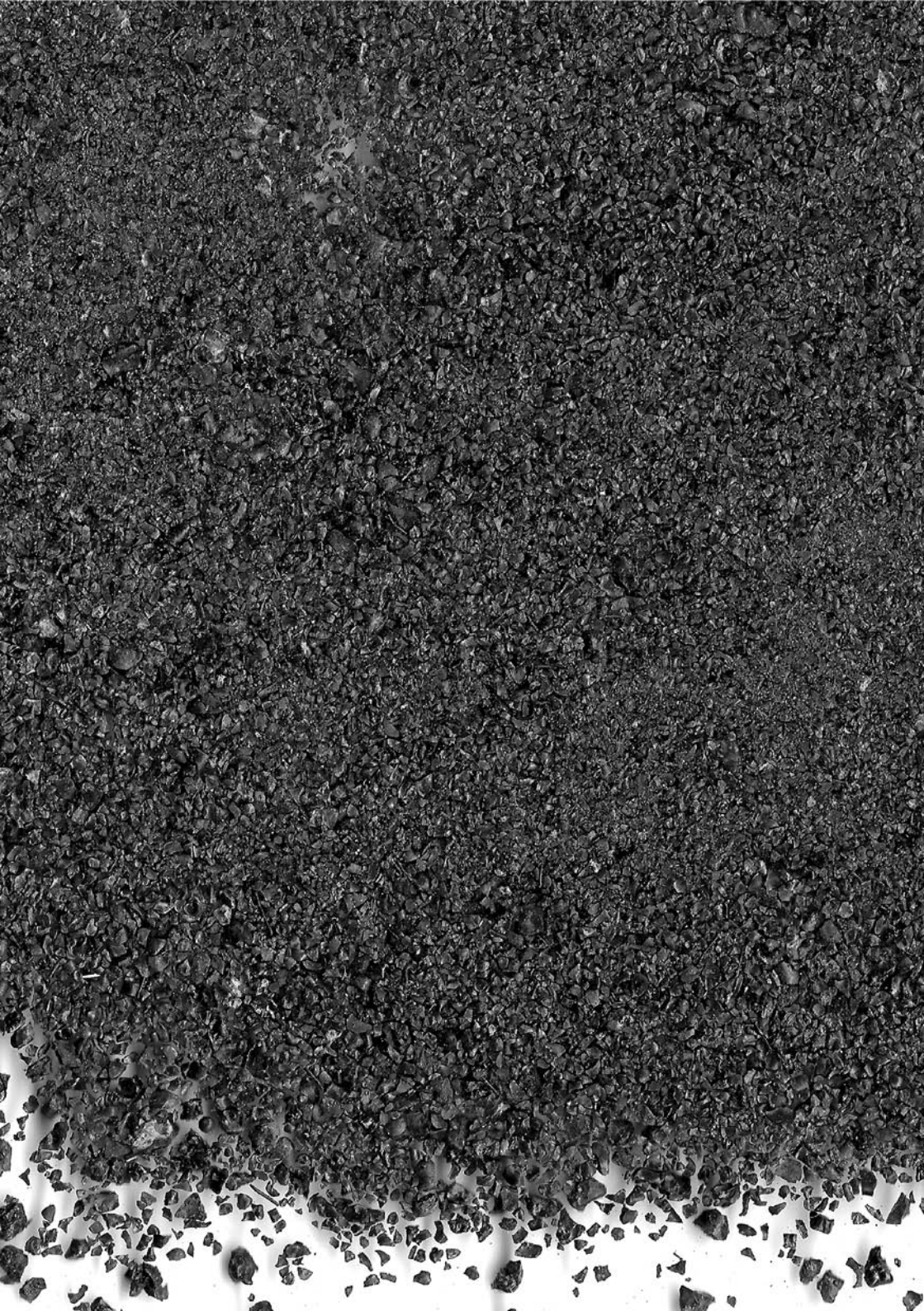


Appendix

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Relatório de unidade curricular

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 Unidade curricular
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Nome	Código	Áreas científicas	Departamento responsável	Ano letivo
Projeto III	ARQ25141	Arquitetura	Departamento de Arquitectura	2012/2013

 Funcionamento/Horas letivas
 topo

Tempo de ministração	ECTS	Total de horas de trabalho semestrais	Horas de contacto semestrais	Língua alternativa de ensino	Observações relativas à língua de ensino
Semestral	12 ECTS	312	180		português e inglês

Tipo de aula	Aulas semestrais			
	previstas	realizadas	validadas	
Prática Laboratorial	60	52	52	52
Orientação Tutorial	0	12	12	12

 Informação científico-pedagógica (PT Português)
 topo

Pré-requisitos

-

Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes)

Esta unidade curricular tem como principal objetivo o reconhecimento e desenvolvimento de uma estratégia projectual.

Partindo de uma leitura e análise do território o aluno deve ser capaz de definir uma estratégia de projecto coerente, fundamentada e ancorada ao lugar.

Será realizada um exercício onde será explorada a compreensão dos elementos caracterizadores do território (paisagem e estruturas arquitetónicas construídas) procurando o estabelecimento de uma estratégia de projecto coerente e articulada com o lugar e propositiva da especificidade do programa funcional que o aluno deverá questionar, propor e desenvolver.

Objectivos:

1. Ampliar o uso dos instrumentos de projecto;
2. Desenvolver a capacidade de pesquisa, leitura e observação crítica;
3. Desenvolver a capacidade de comunicação do projecto;
4. Desenvolver a capacidade de interpretar e analisar um território/lugar e um programa;
5. Introduzir o reconhecimento da importância da definição de uma estratégia projectual coerente, fundamentada e ancorada ao lugar.

Conteúdos programáticos

Programa

Construção de um percurso + centro interpretativo de relação intensional com o lugar que permita encenar uma leitura específica deste e das suas características paisagísticas, históricas e culturais.

O aluno deverá através da pesquisa, análise e interpretação crítica propor um programa coerente com a sua estratégia de projecto.

O programa deve incluir:

1. Percurso

Com espaços de acesso, acolhimento, pontos de observação da paisagem distantes e próximos, pontos de paragem e descanso, e outros elementos a propor pelo aluno dentro da lógica narrativa do percurso.

2. Centro de Acolhimento

Com espaço exterior de recepção que se relacione com o lugar e com o programa a propor pelo aluno de acordo com a sua estratégia de projecto.

LUGAR

Paisagem arqueológica das Minas de São Domingos, Mértola.

Contexto peri-urbano e de paisagem arqueológica/industrial com uma relação muito evidente com o território envolvente e a história daquela paisagem.

Pretende-se que o aluno seja capaz de desenvolver uma leitura sensível do lugar, a partir da investigação sobre a sua história e funcionamento, permitindo através do projecto a reconstituição da lógica de percursos e usos da antiga infraestrutura.

Bibliografia principal / Bibliografia de consulta/existência obrigatória

Baeza Campo, Alberto: A ideia construída. Ed. Caleidoscópio, 2004.

Siza, Álvaro: Imaginare a Evidencia. Editorial Laterza, 1998.

Tavares, M. Gonçalo: Breves Notas sobre a Ciência. Relógio d'Água, 2006.

Zumthor, Peter: Thinking Architecture. Lars Muller Publishers, 1998

Metodologias de ensino (avaliação incluída)

As aulas serão dadas em regime de ensino prático e laboratorial, num total de 12 horas de contacto semanal, a que se somam 6 horas de acompanhamento tutorial.

Os conteúdos programáticos serão introduzidos pelo docente através de aulas com apoio audiovisual, conferências, visitas de estudo e acompanhamento individual ou em grupo dos trabalhos. Os exercícios serão desenvolvidos nas aulas, sob a orientação do professor.

Métodos de avaliação

A avaliação dos alunos é contínua, pelo que a assiduidade é essencial para a concretização dos objetivos.

A avaliação resulta do acompanhamento crítico e da avaliação global dos trabalhos desenvolvidos ao longo do semestre. A classificação terá em consideração a qualidade do trabalho apresentado, a reflexão crítica e teórica ao longo do processo, o modo de utilização dos instrumentos de projecto e a assiduidade.

Em cada momento de avaliação serão tidos em consideração os seguintes parâmetros: i) capacidade de definição de uma estratégia projectual que se relacione de forma intencional e propositiva com o Lugar (factor de ponderação 35%); ii) relação / integração da proposta com o lugar e manipulação dos temas arquitectónicos (factor de ponderação 25%); iii) capacidade de analisar e interpretar criticamente o programa e a escala de intervenção (factor de ponderação 20%); iv) domínio das técnicas de representação do projecto e qualidade da apresentação (factor de ponderação 20%).

Serão fornecidas classificações qualitativas durante o semestre em momentos específicos (entregas preliminares), sendo as classificações quantitativas (notas) lançadas apenas no final do semestre.

A avaliação final é, ainda, aferida em apresentação final com o júri da disciplina proposto pelo Conselho do Departamento de Arquitectura.

Acompanhamento e atendimento dos alunos

Está previsto para além das 12 horas lectivas semanais, 6 horas de acompanhamento tutorial dos alunos pelo docente.

Outras Observações

Informação não preenchida.

Demonstração da coerência dos conteúdos programáticos com os objetivos da unidade curricular

Informação não preenchida.

Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular

Informação não preenchida.

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Dados do par unidade curricular/curso

Curso			Semestre curricular	Tipo	Tipo de inscrição	Nº de alunos inscritos	Horário
nome	ciclo de ensino	relatório de ciclo de estudos					
Arquitetura [cód. 209]	Mestrado Integrado		Ímpar	Obrigatória	Mobilidade In	5	
Arquitetura [cód. 209]	Mestrado Integrado		Ímpar	Obrigatória	Normal	54	

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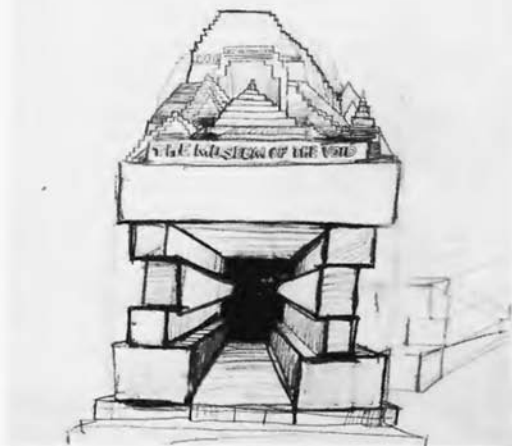
Turmas

Curso(s)	Tipo/Número
Arquitetura [cód. 209]	Outra / 2

topo

Recursos humanos

Equipa docente	
curso(s)	docente(s)/horas de contacto
Arquitetura [cód. 209]	Sofia Maria Mendes Barbosa da Costa Salema Guilherme / 180 José Adrião Antunes da Costa Martins / 180
Docente responsável	Sofia Maria Mendes Barbosa da Costa Salema Guilherme



ROBERT SMITHSON, *The Museum of the Void*, c. 1967. Pencil, 19 x 24".

SOME VOID THOUGHTS ON MUSEUMS (1967)

Tomb furniture achieved apparently contradictory ends in discarding old things all the while retaining them, much as in our storage warehouses, and museum deposits, and antiquarian storerooms.

George Kubler, *The Shape of Time: Remarks on the History of Things*

History is a facsimile of events held together by flimsy biographical information. Art history is less explosive than the rest of history, so it sinks faster into the pulverized regions of time. History is representational, while time is abstract; both of these artifices may be found in museums, where they span everybody's own vacancy. The museum undermines one's confidence in sense-data and erodes the impression of textures upon which our sensations exist. Memories of "excitement" seem to promise something, but nothing is always the result. Those with exhausted memories will know the astonishment.

Visiting a museum is a matter of going from void to void. Hallways lead the viewer to things once called "pictures" and "statues." Anachronisms hang and

Arts Magazine, February 1967

protrude from every angle. Themes without meaning press on the eye. Multifarious nothings permute into false windows (frames) that open up onto a verity of blanks. Stale images cancel one's perception and deviate one's motivation. Blind and senseless, one continues wandering around the remains of Europe, only to end in that massive deception "the art history of the recent past." Brain drain leads to eye drain, as one's sight defines emptiness by blankness. Sightings fall like heavy objects from one's eyes. Sight becomes devoid of sense, or the sight is there, but the sense is unavailable. Many try to hide this perceptual falling out by calling it abstract. Abstraction is everybody's zero but nobody's nought. Museums are tombs, and it looks like everything is turning into a museum. Painting, sculpture and architecture are finished, but the art habit continues. Art settles into a stupendous inertia. Silence supplies the dominant chord. Bright colors conceal the abyss that holds the museum together. Every solid is a bit of clogged air or space. Things flatten and fade. The museum spreads its surfaces everywhere, and becomes an untitled collection of generalizations that immobilize the eye.

WHAT IS A MUSEUM? (1967)

A Dialogue between Allan Kaprow and Robert Smithson

ALLAN KAPROW: There was once an art which was conceived for the museums, and the fact that the museums look like mausolea may actually reveal to us the attitude we've had to art in the past. It was a form of paying respect to the dead. Now, I don't know how much more work there is available from the past that has to be displayed or respected. But if we're going to talk about the works being produced in the last few years, and which are to be produced in the near future, then the concept of the museum is completely irrelevant. I should like to pursue the question of the environment of the work of art; what kind of work is being done now; where it is best displayed, apart from the museum, or its miniature counterpart, the gallery.

ROBERT SMITHSON: Well, it seems to me that there is an attitude that tends toward McLuhanism, and this attitude would tend to see the museum as a null structure. But I think the nullity implied in the museum is actually one of its

Arts Yearbook, "The Museum World," 1967

Top: Entrance to Philip Johnson Gallery, Connecticut. Architect, Philip Johnson. Photo by Ezra Stoller.
Bottom: Memorial to French soldiers at Verdun.



Top: Installation photograph of the architecture of Louis Kahn at the Museum of Modern Art.
Bottom: Final inspection of refrigerators in Kelvinator Grand Rapids plant.





Top: Whitney Museum of American Art. Architect, Marcel Breuer and Associates. Photo by Ezra Scollor.
Bottom: Mausoleum for Lenin, Moscow. Designed by the Constructivist Shushev.

Top: Proposed monument by Holabird and Root, Chicago.
Bottom: Discothèque, Cheeah. Photo by Thecla.

major assets, and that this should be realized and accentuated. The museum tends to exclude any kind of life-forcing position. But it seems that now there's a tendency to try to liven things up in the museums, and that the whole idea of the museum seems to be tending more toward a kind of specialized entertainment. It's taking on more and more the aspects of a discothèque and less and less the aspects of art. So, I think that the best thing you can say about museums is that they really are nullifying in regard to action, and I think that this is one of their major virtues. It seems that your position is one that is concerned with what's happening. I'm interested for the most part in what's not happening, that area between events which could be called the gap. This gap exists in the blank and void regions or settings that we never look at. A museum devoted to different kinds of emptiness could be developed. The emptiness could be defined by the actual installation of art. Installations should empty rooms, not fill them.

KAPROW: Museums tend to make increasing concessions to the idea of art and life as being related. What's wrong with their version of this is that they provide canned life, an aestheticized illustration of life. "Life" in the museum is like making love in a cemetery. I am attracted to the idea of clearing out the



Top: Museum of Modern Art installation. Two Design Programs:
The Braun Company—Chemex Corporation.
Bottom: Chicago showroom for Crane Company.

Top: Bedroom Ensemble by Claes Oldenberg, 1963.
Bottom: Bathroom Beautiful, Crane Company.

museums and letting better designed ones like the Guggenheim exist as sculptures, as works, as such, almost closed to people. It would be positive commitment to their function as mausolea. Yet, such an act would put so many artists out of business. . . . I wonder if there isn't an alternative on the fringes of life and art, in that marginal or penumbral zone which you've spoken so eloquently of, at the edges of cities, along vast highways with their outcroppings of supermarkets and shopping centers, endless lumberyards, discount houses, whether that isn't the world that's for you at least. I mean, can you imagine yourself working in that kind of environment?

SMITHSON: I'm so remote from that world that it seems uncanny to me when I go out there; so not being directly involved in the life there, it fascinates me, because I'm sure of a distance from it, and I'm all for fabricating as much distance as possible. It seems that I like to think and look at those suburbs and those fringes, but at the same time, I'm not interested in living there. It's more of an aspect of time. It is the future—the Martian landscape. By a distance, I mean a consciousness devoid of self-projection.

I think that some of the symptoms as to what's going on in the area of museum building are reflected somewhat in Philip Johnson's underground

museum, which in a sense buries abstract kinds of art in another kind of abstraction, so that it really becomes a negation of a negation. I am all for a perpetuation of this kind of distancing and removal, and I think Johnson's project for Ellis Island is interesting in that he's going to gut this nineteenth-century building and turn it into a ruin, and he says that he's going to stabilize the ruins, and he's also building this circular building which is really nothing but a stabilized void. And it seems that you find this tendency everywhere, but everybody is still a bit reluctant to give up their life-forcing attitudes. They would like to balance them both. But, I think, what's interesting is the lack of balance. When you have a Happening you can't have an absence of happening. There has to be this dualism which I'm afraid upsets a lot of ideas of humanism and unity. I think that the two views, unity and dualism, will never be reconciled and that both of them are valid, but at the same time, I prefer the latter in multiplicity.

KAPROW: There is another alternative. You mentioned building your own monument, still in Alaska, perhaps, or Canada. The more remote it would be, the more inaccessible, perhaps the more satisfactory. Is that true?

SMITHSON: Well, I think ultimately it would be disappointing for everybody including myself. Yet the very disappointment seems to have possibilities.



Top: Penthouse Dining Room, Los Angeles County Museum.
Bottom: Carl Andre Exhibition, 1966. Limestone and sand bricks.



Top: Proposed memorial by Benjamin Marshall, 1930.
Bottom: Storage Tanks, Mobil Oil.



KAPROW: What disturbs me is the lack of extremity in either of our positions. For instance, I must often make social compromises in my Happenings, while, similarly, you and others who might object to museums nevertheless go on showing in them.

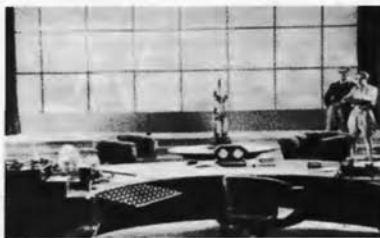
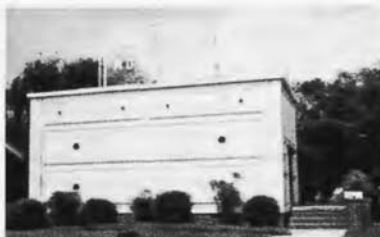
SMITHSON: Extremity can exist in a vain context too, and I find what's vain more acceptable than what's pure. It seems to me that any tendency toward purity also supposes that there's something to be achieved, and it means that art has some sort of point. I think I agree with Flaubert's idea that art is the pursuit of the useless, and the more vain things are the better I like it, because I'm not burdened by purity.

I actually value indifference. I think it's something that has aesthetic possibilities. But most artists are anything but indifferent; they're trying to get with everything, switch on, turn on.

KAPROW: Do you like wax works?

SMITHSON: No, I don't like wax works. They are actually too lively. A wax-work thing relates back to life, so that actually there's too much life there, and it also suggests death, you know. I think the new tombs will have to avoid any reference to life or death.

KAPROW: Like Forest Lawn?



Top: World's largest bureau.
Bottom: Executive Suite for year 2026 from *Metropolis*. Set built in 1926.

Top: Proposed museum for outer space. Designer unknown.
Bottom: Guggenheim Museum exterior.



Top: SOL LeWITT, MA5, 1966.
Bottom: Hydroelectric project, Hirfanli, Turkey.



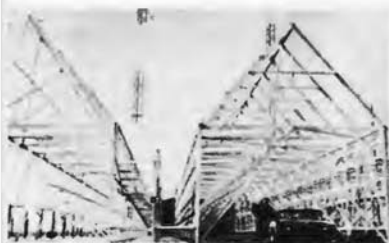
Top: Guggenheim interior (empty).
Bottom: "Invisible Architecture" built by Bernard Zehrfuss for UNESCO, France.

SMITHSON: Yes, it's an American tradition.

KAPROW: Realistically speaking, you'll never get anybody to put up the dough for a mausoleum—a mausoleum to emptiness, to nothing—though it might be the most poetic statement of your position. You'll never get anyone to pay for the Guggenheim to stay empty all year, though to me that would be a marvelous idea.

SMITHSON: I think that's true. I think basically it's an empty proposal. But . . . eventually there'll be a renaissance in funeral art.

Actually, our older museums are full of fragments, bits and pieces of European art. They were ripped out of total artistic structures, given a whole new classification and then categorized. The categorizing of art into painting, architecture and sculpture seems to be one of the most unfortunate things that took place. Now all these categories are splintering into more and more categories, and it's like an interminable avalanche of categories. You have about forty different kinds of formalism and about a hundred different kinds of expressionism. The museums are being driven into a kind of paralyzed position, and I don't think they want to accept it, so they've made a myth out of action; they've made a myth out of excitement; and there's even a lot of talk about interesting spaces. They're creating exciting spaces and things like that. I never saw an exciting



Top: Housing development, Jersey City. Photo by Dan Graham.
 Bottom: Radar-observing sites. Courtesy Smithsonian Astrophysical and Harvard College Observatories.

Top: Storage of wet collections of marine invertebrates. Courtesy of Smithsonian Institute.
 Bottom: Betty Parsons' Long Island house, designed by Tony Smith. Photo by Jon Naar.

space. I don't know what a space is. Yet, I like the uselessness of the museum.

KAPROW: But on the one side you see it moving away from uselessness toward usefulness.

SMITHSON: Utility and art don't mix.

KAPROW: Toward education, for example. On the other side, paradoxically. I see it moving away from real fullness to a burlesque of fullness. As its sense of life is always aesthetic (cosmetic), its sense of fullness is aristocratic: it tries to assemble all "good" objects and ideas under one roof lest they dissipate and degenerate out in the street. It implies an enrichment of the mind. Now, high class (and the high-class come-on) is implicit in the very concept of a museum, whether museum administrators wish it or not, and this is simply unrelated to current issues. I wrote once that this is a country of more or less sophisticated mongrels. My fullness and your nullity have no status attached to them.

SMITHSON: I think you touched on an interesting area. It seems that all art is in some way a questioning of what value is, and it seems that there's a great need for people to attribute value, to find a significant value. But this leads to many categories of value or no value. I think this shows all sorts of disorders and fractures and irrationalities. But I don't really care about setting them right or making things in some ideal fashion. I think it's all there—independent of

any kind of good or bad. The categories of "good art" and "bad art" belong to a commodity value system.

KAPROW: As I said before, you face a social pressure which is hard to reconcile with your ideas. At present, galleries and museums are still the primary agency or "market" for what artists do. As the universities and federal education programs finance culture by building even more museums, you see the developing picture of contemporary patronage. Therefore, your involvement with "exhibition people," however well-meant they are, is bound to defeat whatever position you take regarding the non-value of your activity. If you say it's neither good nor bad, the dealers and curators who appropriate it, who support you personally, will say or imply the opposite by what they do with it.

SMITHSON: Contemporary patronage is getting more public and less private. Good and bad are moral values. What we need are aesthetic values.

KAPROW: How can your position then be anything but ironic, forcing upon you at least a skepticism. How can you become anything except a kind of shy philosopher—a man with a smile of amusement on your face, whose every act is italicized?

SMITHSON: Well, I think humor is an interesting area. The varieties of humor are pretty foreign to the American temperament. It seems that the American temperament doesn't associate art with humor. Humor is not considered serious. Many structural works really are almost hilarious. You know, the dumber, more stupid ones are really verging on a kind of concrete humor, and actually I find the whole idea of the mausoleum very humorous.

KAPROW: Our comparison of the Guggenheim, as an intestinal metaphor, to what you've called a "waste system" seems quite to the point. But this of course is nothing more than another justification for the museum man, for the museum publicist, for the museum critic. Instead of high seriousness it's high humor.

SMITHSON: High seriousness and high humor are the same thing.

KAPROW: Nevertheless, the minute you start operating within a cultural context, whether it's the context of a group of artists and critics or whether it's

Burial Mounds, Behrain Islands.

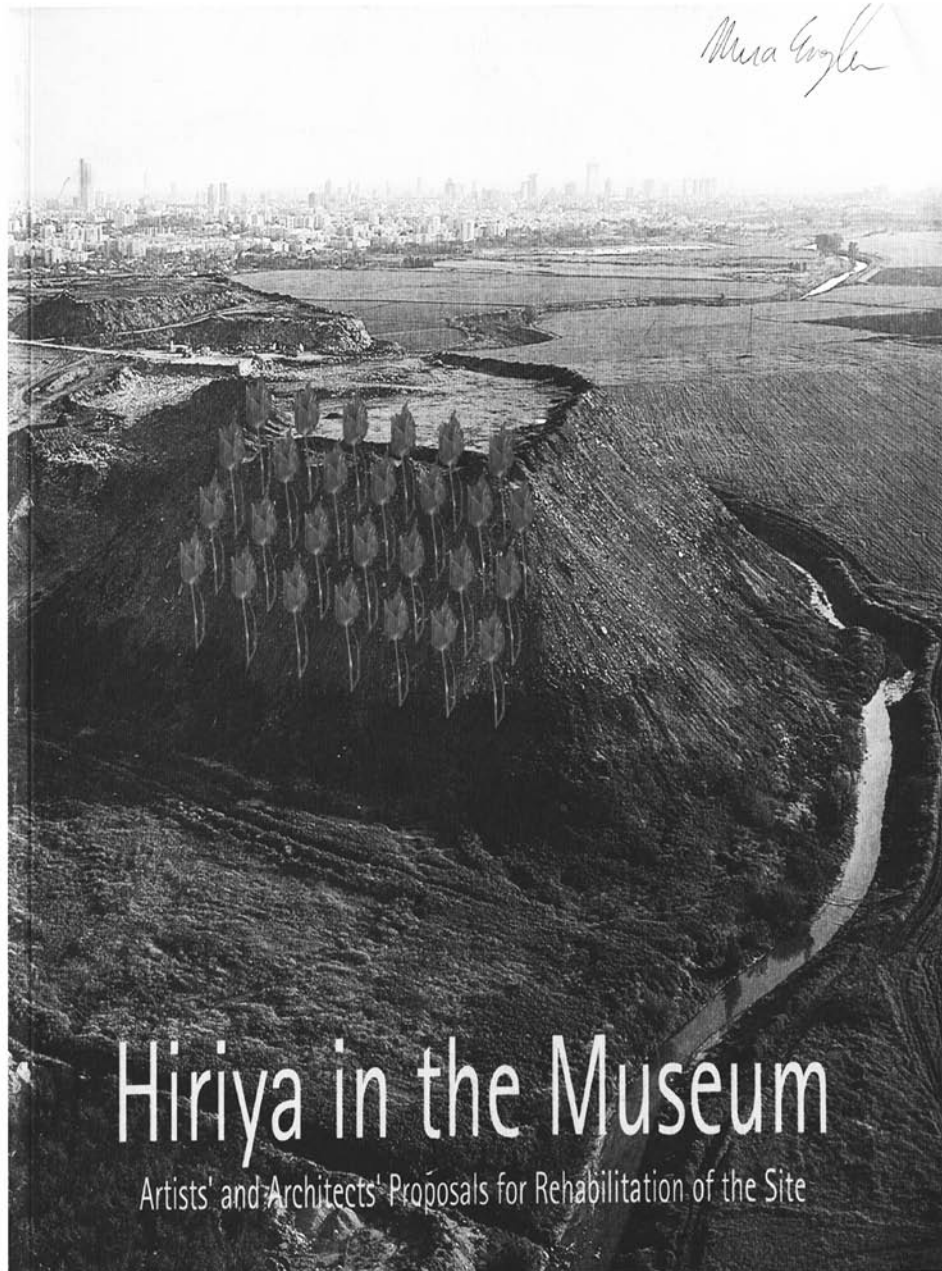


the physical context of the museum or gallery, you automatically associate this uncertain identity with something certain. Someone assigns to it a new categorical name, usually a variant of some old one, and thus he continues his lineage or family system which makes it all credible. The standard fate of novelty is to be justified by history. Your position is thus ironic.

SMITHSON: I would say that it has a contradictory view of things. It's basically a pointless position. But I think to try to make some kind of point right away stops any kind of possibility. I think the more points the better, you know, just an endless amount of points of view.

KAPROW: Well, this article itself is ironic in that it functions within a cultural context, within the context of a fine-arts publication, for instance, and makes its points only within that context. My opinion has been, lately, that there are only two outs: one implying a maximum of inertia, which I call "idea" art, art which is usually only discussed now and then and never executed; and the other existing in a maximum of continuous activity, activity which is of uncertain aesthetic value and which locates itself apart from cultural institutions. The minute we operate in between these extremes we get hung up (in a museum).

Mira Engler



Hiriya in the Museum

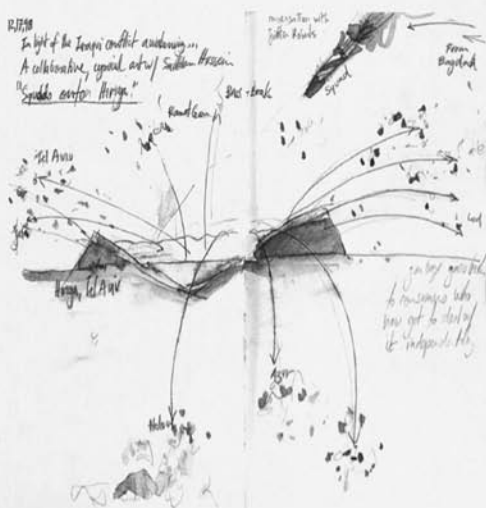
Artists' and Architects' Proposals for Rehabilitation of the Site

מירה אנגלר, ישראל וארה"ב / Mira Engler, Israel & U.S.A.

חילוץ מטאפורות מתוך המזבלה, או ארבע מחוות לחירייה

יחסט לאשפה מוגבל בדרך כלל להדחקה או לזריעה נגעת. מטאפורים פסטוראליים המכסים בירוק מובלת מגרות, מחווים למעשה כסות של אנציה על הגעל-גש הקבור. אבל תלי אשפה, שרוקטם כדי לפתור את בעיית האשפה שלו תוך הרחקת למחוזות השוויה, משויכים לצמוד במחוזותינו בתאמדה עויקשת ומסויכים להגלים מענינו את התאגדות והסיפורים הכמוסים בהם.

העשתי "מחלצתי" כן השוויה ארבע מטאפורות, שנקברו בענת לוררי האשפה שאנתו מייצגים: מאזוליאום של אנארופיה, מוויאון של דרוויים, ארכיון של מסיקני תת-מדע, ומוטנט לזכרים מוכחשים. כל מטאפורה מחלצת מתוך המזבלה הנאלט באופן משעני ומשעני כאחד, כל נאלה כואת מרחה מרחה, וארבע המחוות שכות ומתברות את המצבאים עם המערכות העידויות או המכניות שיצרו אותם. כל מחווה מעלת באופן עצמאי. ביווד מביאות ארבע המחוות האלה לתיסוף שרבו של דר האשפה, כאשר הן שכות ומציבות אותו על בטה תרבותית מוגברת ומעצבות סוג חדש של מרחב יצירי, המכיר בכה המכחש של חיית, חונג אותו ומחלץ אותו מתוך מזבלת התת-מדע.



Re-claiming Metaphors out of the Dump, or Four Gestures for Hiriya

Garbage is something to either forget or bitch about. Bucolic parks that green-coat closed dumps commonly serve as amnesia for the buried repugnance. But garbage mounds, built to resolve our waste problem and assign it to oblivion, rise obstinately, forever refusing to surrender their hidden stories and energies.

This proposal "re-claims" and builds on four metaphors buried along with our garbage mountains: mausoleum of entropy ▲ museum of rejects ▲ archive of subconscious depositories ▲ monument of unpleasant necessities

Each metaphor is conceptually and literally dug out of the dump and redeemed. Each redemption forms a gesture. The four gestures re-connect the disclosed with their ensuing urban or natural networks.

Each gesture acts independently. Together the four gestures valorize the infamous garbage mountain, re-position it on an elevated cultural platform, and shape a new kind of public space, one which acknowledges, celebrates, and recovers the rejected side of our lives from the dump of the sub-conscious.

Mausoleum of Entropy The first gesture reclaims the captive energies of decomposition buried inside the entombed mausoleum of dead commodities. Thick brownish leachate is channeled outward and flows intermittently out of the mountain through seven sculpted spouts located at the foothill. The liquid stains the gathering-basins below and continues to flow into a cleansing system, a "natural kidney" made of settling ponds and marsh plants whose tedious labor releases a clean flow into the Shapirim tributary and the Ayalon River.

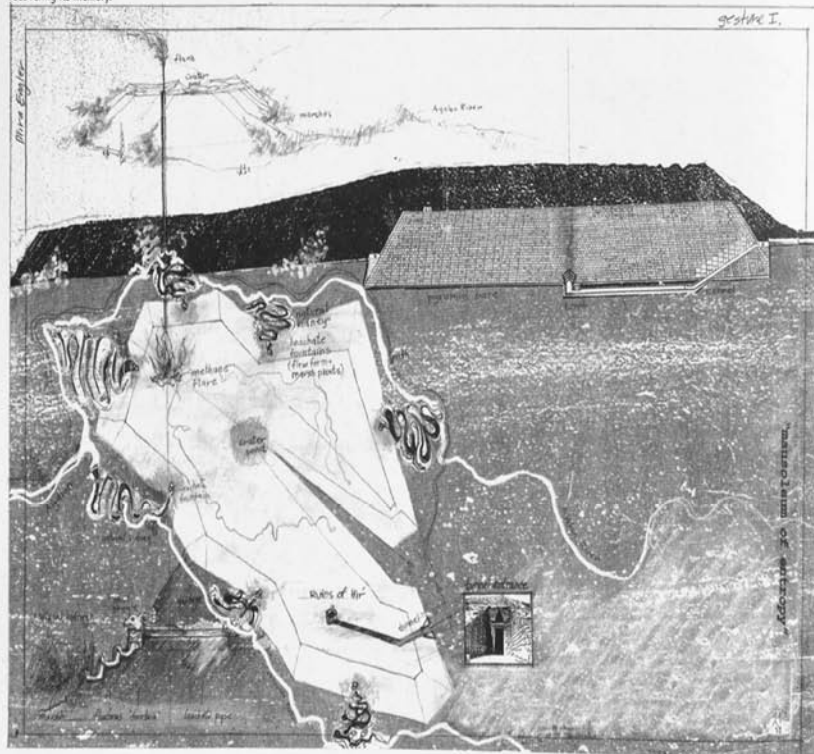
A flare ignited by methane gas towers on top of the mound, exhausts the last breaths of inner energies, releasing them to the sky. The four elements – water, fire, earth, and air – are again connected into a complete cycle.

In the middle of the crater-like mountaintop a central impermeable pond collects run-off and attests to the impervious nature of the dump. From down below a narrow tunnel is dug up, re-connecting the buried, ruined Arab village of Hir' with daylight, and recovering its memory.

מאוזוליאום של אנטרופיה המחווה הראשונה מחלצת את המינות הריקבות של מצרי העריכה התיים (ואו מתאן ותשטוף וכל הכסאום בתוך המאוזוליאום. נוזל רפש חומים וצמיגים ממתבים החוצה והנביים מתוך הרך דרך שבע דובכיות מטוסלות הממוקמות בבסיסו. הנוזלים ממתבים את אנגי העיקויו שלמטה ומשמיכים לרום לתוך מערכת טיהור, יכלה טבעית של בריכות משקיה וצמחי בצה, שנבמלם הבלתי נלאה משוררים וריטה נקיה אל ערוגי הנחלים נעזרים איווקן.

להבה המונעת בנאו מתאן מתנפסת בראש התל, מכלה את שמינתיהן האחרונות של המינות הפנימיות ומשחררת אותן אל השמים. ארבעת היסודות – מים, אש, אדמה ואוויר – מתאחדים מנם נוספת לעיתת מחור טבעי שלם.

במרכזו של סבתש הפסנה שוכנת בריכה לא מחלחלת, הקולטת מי-נג העמידים על עורה האטום של המובלה. מתחתית הרר כרויה מנורה צרה, הטבה וחופשת לאור היום את שרידיו הקבורים של הכפר העיבי חויר ובתוך כך מעלה את זכרו.

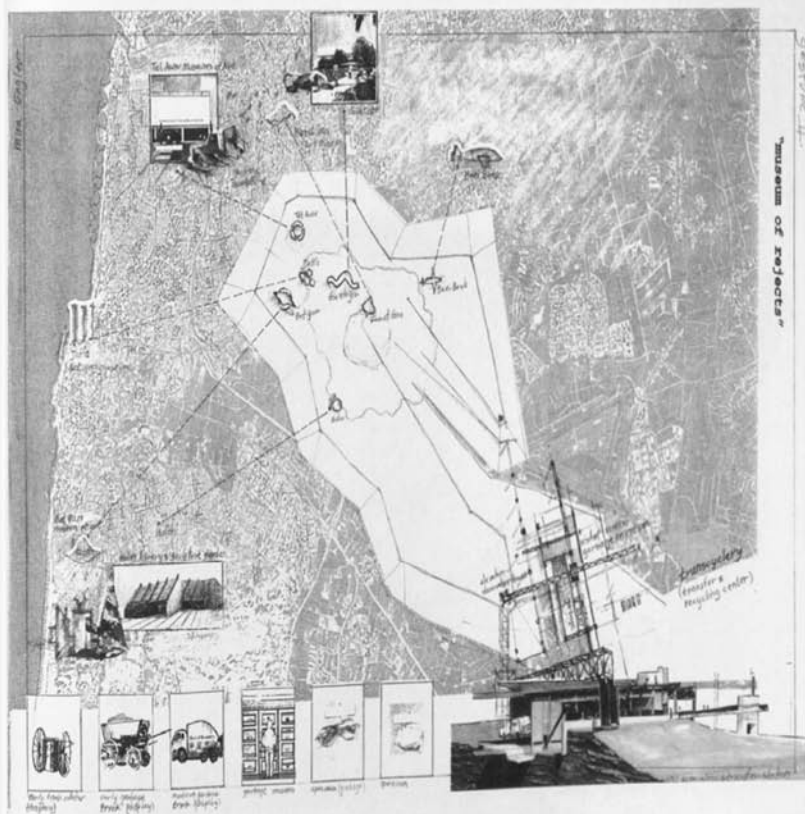


מוזיאון של דחיים מובלעת של מוזיאונים של שרידי יריבה לא-רצויים בזומה למוזיאונים סמולתיים הן מלעות כמסגרים, המוציאים מן הממוד אוניקטיים הנחשבים משמעותיים דיים כדי שיושרו בבר לשמרת. מוזיאונים מארחים את הנגינים יקוי-הערך של שאומתש הרומיות העלת ביותר, מובלעת מארחות את הלקים הרחיים של הרבנות.

המחווה האקטית מבכירה את גבעת הובל למנסח של מוזיאון מזכר ומערך. הוא מחברת את חייה עם המוזיאונים של שבע ערי המרכז, שתושביו הם שרביא לחינוכותה של חדייה תושבי כל ארות מן הערים מוסמים לרות לעצמם נוט אושה מנססת הרר ולמקמו ביחור הקדמית של המוזיאון החשוב בערים. לארז מכן תצוגה המרעדת בלטה ותיוותר על מקומה כיכלקתי קבועה או כולל קבועה מוסמן. לוחות זיכור תגיין את העיר המארת, שאליה הוחזרה האשה כנסל עכשווי.

מתקן חדש לשיעור ולמחזור אשה יקום בנסום בעיר לרר הובל וממוזיאון. המבקרים יוכלו לצמת בעלילות הוטרפת דרך הלעות ומסלולי הליכה תלויים ולחיות בגולל האשה שלהם, שחלקה נשלח למבולעת 'יסטיטאריות' וחלקה מעבר לשחזור. המתקן החדש כולל מרכז מבקרים ומוזיאון מיוחד, המציג חפצים יקוי-ערך, שחובלו מן הובל, בקוספאות וזכות מאריות. סקסטום לנזויים ימנו לעניי הטומים את הקשרים של כל מצג עם עולם החומר ואת סקומו מטרות העריכה.

המבקרים יוכלו לביור אם להצג במסכותים דרך המתקן החדש אל מעלה הרר – או לזיכנס לבניין המוזיאון, שסמנו, דרך גשר מיוחד, יגיע למעלת המובילה אל הפסגה. שירה של מישיות באת-בישים תוגד דרך קנב במרש החייה של האתר.



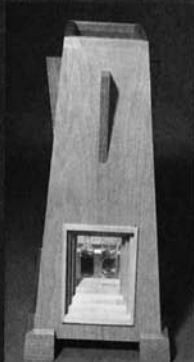
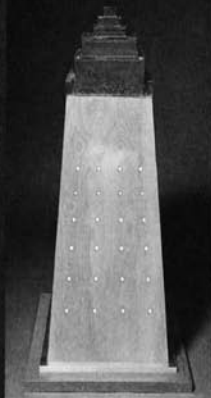
Museum of Rejects Dumps are museums of the unwanted material remains. Like other traditional museums, they act as filters, removing from circulation those objects deemed significant enough to be set aside. Museums host the precious representatives of our highest cultural aspirations; dumps serve as hosts to our cultural corns.

The second gesture elevates the dump hill to the status of a recognized and valued museum. It connects Hiriya with the museums of the 7 major cities whose citizens gave rise to Hiriya. People from each city are invited to extract a volume of garbage from the mountaintop and place it in the "front yard" of their respected museums. The subtracted, empty space is then glass-coated and left as a permanent "scar", an inverted burial mound. A plaque identifies the host city to which the garbage was returned, transformed into a contemporary sculpture.

A new garbage transfer and recycling facility is built as a gateway to the garbage mountain and as a museum. People are able to view the on-going operation through windows and cat walks and observe the fate of their garbage now assigned to distant, "very sanitary" landfills and to recycling. The new facility also hosts a visitors' center and a special museum where recovered, precious artifacts are displayed in glowing glass boxes. Accompanying narratives recreate a lifetime portrait of each remnant, mapping its branching connection to the worlds of phenomena and materials, and its place in consumer culture.

People are able to drive through the new facility and up the mountain or to enter the building and pass over a bridge to an elevator that will take them to the top.

A procession of outdated garbage trucks rests permanently in the parking lot.

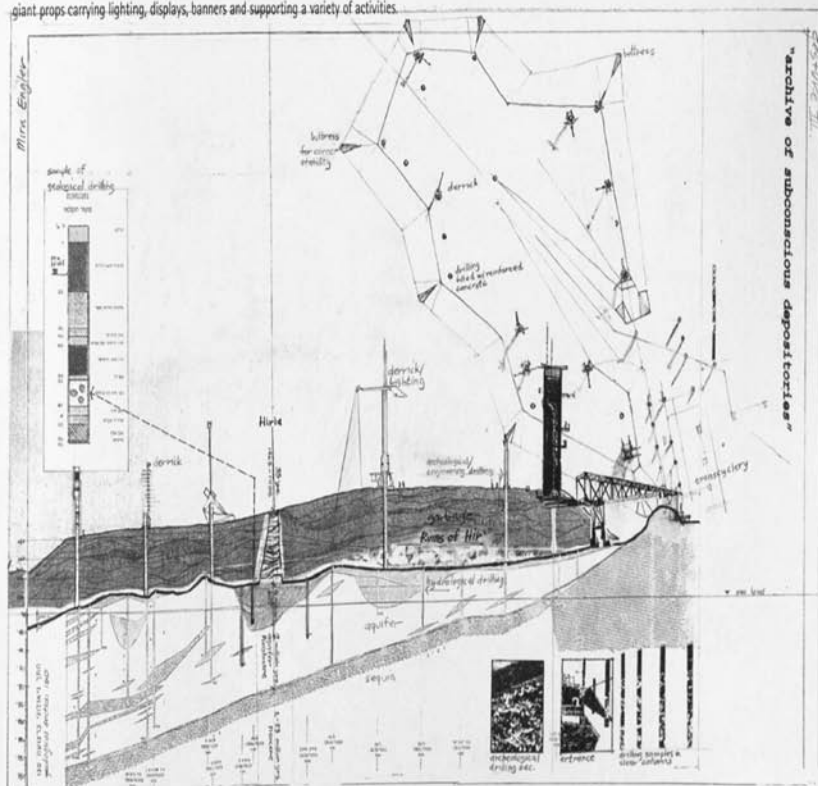


Archive of Subconscious Depositories The dump is an archive containing depositories of hidden histories, cultural secrets, and human errors (e.g., our notes on projects that never happened, our letters written and not sent, accidentally thrown out jewelry or a pack of dollars). It is built on the grounds of yet another archive of geological deposits. Some of Hiriya's toxic tears seep slowly down and mix with a 2 million-year-old Pleistocene aquifer settled in a residue of sand and limestone.

The third gesture facilitates the work of the site's archivists. New archeological and engineering drillings to study and stabilize the mountain join existing hydrological test drillings in the area. The extracted garbage columns are integrated into the recycling/transfer facility and gateway area, and their emptied holes are filled up with reinforced concrete to prevent the mountain's likely disintegration. Derricks of imaginative sculptural construction tower above each of the drilling holes and serve as giant props carrying lighting, displays, banners and supporting a variety of activities.

ארכיון של משקעי תודע-מועד המובלה היא ארכיון הנוג משקעים של היסטוריות נסתרות, סודות תרבותיים וטעויות אנוש (כמו, למשל, רעיונות שרשטמו לעצמנו לפרויקטים שכשמו של דבר לא יצאו אל הפועל, מכתבים שכתבנו ומוטלים אל שולחנו, תכשיטים או הפיכת ספרות שטרקו בסטופות), הבנוי על גבי ארכיון נוסף של משקעים גיאולוגיים. כמה מדמועותיה הרעילות של חירייה וולטת מטה לאיסון ומחלחלת לתוך אקוויפר פלסטוצני בן שני מיליון שנים, הוישב בתוך משקע של חל האבן.

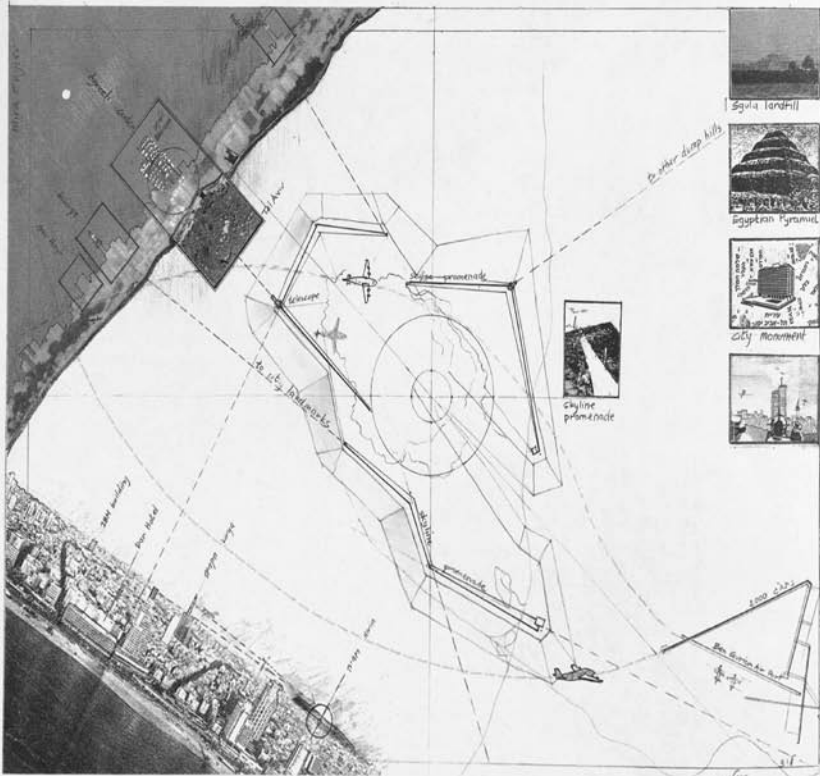
התמונה השלישית מסוימת לעבודתם של ארכיונאי האתר. הפירות ארכיאולוגיות והנדסיות חדשות, שתכליתן מחקר וייצוב של ההר, מצטרפות לפירות דגימה הידרולוגיות שכבר מתנהלת באזור. עמודי האשפה הכרויים משולבים במתקן השינוע והמחזור ובאזור הנגיפה לאתר, ולתוך חוריהם המרוקנים מחדר כבון מוון כדי למנוע את קריסתו הנצירה של ההר. מגדלי קידוח פיוסיליים רבי-דמיון, המתנשאים מעל כל אחד מחורי הפירות, משמשים כאבזרי ענק לנשיאת תאורה, מוצגים ודגלי שילוט ולתמיכה במגוון של פעילויות.



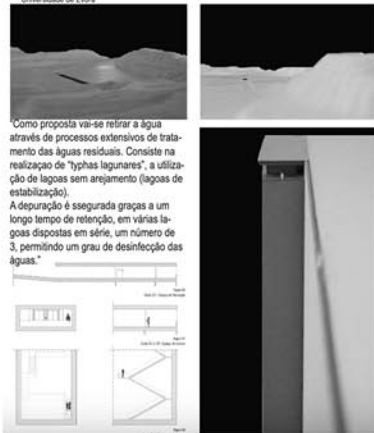
Monument of Unpleasant Necessities As a built monument, the fourth gesture draws connections and enhances high-level "conversations" between Hiriyá and other contemporary monuments in its vast urban surroundings. A skyline promenade directs walkers' and joggers' views to distant landmarks and other garbage mounds, using graphics signage and telescopes. Each of the designated monuments respectively redirects views back towards Hiriyá. Likewise, the top floor of the Shalom Tower, the Azrieli Center and the Opera Building, among others, are equipped with a telescope and display information about Hiriyá.

Like a Mesopotamian Ziggurat or a Mayan Temple, in which gods were called upon to answer the pleas of ordinary people, the garbage temple cries out to the deities of unpleasant necessities, forever reminding of our ubiquitous and precious lives.

מונומנט לצרכים מוכחשים כמומנט בניו, המחזה הרביעי מכוונת ויוזמת "שיחות" רמות-דרג בין חירייה לבין מונומנטים שכנויים אחרים בשיבתה האורבנית. טיילת של קו-רקיע מכוונת את מבטם של המטיילים אל נקודות-ציון מרוחקות ואל תלי אושה אדירים, תוך שימוש בשילוט גרפי ובטלסקופים. כל אחד מן המונומנטים הימשתתפים בשיחה, בתור, מכון את המבטים בחזרה אל חירייה. הקומות הנלוות של מגדל שלם, מרכז עיריילי ובניין המופרז, בין השאר, מצוידות אף הן בטלסקופים ומציעות מודע על חירייה. כמו יונרס מסמונטאמי או מקדש של בני המאיה, שבהם וזמן האלים בבקשה להיענות לתחייתיהם של האנשים, מקדש האשפה וזקק אל אלי הצרכים המוכחשים כתזכורת נצח לחייו – נדושים ויקרי-ערך כאחד.



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 Universidade de Euzora



Como proposta vai-se retirar a água através de processos extensivos de tratamento das águas residuais. Consiste na realização de "typhas lagunares", a utilização de lagoas sem arejamento (lagoas de estabilização).
 A depuração é assegurada graças a um longo tempo de retenção, em várias lagoas dispostas em série, um número de 3, permitindo um grau de desinfecção das águas."

Organização Arquitectónica do Centro Interpretativo:

"Ao encher-se a cortá, obtêve-se um espaço amplo onde se propôs edificar o Centro Interpretativo, que a partir daquele momento integra a paisagem da alóeia mineira de São Domingos.
 Recreou-se um edifício com a mesma forma e as mesmas dimensões (...) da Falca Pitrosa existente antes da extração mineira.

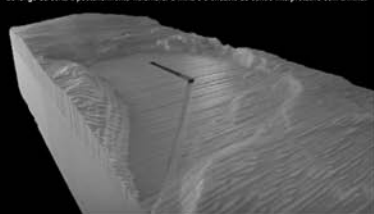
Como é um espaço amplo, idealizou-se transformá-lo num espaço público, onde enquadra no programa já existente da alóeia de São Domingos.

O Centro Interpretativo inicia-se por uma rampa, possibilitando desta forma o acesso a pessoas portadoras de deficiência.

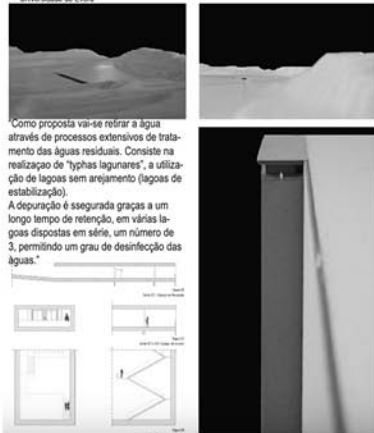
A rampa dá a percepção de estarmos a entrar para o subsolo, a mesma sensação que um mineiro sentia quando entrava para o antigo jazigo, contudo, a pessoa poderá visualizar o céu. No edifício temos dois corredores que são formados por massa, podemos aí encontrar os serviços sanitários e os acessos (elevadores). Nesse mesmo espaço, encontra-se um alpendre que permite olhar para as "profundezas" do Centro Interpretativo.

No final do acesso (elevador) temos um espaço de dispositivo onde permite à pessoa ler conhecimento não só, da vida do mineiro bem como o recurso natural que eles extrairam.

No final do dispositivo, encontra-se outro espaço de acesso – escadas – formada 700 degraus que dá a conhecer a altura que antes tinha desido, no final destas escadas existe a possibilidade de caminhar ao longo da cortá e posteriormente vislumbrar a mina e o enclave do centro interpretativo com a mina."



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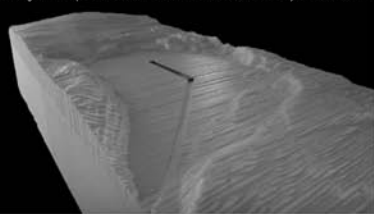
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Architettura e archeologia

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DADU Dipartimento di architettura, design e urbanistica, Università di Sassari

ESA École Spéciale d'Architecture, Paris

IUAV Istituto Universitario di Architettura di Venezia

Accademia di Architettura di Mendrisio, Università della Svizzera Italiana

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PAESAGGI MINERARI

Architettura e archeologia

PAESAGGI MINERARI
Territori dell'archeologia

Mining
landscapes
territory
of
archeology.

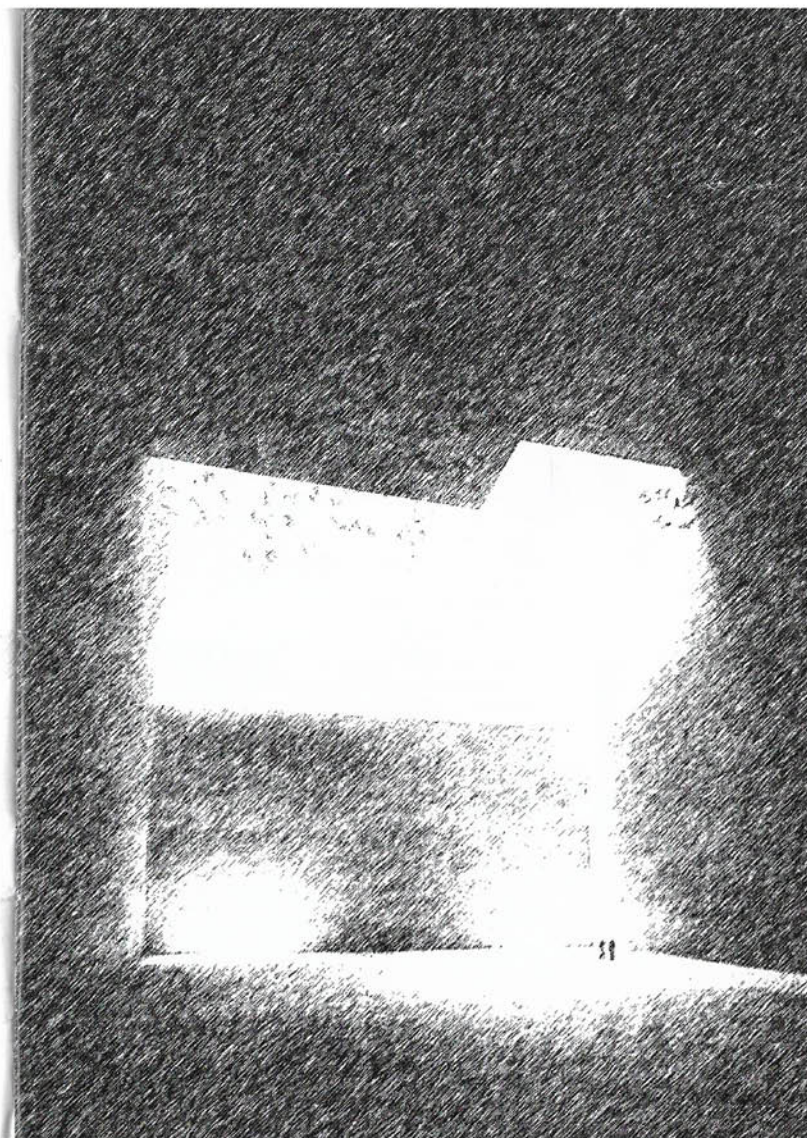
Il paesaggio minerario è una grande archeologia che si offre, oggi, come un potente dispositivo della forma e dell'analogia capace di provocare un senso della storia e della memoria dell'antico e l'immagine di una grande macchina architettonica i cui ingranaggi, bloccati, generano una sorta di sospensione della sua figura e il suo momentaneo offuscamento.

Gli aspetti, potremmo dire funzionali ed evidenti, non bastano, infatti, a descrivere e rappresentare il paesaggio minerario dismesso. Siamo di fronte, spesso, a straordinarie costruzioni geografiche artificiali, architetture di terra e "nella terra", infrastrutture, che si presentano come ignote e di difficile decifrazione, avendo perduto il dato funzionale originario che ne aveva determinato la loro condizione formale. Una situazione che ci consente alcune riflessioni generali che, direttamente o indirettamente, coinvolgono l'architettura.

L'archeologia è intesa come sistema di relazioni, segni, manufatti, memorie sparsi nel territorio, che attendono una loro decifrazione che può fondarsi su punti di vista diversificati. Gli argomenti progettuali proposti si definiscono, in questo senso, come una serie di tematiche alla scala territoriale che consentono di esprimere un progetto complesso e polisemico, di natura strategica, capace di ripensare il paesaggio minerario come archeologia, cioè spazio dell'interpretazione e dell'invenzione.

La grande scala e la percezione/representazione di un paesaggio territoriale coincidono con la natura di questi sistemi minerari, mai limitati alle relazioni solo localizzate ma sempre interrelati con il fatto geografico e con i processi ambientali più vasti. Questi scenari sono, quindi, le cornici entro cui approfondire, anche puntualmente, il progetto di architettura.

Proposta ispirata all'opera di Chillida per la definizione di uno spazio conformato nei vuoti della Miniera di Aquaresi-Masua (G. Peghin, 2016). Gli sterili delle lavorazioni minerarie vengono ricollocati nel sottosuolo come agglomerati cementizi che prendono forma architettonica e ridefiniscono i volumi dei vuoti sotterranei, consolidandoli.



TEMI PROGETTUALI

Il sistema delle grandi discariche minerarie
Per una esposizione internazionale dei paesaggi minerari

Il parco delle forme della terra
Itinerari topografici

Paesaggi del vino
Agricoltura, produzione, conservazione, immagine

Le vie dell'acqua
I sistemi idrografici e la questione ambientale

Punti, linee, superfici
Infrastrutture tra miniere e città di fondazione

Archeologie sotterranee
Spazi e sistemi ipogei dell'architettura mineraria

Riciclo
Sistemi e economie circolari nella costruzione del paesaggio post-minerario

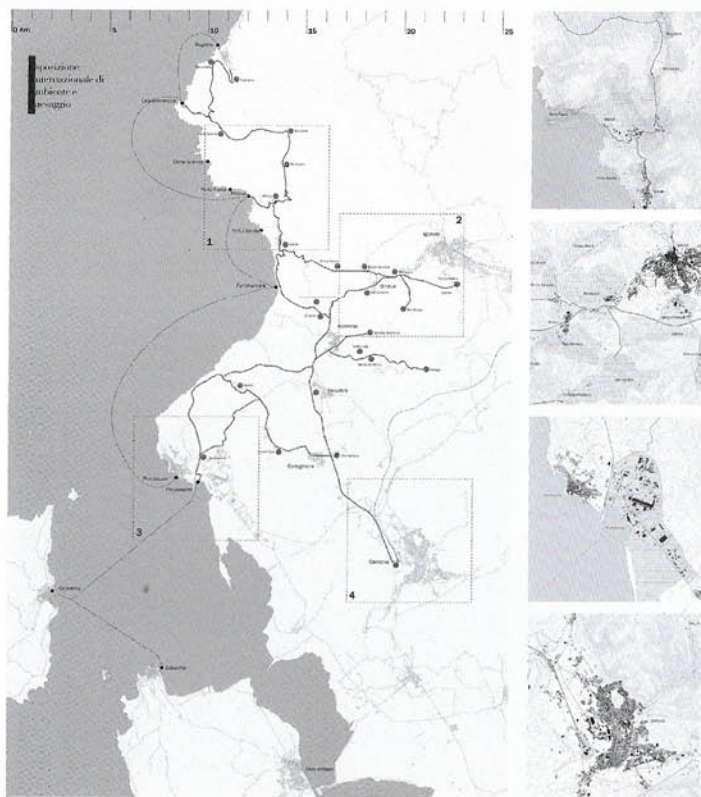
Giardini pensili
Paesaggi botanici e topografie artificiali

Narrazioni minerarie
Luoghi dell'abbandono e figure della memoria

**Il sistema delle grandi
discariche minerarie**
Per una esposizione
internazionale dei paesaggi
minerari.

Il paesaggio minerario dismesso può trasformarsi in un'esposizione che, oltre a definire un nuovo assetto territoriale basato sui luoghi delle attività estrattive ed industriali, introduce nuovi spazi della conoscenza e della sperimentazione sull'architettura alla grande scala.

Un'esposizione, quindi, che mette in scena il sistema di aree minerarie dismesse e le molteplici e differenziate tecniche di risanamento ambientale in una prospettiva di progetto di architettura del paesaggio.



**Il parco delle forme
della terra**
Itinerari topografici

Grandi scavi, colline artificiali, montagne bucate, terreni corrosi e incisi. Il paesaggio minerario è anche un grande manufatto artificiale di forme della terra che, semplificandone le evidenze, si possono riassumere in due principali espressioni: la sottrazione e l'addizione, azioni progettuali inconsapevoli, in quanto determinate da ragioni produttive e non dalla volontà di prefigurazione.

Oggi, queste "forme" si possono riconoscere come "monumenti" e archeologie, in un itinerario fantastico tra spazi sotterranei e topografie geometriche.



Paesaggi del vino
Agricoltura, produzione,
conservazione, immagine

Il Sulcis Iglesiente si presenta, alla fine della sua storia mineraria e produttiva, come uno dei luoghi della produzione vitivinicola internazionale. Le miniere dismesse e le vaste aree di sterili possono assumere, in questo contesto, il ruolo di luoghi della "conservazione" - negli spazi sotterranei - e della "sperimentazione" - nei terreni in cui sono presenti componenti chimici che possono generare nuovi e inediti tipologie di vino. Le archeologie di questo paesaggio industriale - manufatti e topografie artificiali - si trasformano in un nuovo paesaggio dell'agricoltura.



Le vie dell'acqua
I sistemi idrografici e la
questione ambientale

Le vie dell'acqua, ossia dal ruolo che l'acqua può assumere come elemento di un progetto che ne riconosce le sue molteplici forme: costruisce paesaggi dalla diversa vocazione ecologica e ambientale, si presenta come risorsa o come problema, è superficiale o sotterranea, visibile o invisibile.

La riconfigurazione del paesaggio attraverso nuovi spazi d'acqua consente di riflettere sul ruolo simbolico ed ecologico dei sistemi idrici e sul riequilibrio idraulico-ambientale del territorio.

Le vie d'acqua, la loro evidenza "archeologica", la natura simbolica, il ruolo ecologico e ambientale, possono divenire l'argomento per definire un dispositivo di rigenerazione urbana e territoriale attraverso il quale re-immaginare l'acqua come elemento fondativo di questo paesaggio.



Punti, linee, superfici
Infrastrutture tra miniere
e città di fondazione

La rete infrastrutturale di questo paesaggio costituisce una delle risorse più importanti che la vicenda mineraria e industriale hanno lasciato in eredità. Ferrovie, strade, stazioni, luoghi di interscambio, depositi, porti, centrali elettriche sono gli elementi - puntuali, lineari, areali - di un sistema "archeologico" che si presenta come residuo e frammento, in attesa di una ricomposizione secondo funzioni e ruoli differenti.



Archeologie sotterranee

Spazi e sistemi ipogei
dell'architettura mineraria

Il tema della rappresentazione di un luogo attraverso uno sguardo "creativo" può rendere il paesaggio minerario un luogo "altro", una cornice di possibili figure che si accalcano nell'immaginario e che trovano, nella laconica presenza del rudere e del frammento, la loro materializzazione. È un tema che si riferisce alle azioni e procedimenti, attraverso l'analogia e la trasposizione simbolica delle forme dell'architettura delle miniere: quelli dello scavo, della risignificazione di spazi vuoti sotterranei, potenziali espressioni formali e costruttive, che possono esprimere tecniche del progetto.

Lo scavo, la stereotomia e la tettonica, il conformare o dare forma, modellare, incidere, il pieno e il vuoto, la luce e il buio, il silenzio, sono parole che rappresentano azioni o concetti, in un'ipotesi di lavoro che può utilizzare i materiali della tecnica e della poetica, le immagini traslate o i luoghi reali.



Riciclo
Sistemi e economie circolari
nella costruzione del
paesaggio post-minerario

Il progetto di paesaggio non può interessare solo il singolo manufatto ma deve comprendere le profonde e critiche relazioni tra gli edifici, le dinamiche ambientali e i residui tossici, segni di una fragilità di questo sistema e insieme di una sua forte resilienza che costituiscono un'identità paesaggistica unica e di grande bellezza.

La riqualificazione, la rigenerazione e il risanamento ambientale dei siti minerari e industriali dismessi rappresentano - in una prospettiva di economie circolari - una sfida importante e urgente, ma anche l'occasione per definire una più ampia prospettiva di sviluppo basata sull'impulso alla ricerca scientifica nell'ambito delle tecniche di recupero ambientale e di architettura del paesaggio tale da generare competenze e strutture che operino a livello mediterraneo ed europeo.



Giardini pensili
Paesaggi botanici e
topografie artificiali

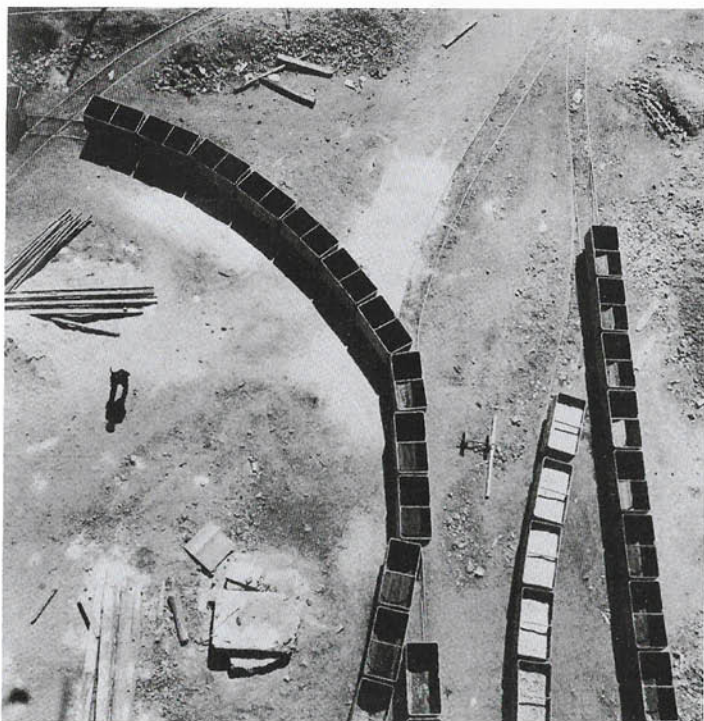
La natura si riappropria dei luoghi, anche di quelli in apparenza inhospitali e privi di materia organica. Nei paesaggi minerari i processi di abbandono hanno generato porzioni di paesaggi vegetali nuovi, inediti, residui di varietà botaniche introdotte per motivi funzionali o estetici, piante che decoravano i luoghi del lavoro, per ricordare la bellezza di un mondo normale, per risarcire la durezza del lavoro minerario.

Il paesaggio minerario è, in questo senso, un grande "orto botanico" che può svolgere una funzione rigeneratrice, soprattutto se si coglie il potenziale "depurativo" di alcune specie. L'introduzione, quindi, di un nuovo paesaggio vegetale - come in passato, ma con obiettivi differenti - può favorire la riqualificazione ambientale e la costruzione di una nuova figurazione.



Narrazioni minerarie Luoghi dell'abbandono e figure della memoria

La narrazione della miniera come città e come edificio richiama alcune figure dell'architettura, potenti attivatori di memorie, modelli: il tracciamento di un giacimento è un atto fondativo che produce figure simili alla pianta della città romana di Timgad; le prigioni di Piranesi sembrano restituire il complesso mondo sotterraneo di intrecci, livelli, collegamenti, spazi bui; i disegni di Fischer von Erlach sulla grande cisterna di Costantinopoli ci consente di immaginare gli spazi sotterranei come una grande architettura ipostila; il progetto per una Cattedrale Metropolitana di Boullée ricorda la maestosità delle grandi "camere" minerarie; il progetto della Banca d'Inghilterra di John Soane, disegnato da Joseph Michael Gandy, ci rimanda alla suggestione delle rovine come immagine di un grande monumento da interpretare e completare. Sono solo alcune delle immagini traslate possibili che creano una similitudine creativa e immaginaria tra il mondo delle miniere e il mondo dell'architettura.



LUOGHI DEL PROGETTO

Monteponi / San Giovanni / Campo Pisano

Nebida

Masua / Porto Flavia

Bugerru

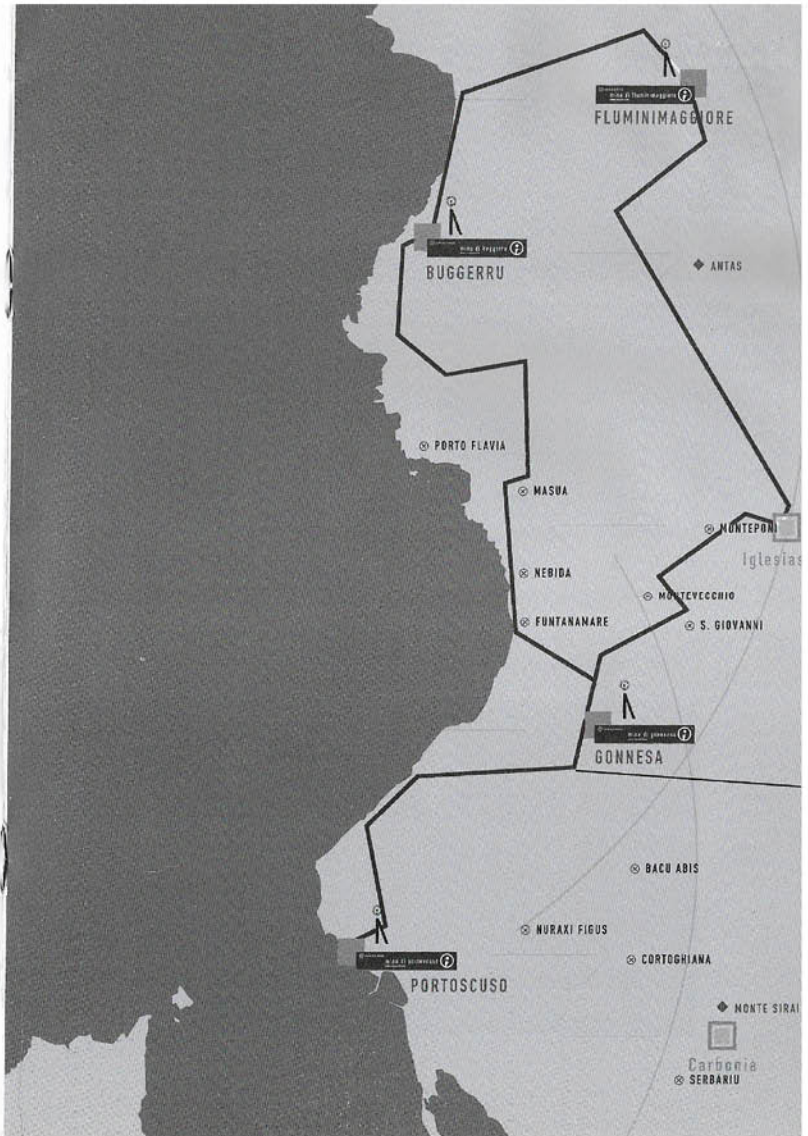
Funtanamare

Fluminimaggiore

Gonnesa

Portoscuso

Città di Fondazione



PORTO FLAVIA

Porto Flavia, opera realizzata nel 1924 dall'ing. Cesare Vecelli, è interamente scavato nella roccia. Attraverso una galleria di carico consentiva di caricare il minerale direttamente nella stiva delle navi mercantili. Il complesso sotterraneo riceveva i minerali dai depositi sotterranei delle miniere di Masua e Aquaresi per poi trasferirli nelle navi che potevano avvicinarsi alla costa, in un punto in cui la profondità del mare e la relativa protezione del sito per la presenza dello scoglio-isola di "Pan di Zucchero" consentiva questo tipo di sistema per l'imbarco dei minerali.

La perfetta corrispondenza tra l'architettura e la natura e l'integrazione tra il disegno e la forma naturale ha creato un'opera non mimetica che consente alla natura di assumere artificialmente una certa configurazione anche funzionale, applicando il principio del massimo risultato con il minimo sforzo.



MASUA

Sul finire del XIX secolo la Miniera di Masua costituiva una delle realtà industriali più importanti della Sardegna per l'estrazione dei minerali di piombo e dello zinco. Negli anni '70 venne intrapresa la coltivazione dei solfuri e degli ossidati della vicina miniera di Acquaresi. Questi giacimenti erano collegati con l'impianto di trattamento di Masua tramite la moderna Galleria di carreggio, denominata Ornella, lunga 12 km. Questa consentiva di raggiungere i cantieri e di trasportare ogni anno 500.000 tonn. di minerale. Nel 1991 per ragioni economiche vennero chiusi i cantieri e gli impianti di trattamento della miniera.

Il sito di Masua presenta oggi problematiche analoghe: un paesaggio straordinariamente suggestivo sottoposto a uno sfruttamento intensivo e ormai in abbandono che, portando con sé le difficili conseguenze della radicale trasformazione avvenuta in passato ad opera delle attività estrattive, mantiene allo stesso tempo quella forte connotazione identitaria che ne suggerisce le potenzialità di valorizzazione e sviluppo. Uno dei principali obiettivi per l'attivazione di tale riconversione è sicuramente quello della sostenibilità, che a Masua emerge con evidenza nella sua componente innanzitutto ambientale.

La possibilità di integrare tecniche di rigenerazione ambientale con ipotesi progettuali di riuso e riabilitazione può restituire a questi luoghi un ruolo attivo nella costruzione di un paesaggio che coniuga memoria, forma e nuove funzioni.



§

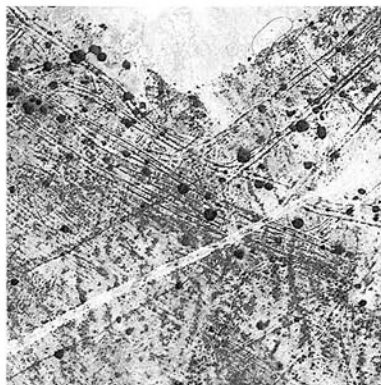
Marco Navarra
João Soares
Adriano Dessi
Roberto Sanna
Marta Oliveira
Jared Fantasia
Pedro Brito
Rui Silvestre

§

Masua_Porto Flavia
Monteponi/Iglesias-2019

frammentare la continuità del sistema minerario
cancellandone le tracce

Introdurre frammenti per
indurre la continuità dei sistemi naturali

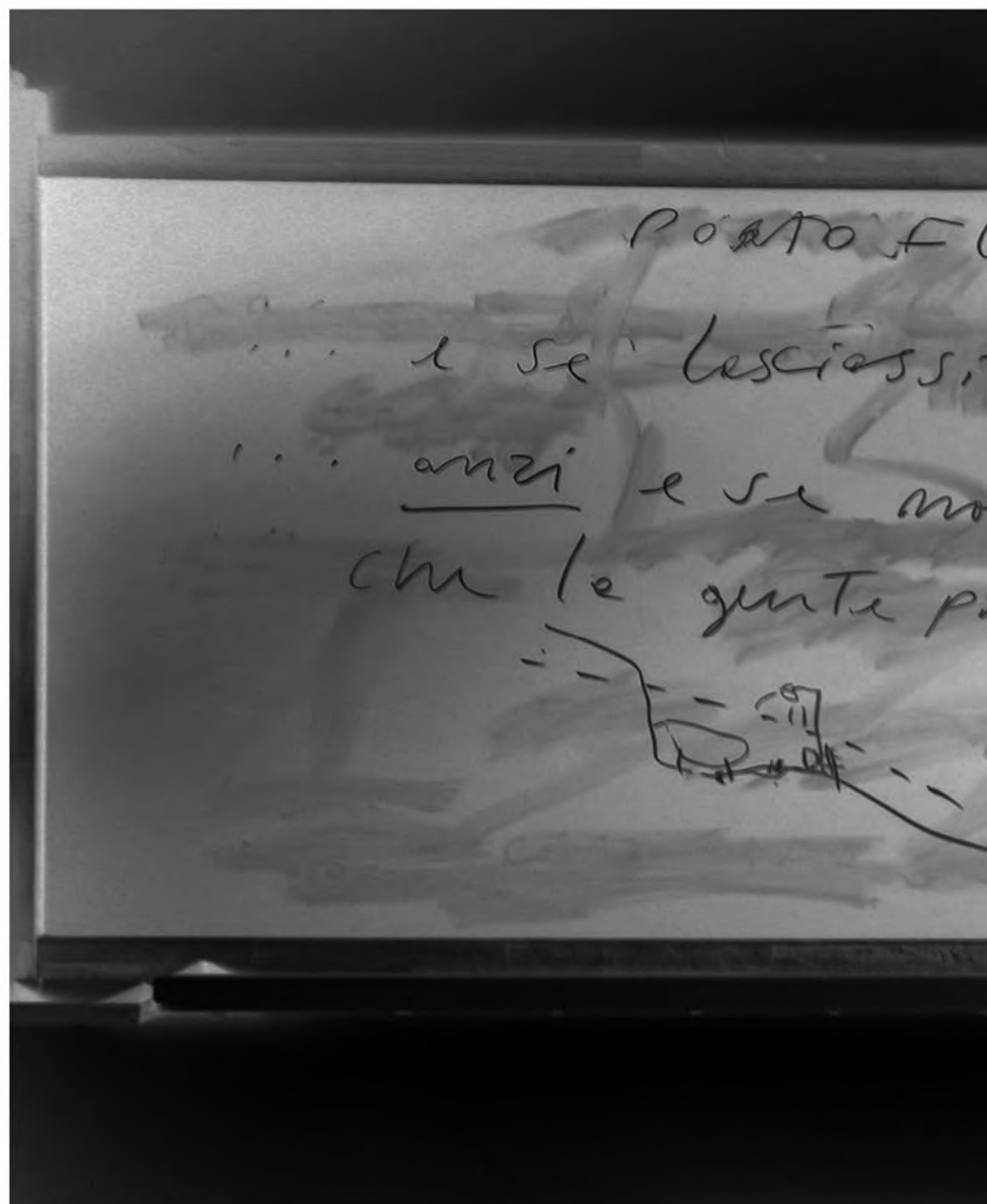






010 Plan showing the intention of the group project. Here we can see the coastal post-industrial site of Masua with its contrast of vegetated area with that of contaminated soil (on the right) as well as the abandoned harbour of Porto Flavia embedded into the cliff (on the left). The lines that are drawn show the proposed access of Port Flavia from land.





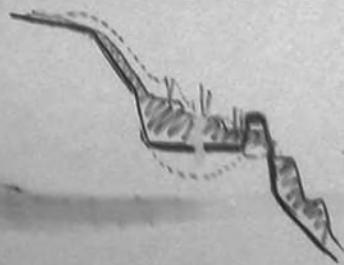
011 Photograph of conceptual drawing on chalk board relating to the initial discussion, in the group project for the workshop, elaborating on the intention to re-vegetate Masua.

LAVIA / MASSA

ma come sta?

in lasciassimo proprio

Tessi passer/entrou?





012 Comparison of two photographs. Left: A picture of a landscape with a lack of vegetation taken in 1940 by the Portuguese geographer, Orlando Ribeiro (at Fórnea, Alcaria, Porto de Mós, Leiria, Portugal). Right: A photograph of the same view of this landscape, taken much later by Portuguese photographer Duarte Belo, showing that after time the vegetation reclaims its way back into the landscape. The discussion of these two pieces was a pivoting point in the group project in relation to the post industrial site of Masua, Sardinia (Italy).





013 Composition of four images (sources unknown) used in the elaboration of the group project within the workshop of the 5th *International Workshop of Landscape and Architecture* (2019) held in Iglesias, Monteponi (Italy) showing the coastal post-industrial site of Masua, Sardinia. Here we can see a strong contrast between the native covering of vegetation and the toxic eroded land affected by mining activities where no vegetation grows.





014 Sequence of four conceptual cross sections - left to right - intended for the coastal region of Masua (Sardinia, Italy) showing the conceptual aim of the group project which was to facilitate the transformation of the post-industrial mining site and re-vegetate it, thus bringing back indigenous fauna and flora.





015 Sequence of two conceptual images - left to right - intended for the coastal region of Masua (Sardinia, Italy) showing the conceptual aim of the group project which was to facilitate the transformation of the post-industrial mining site and re-vegetate it, thus bringing back indigenous fauna and flora.



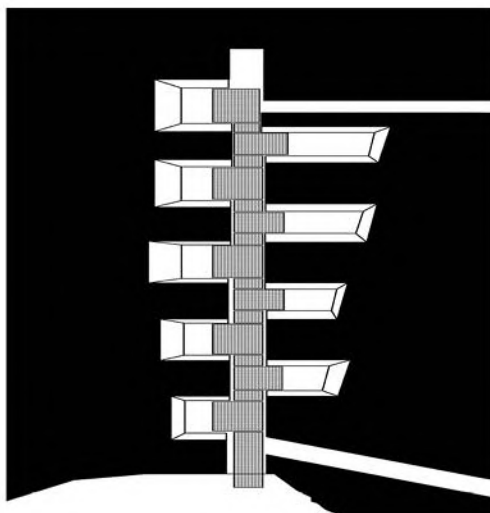


016 Horizontal section of Porto Flavia mining harbour at Masua, Italy (source unknown) showing the interior compartments of the mining structure within the cliff and the subterranean passage to Masua. This plan was used in the following workshop.

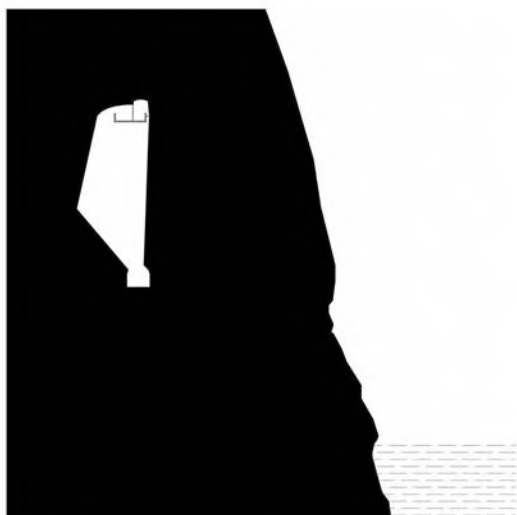




017 Drawing that was part of the development stage of the group project showing three individuals exploring the interior of dark cave. (Source unknown.) The intention of the project was for the individual to be able to access and explore the Porto Flavia post-industrial mining area through the subterranean tunnel built into the cliff from Masua.

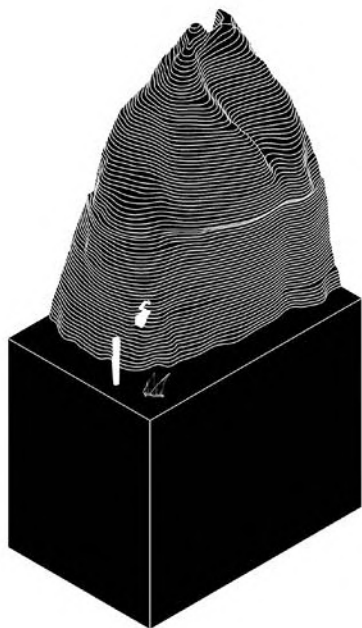


018 Horizontal section of the post-industrial harbour of Porto Flavia (created in the group project). Here we can see the intention of placing a steel platform that will allow access to the diverse empty compartments (voids) within the structure in the cliff face.

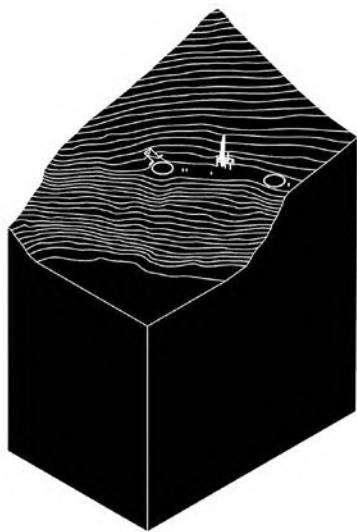


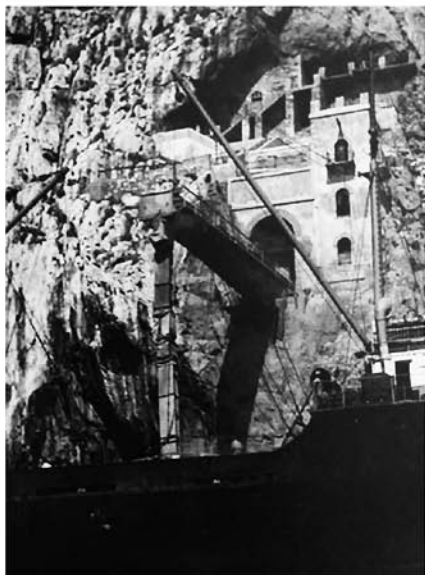
010 Two vertical section (left and right) of the post-industrial harbour of Porto Flavia (created in the group project). Here we can see the intention of placing a steel platform that will allow access to the diverse empty compartments (voids) within the structure in the cliff face.



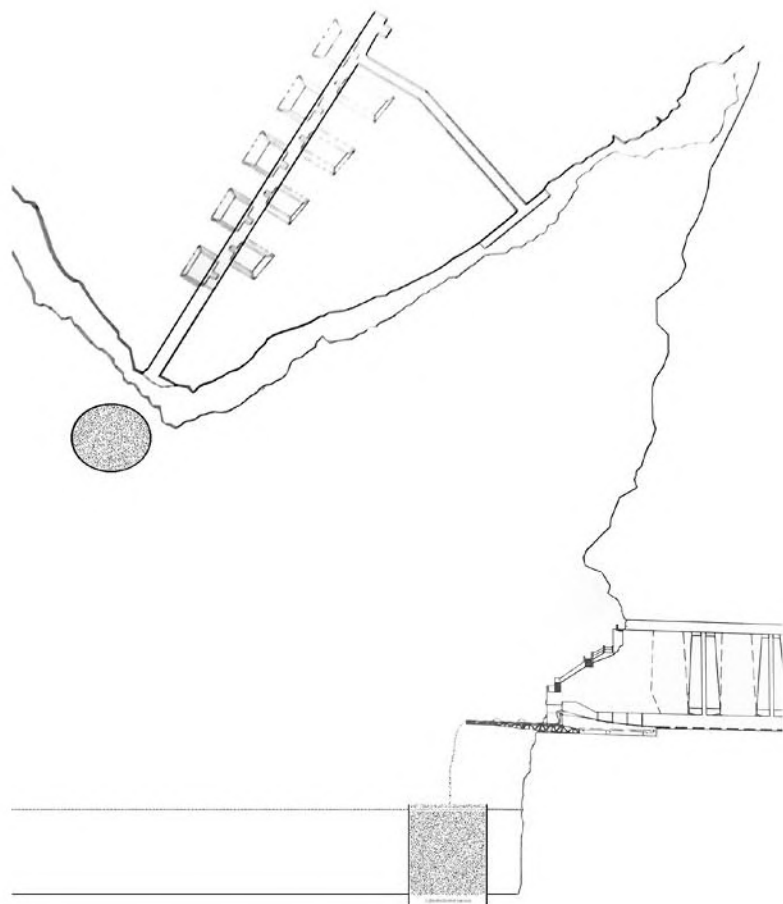


020 Two conceptual axonometric views (left and right), produced during the group work, showing the post-industrial harbour of Port Favia embedded in the cliff face. Left: The project of a towering concrete structure rising from the ocean floor to the height of the port. Right: The entrance to the subterranean gallery that allows access to Porto Flavia.

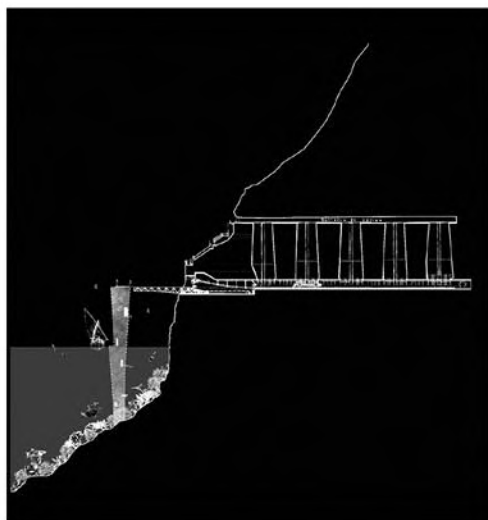




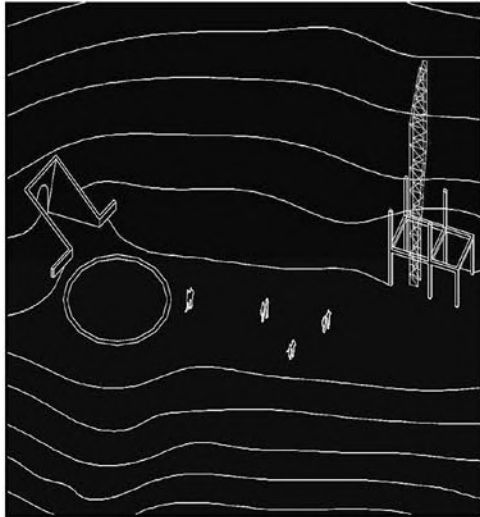
021 Top and Middle: Historical photos of Porto Flavia showing the loading of ore into ships.(Source unknown) Bottom: Image showing a work of Richard Long's exhibition piece (2009) consisting circle of gathered stones in the retrospective exhibition, 'Heaven and Earth' at Tate Britain, London, UK. 2009



022 "The island." A conceptual drawing © Jared Miguel Fantasia, 2018) from a personal proposal for a project at Porto Flavia Sardinia, created in the 5th *International Workshop of Landscape and Architecture, Iglesias Monteponi, 1/8 luglio 2019*. The work consisted of the creation of an artificial island with the action of continuous depositing of debris from the mine into a steel cylinder caisson delivered by boat. The project evokes the sublime technological beauty of the place where mineral ore was deposited into ships which transported it for transformation. The project was created through the idea of the filling of a steel cylinder caisson with rock to create an artificial island that can be visited. The island acts as a sort of non-site earthwork piece and, as a stage to understanding this landscape as a place of beauty dominated by the ingenuity of man i.e. the nature and capacity of Anthropocene man to overcome obstacles.



023 Two drawings which were produced during the group work, showing the post-industrial harbour of Port Favia embedded in the cliff face. Left: A cross section of the project of a towering concrete structure rising from the ocean floor to the height of the port, allowing access to the post-industrial structure from the sea and vice versa. Right: An axonometric view of the entrance to the subterranean gallery that allows access to Porto Flavia where a circular mirror of water is placed in front of the access.



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materials that make a difference

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Reinforced Soil Case Studies



Protective & Outdoor Fabrics
Aerospace Composites
Armour Composites

Geosynthetics
Industrial Fabrics
Grass

 **TENCATE**
materials that make a difference

Ten Cate Geosynthetics

Ten Cate Geosynthetics has been at the forefront of reinforced soil technology for more than 30 years. During that time our Company has built formidable expertise in reinforced soil technology. Today, Ten Cate Geosynthetics Group's reinforced soil business is focused as follows.

Worldwide coverage: Ten Cate Geosynthetics Group has worldwide coverage providing advice and delivery in all locations. Our geographical network can readily respond and provide quality solutions to create value for our clients.

Applications knowledge: Our expert personnel are at the forefront of reinforced soil applications knowledge. We not only provide applications advice and solutions for our clients but also serve on National Standards bodies that develop Codes of Practice on reinforced soil.

Value-engineered solutions:

By combining our applications expertise with our extensive range of geosynthetic reinforcements we are able to provide innovative, value-engineered solution to many reinforced soil applications. This approach increases the value provided to our clients.

High performance reinforced soil materials:

Ten Cate Geosynthetics Group manufactures and supplies a wide range of geosynthetic reinforcement materials specifically engineered for a wide range of reinforced soil applications.

High quality standards:

Ten Cate Geosynthetics Group operates to ISO 9001 quality procedures, the best standards in the industry. Also, our geosynthetic reinforcements conform to specific National quality requirements.

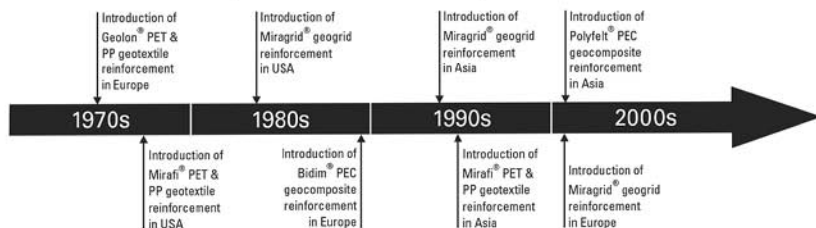
Efficient reinforcement material delivery:

Our Group is able to deliver our geosynthetic reinforcement materials efficiently to many diverse geographical locations. The materials are specifically packaged for ready storage on site if required.

Research and development:

We operate extensive research and development programs in the fields of both reinforced soil applications technology and geosynthetic reinforcement engineering. This places us at the forefront of new reinforced soil developments.

Ten Cate Geosynthetics' history in reinforced soil



Ten Cate Geosynthetics Group is a pioneer in the field of reinforced soil using geosynthetic reinforcements. The history of the Group's involvement stretches back to the mid 1970's.

- During the mid 1970's Ten Cate Geosynthetics Group first manufactured PET and PP woven geotextile reinforcements in Europe. These geosynthetic reinforcement materials were used for the efficient construction of basal reinforced embankments. In the late 1970's this technology was exported to the

United States with great success, and later to Asia (mid 1990's).

- During the early 1980's PET geogrid reinforcements were introduced in the USA. These geosynthetic reinforcement materials were used for the efficient construction of reinforced slopes and walls. Later, this technology was exported to Asia (mid 1990's) and to Europe (early 2000's).
- During the late 1980's PEC geocomposite reinforcements were introduced in Europe. These geosynthetic reinforcement materials

are novel in that they combine strength and stiffness with the ability to dissipate pore water, and have been used in reinforced slopes and walls where conditions require these characteristics. In the early 2000's this technology was exported to Asia.

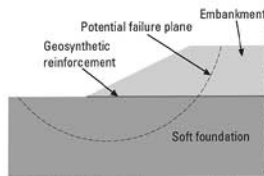
Ten Cate Geosynthetics Group has also been at the forefront of reinforced soil applications technology for over 30 years. During this time our expertise has enabled innovative reinforced soil design procedures to be developed.

Reinforced soil applications

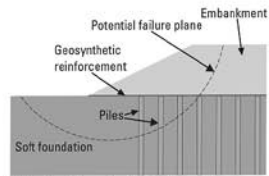
For reinforced soil applications a single layer, or multiple layers, of geosynthetic reinforcement are used to provide stability, and reduce deformations, in geotechnical structures. Geosynthetic reinforcement is used for a variety of reinforced soil applications, the most common are summarised below.

Basal reinforced embankments on soft soil

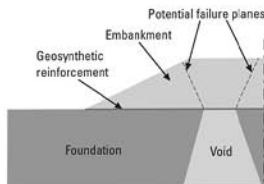
Here, a layer of geosynthetic reinforcement is placed at the base of an embankment constructed over soft foundation soils to improve the stability of the embankment. The presence of the geosynthetic reinforcement enables the embankment to be constructed higher, and with steeper side slopes, than would be the case if no reinforcement was used.



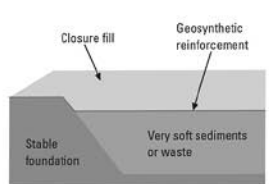
a) Basal reinforced embankments on soft soil



b) Basal reinforced embankments on piles



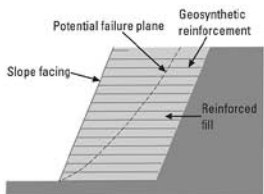
c) Basal reinforced embankments spanning voids



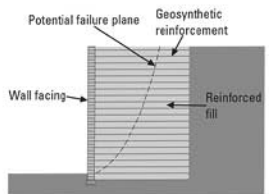
d) Reinforced soft site closures

Basal reinforced embankments on piles

Here, a layer of geosynthetic reinforcement is placed at the base of an embankment over a pile foundation platform to improve the stability, and prevent settlement, of the embankment. The presence of geosynthetic reinforcement in combination with the pile foundation platform enables the embankment to be constructed to any height, at any rate, without instability and settlement problems.



e) Reinforced fill slopes



f) Reinforced soil walls

Typical reinforced soil applications

Basal reinforced embankments spanning voids

Here, a layer of geosynthetic reinforcement is placed at the base of an embankment over a foundation that is prone to the formation of voids, to prevent instability and excessive localised settlements, to the embankment. The presence of the geosynthetic reinforcement ensures that foundation void formation does not lead to distress at the surface of the embankment.

Reinforced soft site closures

Here, a layer of geosynthetic reinforcement is placed across the surface of very soft deposits prior to the placement of fill and closure of the site. The presence of the geosynthetic reinforcement provides local stability, thus enabling a stable working platform to be constructed across the very soft deposit.

Reinforced fill slopes

Here, multiple layers of geosynthetic reinforcement are placed in the slope to provide stability and limit deformations while placing and compacting the reinforced fill. The presence of the geosynthetic reinforcement enables stable slopes to be constructed to any height and at any slope angle.

Reinforced soil walls

Here, multiple layers of geosynthetic reinforcement are placed in the wall to provide stability and limit deformations while placing and compacting the reinforced fill. The presence of the geosynthetic reinforcement enables stable walls to be constructed to a wide range of heights.

Reinforced soft site closures: Mine tailings pond closure, Huelva, Spain



The Sotiel Coronada mining complex is located at Calañas in the province of Huelva (Andalucia), Southwest Spain. This was a huge deposit of pyrite mineral that had been extracted over centuries of mining in the area. The main mineral extraction activity was the processing of copper, lead and zinc, as well as the production of sulphuric acid.

Following completion of mining and processing activities in the area, the environmental company, EGMASA of the Regional Government of Andalucia (Junta de Andalucia) was made responsible for the reclamation and closure of the large pyrite tailings pond (surface area around 35 ha) from September 2005 to April 2006.

The reclamation and closure of the tailings pond required the movement and placement of large volumes of tailings and subsequent fill. The tailings were very soft and extended to a depth approximating 18 m. In many areas the surface of the tailings were saturated, while in other areas there was a crust on the surface of the tailings, but very low shear strengths existed at shallow depth below the surface.

Due to the extensive area to be reclaimed, the large volumes of fill to be moved, and the tight time schedule of the Client, large volume, heavy earth

moving equipment had to be used. This posed a major technical problem as the heavy equipment had to traffick over the very soft tailings. The solution was to construct a 1.0 m thick stone-fill working platform over a layer of Polyfelt® PEC400 geocomposite reinforcement. Polyfelt® PEC400 is composed of high modulus polyester yarns in a composite structure and has an initial tensile strength of 400 kN/m in both the longitudinal and cross directions. The Polyfelt® PEC400 also acts as a geotextile separator preventing the intermixing of the soft tailings with the stone fill. The selection of this geocomposite reinforcement was determined on the basis of a detailed stability analysis of support for the heavy earth moving equipment over the very soft tailings deposit. Different possible loading scenarios were investigated before arriving at the final solution. Further, consideration was also given to the good resistance of this geosynthetic material to the effects of installation damage caused by the placement of large stones in the working platform.

The Polyfelt® PEC400 geotextile reinforcement was placed starting at the edges of the tailings pond (the high points) and working inwards to the centre (the low point). Care was taken to ensure that any run-off water would not contaminate the new working platform.

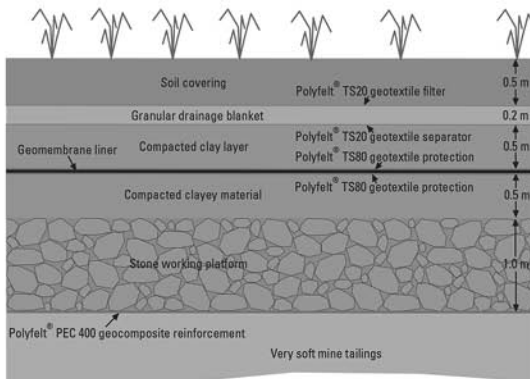
The stone fill was back-dumped from the earth moving equipment and then bulldozed over the top of the Polyfelt® PEC400 geocomposite reinforcement to ensure there was minimal disturbance of the soft tailings below.

Across the top of the working platform a 0.5 m thick layer of compacted clayey material was placed. This layer provided a smooth, stable platform for the subsequent placement of the geomembrane liner.

To prevent rainfall seeping into the contained mine tailings and prevent contaminants rising to the ground surface a barrier consisting of a composite geomembrane/ compacted clay liner system was employed. This consisted of a 1.5 mm thick HDPE geomembrane cushioned between two layers of Polyfelt® TS80 geotextile



Very soft, saturated tailings at certain locations in the tailings pond



Section through the mine tailings pond closure

protection, with a 0.5 m thick compacted clay layer on top.

To drain any percolating rainfall a 0.2 m thick granular drainage blanket was installed on top of the composite liner system. First, a Polyfelt® TS20 geotextile separator was placed to ensure no intermixing of the clay layer and the granular drainage blanket occurred. Then, the granular drainage layer was placed, and finally, a Polyfelt® TS20 geotextile filter was placed on top. After this, a 0.5 m thick soil covering was placed and the area vegetated. Extensive surface run-off drainage was also installed.

Client: Empresa de Gestion Medioambiental, S. A., Junta de Andalucía (EGMASA), Spain.

Consultant: Empresa de Gestion Medioambiental, S. A., Junta de Andalucía (EGMASA), Spain.

Contractor: Ferrovial Agroman, S.A., Madrid, Spain.



Placement of the granular fill working platform over the Polyfelt® PEC400 geocomposite reinforcement



Type of stone fill used as the working platform on top of the Polyfelt® PEC400 geocomposite reinforcement



Partial closure of the mine tailings pond



Installation of the Polyfelt® TS20 geotextile separator prior to placement of the granular drainage blanket

Reinforced soil walls: Coal mine dump wall, Sangatta, East Kalimantan, Indonesia



PT Kaltim Prima Coal located at Sangatta, on the East coast of Kalimantan, has been mining coal in this location since the early 1990's, and is today one of the largest coal mining companies in Indonesia. At Sangatta, the company has developed a fully integrated and self-supporting mine with a series of open-cut pits and coal preparation and processing facilities, supported by a 10 MW coal fired power station.

The coal at the Sangatta mine is delivered to the coal crushing plant where it is crushed and, if necessary, screened and washed at the coal washing plant before it is placed onto a 13 km long overland conveyor belt for transportation to the shipping terminal.

To increase the handling and transportation capacity at the mine site a new vertical dump wall had to be constructed. To minimize earthworks, the vertical dump wall was to be constructed by excavating into a hill side slope. On top of the hill an access road would lead large dump trucks up to the top edge of the dump wall. A hopper chamber would receive the dumped coal and this chamber would funnel and deliver the coal at a constant rate onto the conveyor belt located at the foot of the vertical dump wall.

Various retaining wall options were investigated for the dump wall. The retaining wall has a maximum height of 17.5 m and is required to support the vertical loads of the heavy dump trucks working close to the top of the wall face. A reinforced soil retaining wall system was chosen using a rock-filled gabion facing with Polyfelt® PEC geocomposite reinforcements. The unusual feature of the wall was that the Polyfelt® PEC geocomposite reinforcements were not structurally connected to the gabion facing. Instead, the gabion facing was connected to the geosynthetic reinforced soil structure by the short embedment of wire mesh tails into the reinforced fill zone.

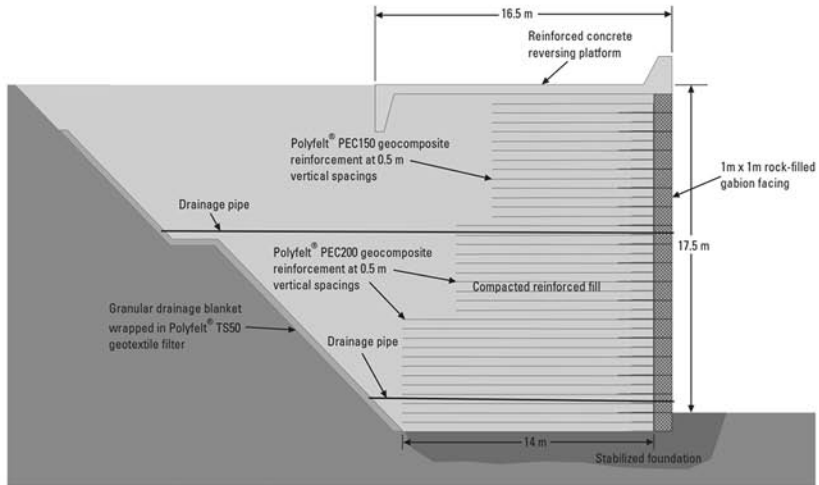
The foundation base of the reinforced soil retaining wall was stabilized, leveled and then compacted to achieve a minimum undrained shear strength of 200 kPa. The lowest level of the gabion facing was set 1 m below surrounding ground level. Polyfelt® PEC geocomposite reinforcements were installed at 0.5 m vertical spacings throughout the height of the wall. At the face of the reinforced fill zone, immediately behind the gabion facing, the Polyfelt® PEC geocomposite reinforcements were wrapped around the face of the compacted reinforced fill and anchored back into the fill to the required embedment length at the next

reinforcement level. Polyfelt® PEC200 (200 kN/m tensile strength) was used for the lower courses of the reinforcement while Polyfelt® PEC150 (150 kN/m tensile strength) was used for the upper courses of the reinforcement.

At each gabion level, the wire mesh tails of the gabion units were laid 2 m into the compacted reinforced fill at each 1 m gabion height. The reinforced fill used for the construction of the reinforced soil retaining wall was a residual soil obtained from a borrow area within the mine site. The residual soil was of a silty sand gradation and was considered appropriate provided good compaction was carried out and good drainage measures were provided. Compaction was carried out using a 10 tonne compactor to achieve 90% Standard Proctor compaction.



Placing Polyfelt® PEC geocomposite reinforcement across reinforced soil wall



Section through retaining wall at maximum height

A drainage blanket to intercept groundwater seepage at the rear of the reinforced soil wall was provided. This consisted of granular material wrapped in a Polyfelt® TS50 geotextile filter. At two levels within the wall a series of drainage pipes at 4 m horizontal spacings were installed to drain the water captured in the drainage blanket out through the face of the retaining wall.

The choice of Polyfelt® PEC geocomposite reinforcement enabled the use of the local residual soil as the reinforced fill material even though it contained a significant fine fraction. It was considered that if water penetrated the reinforced fill zone at a later time, then it could be dissipated out of the wall structure using the geocomposite structure of the Polyfelt® PEC reinforcement.

A 0.5 m thick reinforced concrete slab was cast on top of the retaining wall. This served as a reversing platform for the coal dump trucks.

The choice of a rock-filled gabion facing permitted the facing erection process to be done manually, without the use of lifting cranes. Besides being the most cost effective option for the client, the reinforced soil wall structure was successfully completed to good

engineering tolerances without any contractual delays.

Client: PT Kaltim Prima Coal, East Kalimantan, Indonesia.

Consultant: Golder Associates, Brisbane, Australia.

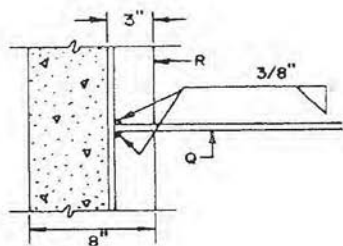
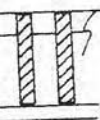
Contractor: PT Petrosea, Jakarta, Indonesia.



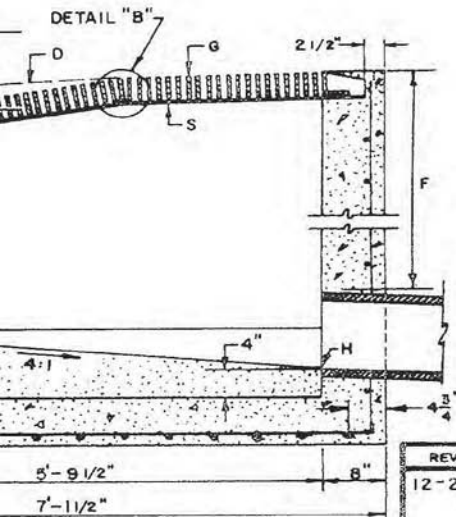
Compacting granular drainage blanket wrapped in Polyfelt® TS50 geotextile filter



Construction of gabion facing



DETAIL "A"



SECTION B-B

GENERAL NOTES:

1. FOR STORM INLET GUTTER TRANSITION, SEE DWG. 2207.
2. OUTLET PIPE SIZE, PER DESIGN REQUIREMENT.
3. FOR FRAME & GRATING, SEE DWG 2216, 2220 & 2221.
4. FOR ANCHOR DETAIL, SEE DWG 2205.

CONSTRUCTION NOTES:

- A. GUTTER TRANSITION.
- B. BACK OF CURB.
- C. TOP OF CURB.
- D. NORMAL GUTTER LINE.
- E. CONSTRUCTION JOINT.
- F. 1'-10" MIN. UNLESS OTHERWISE DIRECTED.
- G. SLOPE GRATE TO PAVEMENT GRADE.
- H. INVERT PER DESIGN.
- J. CONCRETE FILL, MINIMUM SLOPES AS SHOWN.
- K. FOR STORM INLET DEPTHS GREATER THAN 4' INSTALL STD STEPS, SEE DWG 2229.
- L. EXTEND NO. 4 REBARS 18" INTO CURB ON EACH SIDE OF STORM INLET.
- M. NO. 4 BARS AT 6" O.C.
- N. ANCHOR.
- P. 3 1/2" X 3 1/2" X 1/2" X 4'-4".
- Q. 3 1/2" X 1/2" X 3'-4 3/8".
- R. 4" X 3" X 1/2" X 5'-2".
- S. FRAME AND GRATE.
- T. STEPS ON DOWNSTREAM FACE.

REVISIONS
12-21-92

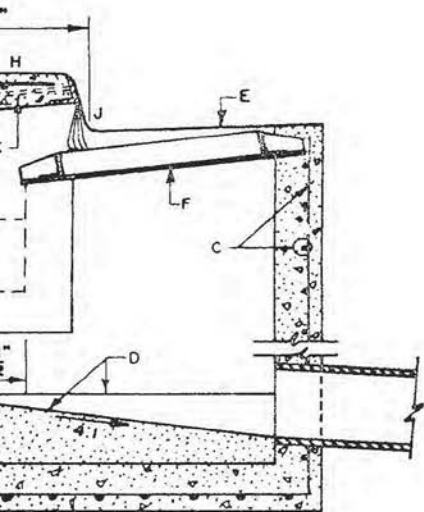
CITY OF ALBUQUERQUE
DRAINAGE
STORM INLET TYPE "B"
DWG. 2203
AUG. 1986

GENERAL NOTES:

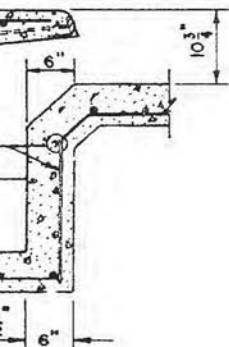
1. SEE DWG 2201 FOR PLAN AND SECTION A-A.
2. GENERAL NOTES 2, 3 & 4 ON DWG 2201 ALSO APPLY TO THIS DWG.
3. FOR ANCHOR DETAIL, SEE DWG 2205

CONSTRUCTION NOTES:

- A. STORM INLET STEPS, SEE DWG 2229 FOR SPACING.
- B. 1"-10" MIN UNLESS OTHER WISE DIRECTED.
- C. NO. 4 BARS AT 6" O.C. EACH WAY.
- D. CONCRETE FILL, MINIMUM SLOPES SHOWN IN SECTIONS.
- E. NORMAL GUTTER.
- F. GRATE FRAME.
- G. INVERT ELEVATION PER DESIGN.
- H. TOP OF CURB.
- J. FLOWLINE.
- K. ANGLE ANCHOR.

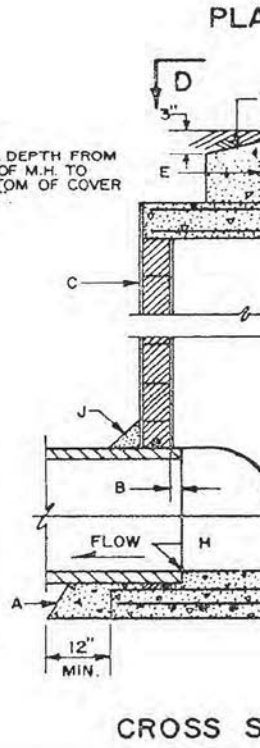
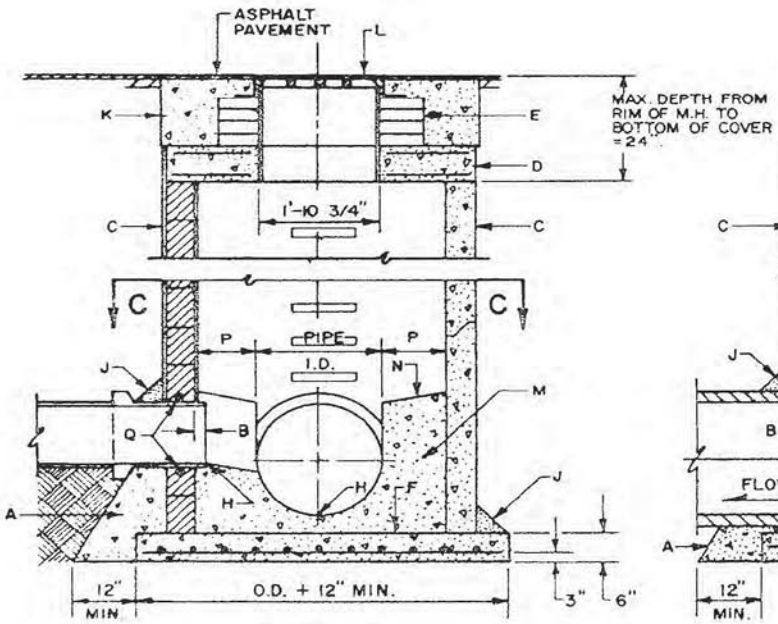
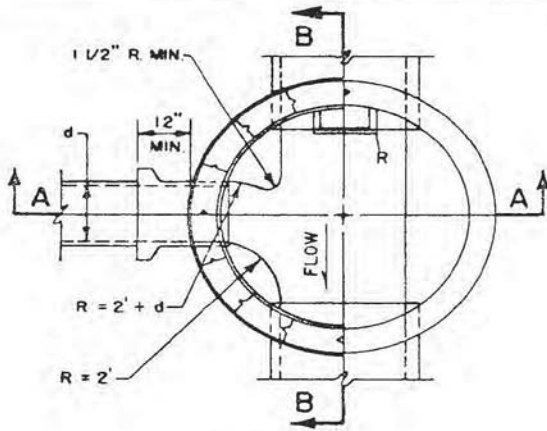


SECTION C-C



SECTION E-E

CITY OF ALBUQUERQUE	
REVISIONS	DRAINAGE STORM INLET TYPE "A" SECTIONS B-B, C-C, D-D & E-E DWG. 2202
	AUG. 1986

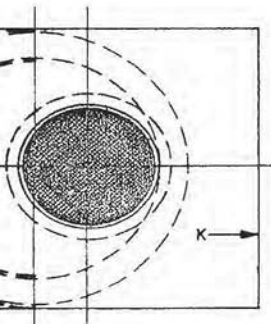


GENERAL NOTES

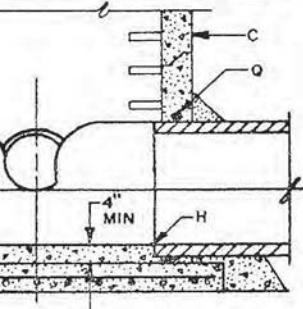
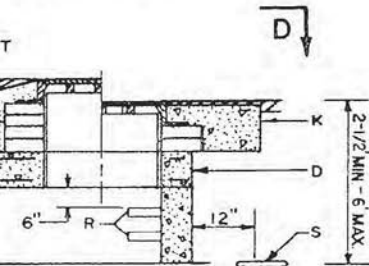
1. USE TYPE "C" MANHOLE FOR DEPTHS OF LESS THAN 6' MEASURED FROM INVERT TO RIM.
2. CONTRACTOR HAS OPTION TO CONSTRUCT TYPE "C" MANHOLE IN LIEU OF TYPE "E" MANHOLE FOR DEPTHS OF 6' OR MORE.
3. DESIGN APPLIES TO 4' TO 6' I.D. MANHOLES.
4. MANHOLE GREATER THAN 18' IN DEPTH SHALL ONLY BE CONSTRUCTION PRECAST CONCRETE SECTIONS.
5. USE NON-SHRINK GROUT FOR JOINTS, FILLETS AND PENETRATIONS.
6. COMPACT ALL BACKFILL AROUND MANHOLE TO 95%.
7. POSITION MANHOLE OPENING OVER THE UPSTREAM SIDE OF MAIN LINE.

CONSTRUCTION NOTES

- A. CONCRETE PIPE SUPPORTS SHALL EXTEND OUTSIDE OF MANHOLE TO BELL OF FIRST JOINT AND SHALL CRADLE PIPE TO SPRING LINE NOT APPLICABLE FLEXIBLE PIPE.
- B. PIPE PENETRATION INTO MANHOLE SHALL BE FLUSH TO 2" MAX., MEASURED AT SPRINGLINE OF PIPE.
- C. MANHOLE MAY BE CONSTRUCTED OF CONCRETE BLOCK, GR. MS BRICK, POURED CONCRETE OR PRECAST REINFORCED CONCRETE IF BLOCK OR BRICK PLASTER INSIDE AND OUT WITH 1/2" MORTAR. SEE DWG. 2118 FOR DETAILS.
- D. PRECAST CONCRETE COVER, SEE DWG. 2107.
- E. USE MAX., 4 COURSES GR. MS BRICK ON UNPAVED STREET FOR FUTURE ADJUSTMENT OF MANHOLE FRAME TO PAVEMENT GRADE PLASTER INSIDE WITH 1/2" MORTAR.
- F. CONCRETE BASE TO BE POURED IN PLACE USING NO. 4 BARS AT 6" O.C. EA. WAY FOR MANHOLE DEPTH OF 16' OR GREATER. NO. 4 BARS AT 12" O.C. EA. WAY FOR MANHOLE LESS THAN 16' IN DEPTH.
- H. INVERT ELEVATION OF STUB OR LATERAL AS SHOWN ON PLANS.
- J. 6" GROUT FILLET ON UPPER HALF OF PIPE AND AROUND BASE.
- K. USE A 5' X 5' CONCRETE PAD IN ALL AREAS.
- L. FRAME AND COVER, SEE DWG. 2110.
- M. CONCRETE, SEE SECTION 101.
- N. SLOPE 1" PER FT. FROM PIPE CROWN.
- P. SHELF TO BE 9" WIDE MIN.
- Q. APPROVED WATERSTOP TO BE COMPATIBLE WITH TYPE OF PIPE.
- R. STEPS TO BE INSTALLED AS PER SPEC. SECTION 920.
- S. EMD (IN UNPAVED AREAS).
- T. IN UNPAVED AREAS SET FRAME TO GRADE AND SLOPE TOP OF PAD.



MAN AT D-D



SECTION B-B

REVISIONS
11-14-91

CITY OF ALBUQUERQUE	
SEWER	
MANHOLE TYPE "C"	
DWG. 2101	AUG. 1986

Endnotes

1- Sofia Salema is currently Associate Professor at the Department of Architecture at Évora University, Portugal and holds a Doctorate in Architecture from the Faculty of Architecture at the Universidade Técnica de Lisboa, Portugal (2012). Her areas of specialisation are: Architecture, conservation and architectural rehabilitation, conservation of architectural surfaces, heritage and Intervention in the built heritage, research by design/ research by the architectural project. Accessed November 23, 2018. [https://www.eartes.uevora.pt/pessoas/\(id\)/4490](https://www.eartes.uevora.pt/pessoas/(id)/4490)

2- José Adrião, Portuguese architect and teacher at the Architecture Department at the Universidade Autónoma de Lisboa (since 2001) holds a Masters Degree from the Universidade Politécnica da Catalunha, Spain (2002). He was co-director of JA-Journal Arquitectos and has received numerous architectural awards of note.

Accessed November 23, 2018. <https://josedadriao.com/en/practice/people/#1446053066647-5f57ccbe-07de>

3- The programmatic content of this design studio can be consulted in Attachments (pp.012 - 013).

4- These writings can be consulted - with personal notes - in Attachments (pp.014 - 024).

5- Mira Engler is a Professor of landscape architecture (Iowa State University) and Director of the Master of Landscape Architecture (MLA) program (USA). She is a published author having written, *Designing America's Waste Landscapes* (JohnHopkins University Press,2004) where she explores attitudes to urban sewerage grounds and waste dumps.

Accessed November 23, 2018. <https://www.design.iastate.edu/faculty/miraengl/>

6- Mira Engler's proposal for the Hiriyá waste mound can be consulted - in Attachments (pp.025 - 031).

7- Paulo David, Portuguese architect, who graduated from the Faculty of Architecture at Universidade Técnica de Lisboa in 1989, has had (since 2003) an established studio in Madeira, Portugal having previously worked in Lisbon for architects Gonçalo Byrne and João Luis Carrilho da Graça in Lisbon. He has been an invited teacher at university workshops worldwide and has received numerous awards for his work - Including the distinguished Alvor Aalto Medal in 2012. Accessed November 23, 2018. <http://arquinfad.org/2015/premis2009arxiu/Curriculum%20paulo%20david.pdf>

8- Selected images of the project from the design studio 2012/2013 can be consulted in the first edition of the *Revista de Arquitectura e Urbanismo Académico Português*® This can be consulted in Attachments (pp.032 - 033).

Accessed November 23, 2018. [https://www.eartes.uevora.pt/informacoes/noticias/\(item\)/8905](https://www.eartes.uevora.pt/informacoes/noticias/(item)/8905)

9- Portuguese architect João Gabriel Candeias Dias Soares, graduated in architecture at the Faculty of Architecture at Universidade do Porto, Portugal and received a PhD at the IUAV in Venice, Italy. He is currently Associate Professor at the Department of Architecture the University of Évora, Portugal and director of the Doctoral Programme in Architecture at the university. His research focuses on the themes of landscape architecture and public space. His publications have appeared in international journals and books.

Accessed November 23, 2019. http://www.chaia.uevora.pt/pdf/CV_JoaoSoares.pdf

10- The introduction to the program for the *5th International Workshop of Landscape and Architecture* (2019) held in Iglesias, Monteponi (Sardinia, Italy). Can be consulted in Attachments (pp. 034 - 053).

11- Giorgio Peghini, architect and PhD, is a Full Professor and researcher at the Faculty of Engineering and Architecture of the University of Cagliari, where he teaches architectural and urban design. He is a published author and editor of a number of books on architecture. He is a designer and consultant of urban and landscape renewal plans such as the regeneration of the new town and open-air museum of modern architecture in Carbonia, the project for the redevelopment

of the mining landscapes "Costa delle miniere" and agricultural landscapes of the Sulcis. In 2010 the project *Carbonia Landscape Machine*, coordinated by Antonello Sanna and the Department of Architecture of the University of Cagliari, won the Landscape Award of the Council of Europe. Accessed November 23, 2019. <https://people.unica.it/giorgiomariopeghin/curriculum/>

12- Marco Navarra teaches architectural design at the University of Catania. He is the founder of NÓWA studio and is the author of numerous books on architecture and landscape. He has exhibited projects, installations and researches at the Venice Biennale, the Milan Triennale, the Mies van der Rohe Foundation, the CCCB in Barcelona and the CCA in Montreal. He was a finalist for the Mies Van der Rohe Award (2003), the European Prize for urban Public Space (2006) and the BSI Swiss Architectural Award (2008). He won the gold medal for the first work of the Milan Triennale (2003) and the Gubbio Prize (2006). Accessed November 23, 2019. https://trasparenza.polimi.it/sites/default/files/ugov_files/575682_NAVARRA%20MARCO%20C.V.pdf

13- Adriano Dessì, architect, has a PhD in Architecture at the Department of Architecture of Cagliari and is a professor of Architectural and Urban Composition at the Faculty of Engineering and Architecture of Cagliari, Italy. He specializes in Landscape Architecture and has been awarded international recognition for his design activity - four times awarded at the European Competition in Italy, Portugal, Austria and France. Between 2008 and 2010 he received the Landscape Award of the Sardinia Region for Project activities.

Accessed November 23, 2019. <https://people.unica.it/adrianodessi/>

14- Material used and created relating to the group project that was undergone in the 6th International Workshop of Landscape and Architecture (2019) held in Iglesias, Montepòni (Sardinia, Italy) can be consulted in Attachments (pp. 054 - 081).

15- *Paesaggi Minerari Architettura e archeologia Vª Laboratorio Internazionale Di Architettura e Paesaggio International Workshop of Landscape and Architecture Iglesias Montepòni*, 1/6 luglio 2019.

Accessed November 23, 2019. www.architettura.unict.it/upload/archivio_eventi/2018_2019/altro/paesaggi_minerari.pdf

16- Ibid.

17- Sir Robert Eric Mortimer Wheeler (1890-1976) was considered one of the world's first professional archaeologists whose pioneering efforts laid the foundation for modern archaeology.

Accessed January 23, 2018. www.monumentsmenfoundation.org/wheeler-brig-sir-mortimer

18- This is an interesting topic but one which is not investigated in this thesis. Further reading can be found on the subject in Abalos, Itaki, and Juan Heróros. "Areas of Impunity and Vectorial Spaces: 4 Projects for Public Space." *AA Files*, no. 31, 1996, pp. 18-30. JSTOR. Accessed November 23, 2020. www.jstor.org/stable/29543999.

19- In his book *The Songlines*, British travel writer, Bruce Chatwin describes songlines as "the labyrinth of invisible pathways which meander all over Australia and are known to Europeans as 'Dreaming-tracks' or 'Songlines'; to the Aboriginals as the 'Footprints of the Ancestors' or the 'Way of the Lore'. Aboriginal Creation myths tell of the legendary totemic being who wandered over the continent in the Dreamtime, singing out the name of everything that crossed their path - birds, animals, plants, rocks, waterholes - and so singing the world into existence." Chatwin, Bruce. *The Songlines*. New York: Random House, 2012. p.2.

20- Sol LeWitt, (1928-2007) American artist whose work provides a link between Minimalism and Conceptual art. "Sol LeWitt." *Encyclopedia Britannica*. Accessed February 15, 2018. <https://www.britannica.com/biography/Sol-LeWitt>

21- Alessandro Poli (architect) belonged to the Superstudio architectural firm founded in Florence, Italy 1966.

- 22-** "Master Class with Alessandro Poli." Uploaded July 20, 2019. CCA Channel video, 22:19 min. Accessed November 23, 2019. <https://www.youtube.com/watch?v=YMOrOUSRFkEmethod> from traditional materials salvaged from thirty old villages demolished in the area to make way for development. With local craftsmanship, a living place of cultural memory.
- 23-** "Forest, Field & Sky: Art Out of Nature." 2016 [Film] Ben Harding dir. UK. British Broadcasting Corporation (BBC)/Ben Harding dir. & James Fox Script. Accessed August 20, 2019. <https://www.youtube.com/watch?v=q262DGn6QeM>
- 24-** *Nomad: In the Footsteps of Bruce Chatwin.* 2019 [Film] Werner Herzog dir. [Sideways film]United Kingdom: BBC Studios.
- 25-** Burke, Edmund. *A Philosophical Inquiry into the origin of our Ideas of the Sublime and the Beautiful.* 1757.
- 26-** Kant, I., 1764. *Beobachtungen über das Gefühl des Schönen und Erhabenen / Kant, I. Observations on the feeling of the Beautiful and Sublime.* Translated by J.T. Goldthwait, 1961. Berkeley: University of California Press.
- 27-** Nye, D. *American Technological Sublime.* Cambridge, Mass : MIT Press.1994.
David E. Nye is Professor of American Studies at the University of Southern Denmark and published author. "David Nye." University of Southern Denmark. Last modified January 1, 2018. <https://portal.fhnresearcher.sdu.dk/en/parsons/david-nye>
- 28-** The Mathematical term 'Klein Group' was introduced by Felix Klein in his study of the roots of polynomial equations. The Klein four-group was with four elements with a rule for combining them (where the group operation must satisfy four conditions).
Encyclopedia Britannica. Accessed March 12, 2018. <https://www.britannica.com/biography/Felix-Klein>
- 29-** John Beardsley is director of Garden and Landscape Studies at Dumbarton Oaks. He is the author of *Earthworks and Beyond: Contemporary Art in the Landscape* (1984; fourth edition 2006) and numerous books and articles on contemporary art and design.
"Between Land Art and Landscape Architecture: A Dialogue with Udo Weilacher and John Beardsley." Dumbarton Oaks. Accessed December 21, 2018. <https://www.doaks.org/research/garden-landscape/scholarly-activities/between-land-art-and-landscape-architecture-a-dialogue-with-udo-weilacher-and-john-beardsley>
- 30-** "Robert Morris: *Para-Architectural Projects* — Hunter College Art Galleries." Hunter College Art Galleries. Accessed November 11, 2018. <https://huntercollegeartgalleries.org/events/2019/9/26/robert-morris-para-architectural>.
- 31-** A short film, James Turrell's *Roden Crater*, was commissioned by LACMA on the occasion of the exhibition "James Turrell: A Retrospective" on view at LACMA from May 26, 2013 through April 6, 2014. Uploaded 12 February 2020. <https://www.youtube.com/watch?v=g0g6JFYRkxQ>
- 32-** "Carl Andre: *Sculpture As Place, 1958–2010.*" Home · MOCA. Accessed October 26, 2020. <https://www.moca.org/exhibition/carl-andre-sculpture-as-place>.
- 33-** "Troublemakers:The Story of Land Art." 2016. [Film] James Crump dir. Summitridge Pictures and RSJC LLC. http://firstrunfeatures.com/educational-sales_orderinginfo.html
- 34-** Gruen, J., 1977. "Michael Heizer: 'You might say I'm in the construction business'." ARTnews [Art Media ARTNEWS, llc]. Accessed July 26, 2019. <http://www.artnews.com/2015/06/26/theres-no-understanding-of-my-work-michael-heizer-on-his-monumental-art-in-1977/>.
- 35-** "Troublemakers:The Story of Land Art." 2016. [Film] James Crump dir. Summitridge Pictures and RSJC LLC. http://firstrunfeatures.com/educational-sales_orderinginfo.html

- 36-** Smithson, Robert., Jack D. Flam. 1996. *Robert Smithson, the Collected Writings*. Berkeley: University of California Press.
- 37-** The theoretical confrontation between site and nonsite could be contemplated further and discussed relating to other fields. For example could consider the genius loci hypothesis by Norburg Shultz in architecture and by Marc Augé's concept on the Non-places: introduction to Anthropology of Supermodernity.
- 38-** Troublemakers:The Story of Land Art. 2015. [Film] James Crump dir. Summitridge Pictures and RSJC LLC. http://firstrunfeatures.com/educational-sales_orderinginfo.html
- 39-** Ibid.
- 40-** Gruen, J., 1977. "Michael Heizer: "You might say I'm in the construction business"." ARTnews (Art Media ARTNEWS, Inc). Accessed July 26, 2019. <http://www.artnews.com/2015/06/26/theres-no-understanding-of-my-work-michael-heizer-on-his-monumental-art-in-1977/>.
- 41-** Troublemakers:The Story of Land Art. 2015. [Film] James Crump dir. Summitridge Pictures and RSJC LLC. http://firstrunfeatures.com/educational-sales_orderinginfo.html
- 42-** Ibid.
- 43-** Ibid.
- 44-** Lindquist, G., 2013. "Descending into the Abyss of Double Negative." *The Brooklyn Rail*, September, 2013. Accessed July 26, 2019. <https://brooklynrail.org/2013/09/artseen/descending-into-the-abyss-of-double-negative>
- 45-** BmoreArt. Accessed January 22, 2019. <https://bmoreart.com/2018/10/entropy-and-the-old-monuments.html>.
- 46-** "ARQUEOLOGÍA DEL FUTURO." *Multiples Estrategias De Arquitectura*. Accessed October 1, 2018. <https://www.santiagodemolina.com/2014/10/arqueologia-del-futuro.html>.
- 47-** National Geographic Society. "Anthropocena." National Geographic Society. Last modified June 5, 2018. <https://www.nationalgeographic.org/encyclopedia/anthropocena/>.
- 48-** Stromberg, J., 2013. "What is the Anthropocene and Are we in it? *Smithsonian Magazine*, January 2013. Accessed 19 July 2019. <https://www.smithsonianmag.com/science-nature/what-is-the-anthropocene-and-are-we-in-it-164801414/>
- 49-** Tayebi-Khorami et al., 2019 "Re-Thinking Mining Waste Through an Integrative Approach Led by Circular Economy Aspirations." MDPI. Last modified May 10, 2019. <https://www.mdpi.com/2075-163x/9/5/286>
- 50-** European Commission. Accessed October 1, 2018. <https://ec.europa.eu/environment/waste/studies/mining/0204finalreportbrgm.pdf>.
- 51-** European Commission. Accessed October 1, 2018. https://ec.europa.eu/environment/waste/mining/pdf/Annex3_closure_rehabilitation%20.pdf
- 52-** Federal Office for Spatial Development ARE. "1987: Brundtland Report." Accessed October 25, 2018. https://www.arena.admin.ch/arena/en/home/sustainable-development/international-cooperation/2030agenda/un_-milestones-in-sustainable-development/1987--brundtland-report.html.
- 53-** Pina. 2011 [Documentary] Wenders, Wim dir. [FC film] Germany.

54- "Spiral Jetty." The Foundation I Holt/Smithson Foundation. Accessed June 15 2018. <https://hoitsmithsonfoundation.org/spiral-jetty>

55- Heizer, cited in Michael Kimmelman — "Michael Heizer: A Sculptor's Colossus of the Desert." The New York Times Web Archive. Last modified December 12, 1999. <https://archive.nytimes.com/www.nytimes.com/library/arts/121299heizer-art.html>.

56- "Robert Morris: Para-Architectural Projects — Hunter College Art Galleries." Hunter College Art Galleries. Accessed November 21, 2018. <https://hunter-collegeartgalleries.org/events/2019/9/26/robert-morris-para-architectural>.

57- Between 1985 and 2005, Spanish Architects Inaki Abalos and Juan Herreros in the firm, Abalos & Herreros created a series of infra-structural projects related to structures which treated urban waste - such as water treatment plants and garbage recycling plants. In these projects, they faced obstacles relating to pragmatic restrictions of resources in new field of architecture. The construction of the water treatment plants created in 1990 in Majadahonda, Madrid, the Valdemingómez project in 2000, and their Garbage Recycling plant in 2003, showed that architects could develop projects involving the implementation, design and construction of huge urban waste recycling facilities. The structures of these industrial facilities (advanced for their time) were created to hide the waste-removing processes away from the view of its citizens. Juan Herreros stated that the Valdemingómez garbage recycling plant had at the time of construction, the largest green roof in Europe and the first public visitor circuit in this type of building. "This helped to develop the 'museumification' of infrastructure that Cedric Price was so interested in, the idea paved the way for what we would later call 'ecomumentality'." Herreros also claims that Abalos and Herreros actively sought projects in "areas of impunity" referring to "unregulated spaces that have not yet been subject to conventions". Referring to "areas of impunity" (a topic written about by Abalos and Herreros in their book of that title - published by Actar Ed. in 2002), Herreros states that:

The slogan also refers to the fact that in the 1980s, architecture was prejudiced against many types of work, and that the discipline tended to simply ignore them. But for [Abalos & Herreros] these prejudices were effectively hiding real laboratories for experimentation. For this reason, in our first four years working together, Abalos and I entered many competitions associated with engineering firms to build infrastructure - something that closely matched our interest in projects linked to tourism, malls and the repurposing of obsolete industrial spaces. These interests were not typical for architects at that time, and so just working on types of projects like these was a statement. We were claiming a place for architecture that the discipline had so far refused to enter. This gave us the added benefit of being pioneers, and as a result, we had impunity in our experimentation - there were no antecedents to our work.

ARPA Journal | ARPA Journal is a Public Forum for Debate Based at Applied Research Practices in Architecture at the Columbia University Graduate School of Architecture, Planning and Preservation. Accessed October 1, 2018. https://arpajournal.net/wp-content/uploads/2015/07/Herreros-+de-Backer_-_Eficient-cy-As-Design-.pdf.

58- Landscape architect, urbanist, artist and climate activist, Martha Schwartz is Professor in Practice of Landscape Architecture at the Harvard University Graduate School of Design and is a participant of the GSD Climate Change Working Group. She has actively campaigned for the need to green urban space and moreover, has placed the field of landscape architecture in a place of leadership in challenges faced by climate change.

Martha Swartz's *Geraldton Mine Project*, commissioned by the Barrick Gold Corporation and completed in 1998 in a small mining town in Canada, reclaimed mining wasteland and transformed it into an open area for recreation and sport, varying in different seasons. The 27' deep mining tailings over an area of 170 acres were sculpted into an earthwork:

Technical constraints were key to the final form of the earthwork. The different types and sizes of earth moving equipment and their turning radii provided guidelines for the grading plan. A primary objective in the project is to balance cut and fill, and to maintain a maximum total earth moving of 150,000 cubic meters. Cut is kept to a minimum as arsenic levels are higher toward the bottom of the pile. There is a cap at the bottom of the pile of tailings, and there is a maximum of an additional 5 meters that can occur on top. Standing water has been considered as a design element, but the water table has been respected by the re-grading. Storm drainage is maintained and the proposed earthwork will not impede sight lines for traffic safety. Six to twelve inches of peat topsoil will be added to disturbed areas to aid in re-vegetation. A planting plan for the project focuses primarily on native grasses, especially those golden in color. The soil can support plants, although plants will not be watered.

"McLeod Tailings, Geraldton, Canada." Martha Schwartz Partners. Last modified April 4, 2017. <https://msp.world/mcleod-tailings-geraldton-canada/#>.

59- American architect, sculptor and environmentalist, Maya Lin's site-specific earth works include her wave fields and more specifically *Storm King Wavefield* (2007-2008) consisting of seven, one hundred foot series of undulations of grass-covered earth ranging from ten to fifteen feet high resemble the waves in a sea while being set against mountains and valleys in the background (Schunemunk Mountain to the west and the Hudson Highlands to the south and east). The work can be considered as a reclamation earthwork project as it is located on a reshaped gravel pit. Once between the mounds, the work's intention is for the person walking it to become part of the landscape because you become 'lost' inside it. The work can be considered as a reclamation earthwork project as working with the New York State Department of Environmental Conservation a gravel pit was reshaped. Landscape architects used the existing gravel and topsoil at the site and low-impact grasses were planted. Lin designed a natural drainage system. Earthwork artists of the 1970s and 1980s were among influences which shaped her interest in creating works in the landscape.

"Maya Lin." Storm King Art Center. Accessed October 1, 2018. <https://stormking.org/artist/maya-lin/>.

60- Herman Prigann (1942 - 2008) was an environmental land artist, painter and sculptor who approached his works from an ecological perspective. He was drawn to the environment - especially ravaged earth which is damaged by man's activities pertaining his culture of materialism and industrialism, focusing also on Germany's coal mining areas with their degraded industrial sites. Prigann's involvement in the latter involved earthworks, turning post-industrial sites into public parks for recreation but retaining the vestiges of their cultural heritage or *genius loci*. This work bears evidence to his approach to culture and nature - at odds at each other as it were. Prigann in *Thoughts about "Art in Nature"* (1988), advocates that a non-romanticised collaboration between culture and nature is possible and, is in fact critical - given the world's environmental crisis due to man's culture of industrial activity on it. Instead of seeing nature and culture as potlaties, Prigann asserts that a dialogue with nature is possible through art; art in nature has the capacity to change man's aesthetic through dialogue because it immerses man in the landscape and blends him with it. Aesthetic of art in nature, is of free of preconception and other references and so the work is able to mediate between man and nature changing man's perception of the landscape. The aesthetic however is subject to change in time and the artwork is never truly complete as being the landscape, it is subject to change through the natural forces of entropy which act upon it. Art "mediates through the sculptural site in landscape nature as a space of sensation and perception, in which a sensibilization of the relationship environment - human beings - culture - nature is made evident."

Herman Prigann's *Yellow Ramp* 1993 - 1995. Formed part of the biennale for land art, in an old post-industrial lignite mining area, Cottbus, Germany. The earthwork, part of Prigann's Terra Nova Programme consists of a mound (220 m in length) with an observatory (12m in diameter) on top. The mound is composed of granite, large concrete slabs (part of the rubble from a previous industrial site) and covered with vegetation. Unemployed people in the locale were used in its construction providing dialogue with a community who would value the site. The work resembles that of a Neolithic mound serving as an observation point for the surrounding landscape. Lehenbauer (2012, 72) notes that observatory constructed on the lines of that of the Neolithic consists of concrete slabs in four cardinal points. Four passages between the slabs on the eastern side allow the sun to touch the inner two stones (centre) during the solstice. Yellow, flowering plants have been planted over the mound, contributing to the name of the work. Lehenbauer (2012, 72-73) notes that the purpose with Prigann's *Yellow Ramp*, "is to have an interplay between the time process in former coal mines, controlled by technical means and the natural process of time".

61- Latz + Partners' *Landscape Park Duisburg-Nord* (2002) is one project from the International Building Exhibition Emscher Park in the industrial Rhur district of Germany. In *Landscape Park - Duisberg-Nord*, Latz + Partners created from the disused industrial site (the blast furnace plant Thyssen-Meiderich), a landscape park - a place of new cultural heritage. This was achieved by preserving elements of its industrial past while transforming it through nature into a new landscape - rather than completely clearing the site and creating a new project. Various ecological systems with gardens have been created in the different areas on different levels and at the same time are subtly integrated into one another as well as with parts of the town, promenades and a railway park and rail harp.

"August 2015 - The Dirt." Accessed October 1, 2018. <https://dirt.asia.org/2015/08/>

"Duisburg Nord Landscape park, DE." Latz + Partner, Landscape Architects Urban Planners. Accessed October 1, 2018. <https://www.latzundpartner.de/en/projekte/postindustrielle-landschaften/landschaftspark-duisburg-nord-de/>

62- Chinese architect Wang Shu from the Wang Shu, Amateur Architecture Studio creates modern buildings with a sustainable approach. He uses reclaimed materials reclaimed from demolished sites in the area (along with modern material such as concrete) which is not only eco-friendly but creates a cultural dialogue with the community (placing the traditional in harmony with the modern). Wang shu's use of the craftsmen who live in the locale of where a project is built creates a further dialogue with the community who have a cultural investment in the project.

The *Ningbo History Museum* (a 30,000-square metre building) at Ningbo in Zhejiang Province, China in 2008, can be seen as what Wang Shu describes as a building of living culture. A harmonious balance is created between concrete walls (with bamboo moulded texture) and walls constructed (using the wapan method) from traditional materials salvaged from thirty old villages demolished in the area to make way for development. With local craftsmanship, a living place of cultural memory. Architectural Design Based on WangShu's Approach to Theory and Research I KNE Social Sciences. " KNE Publishing Platform. Accessed October 1, 2018. <https://knepublishing.com/index.php/KNE-Social/article/view/5530/10817>.

"Ningbo Historic Museum / Wang Shu, Amateur Architecture Studio." ArchDaily. Last Modified February 22, 2018. <https://www.archdaily.com/14623/ningbo-historic-museum-wang-shu-architect>

"Wang Shu's Ningbo History Museum Built from the Remains of Demolished Villages." Dezeen. Last modified August 10, 2016. https://www.citefast.com/?s=Chicago#_Webpage

63- Architects Enric Miralles and Carme Pinós' project, *Igualada Cemetery* (Barcelona, Spain), completed in 1994, was intended to facilitate a place of connection with the living and the dead through reflection and memories. Built on the edge of a quarry on dry river valley, the project could be said to be one of post-industrial reclamation. Culture and nature are blended, its physical location along a riverbed is symbolic with the notion of a river being synonymous with life. The work seems to blend seamlessly into the natural landscape as the project has made use of the natural contours and features of the site (rather than using intervention) (Talento et al. 2020,9). In addition to concrete and steel, gabions containing stone from the site have been used as supporting walls and used in the paving - as opposed to fabricated material (Talento et al. 2020,9).

"AD Classics: Igualada Cemetery / Enric Miralles + Estudio Carme Pinos." ArchDaily. Last modified May 19, 2013. <https://www.archdaily.com/375034/ad-classics-igualada-cemetery-enric-miralles-carme-pinos>

64- The *Beizec Cemetery Memorial* opened on June 3, 2004. Polish sculptors Andrzej Sioyga, Zdzislaw Pidek and Marcin Roszczyk won the competition for the project to be created on this site - a former Nazi death camp (near the Ukrainian border with South East Poland) and the graveyard of nearly half a million Jews who had been exterminated in its gas chambers. At the end of World War II, the Nazis demolished the buildings and ploughed over the site of mass graves. A wood was then planted and a farm established on the site in an attempt to erase all evidence of its existence. The sculpture today is a cemetery covering an entire site. Entering within it, a didactical experience takes place. The site was accessed by railway (being 50m from the main Lublin-Lvov railway line) and as the visitor enters the path, which gradually becomes a narrow passageway up the hillside, its walls become more oppressive, creating a feeling akin to the fear once experienced by those who entered the camp, having left the train. On either side of the passage and sloping up the hill, the ground is symbolically, covered in "specially prepared material (stone wastes mixed with cinders and sterile soil)" (Talento et al. 2020, 10) evoking memory of the dead beneath the soil. The passage ends at a rectangular cavern - symbolic of a railway carriage - with the names of victims engraved on its walls.

"A Description of the Concept of the Cemetery Memorial to the Victims of the Nazi Death Camp in Beizec." Central page. Accessed October 1, 2018. <http://www.deathcamps.org/beizec/memorialisdescription.html>.

"Beizec." Accessed October 1, 2018. <http://andrzejsoyga.pl/index.php/en/beizec-en>.

"EUMiesAward." Accessed October 1, 2018. <https://miesarch.com/work/1224>

65- Spanish architects, Rafael Aranda, Carmen Pigem and Ramon Vilalta of RCR Architects, *Piedra Tosca Park* of 2004, in Les Preses Catalunya, Spain, created a sustainable sculpture using the material on the site to expose its natural and cultural history. The area, a volcano, is covered in basalt rock which for centuries has been used by indigenous people to create structures and who have cleared it to create patches of land for the purpose of agriculture. In the project, slatted steel walls create passageways through the dense field of rocks in situ and rock has been used to create gabions, paths, walls, seats, flowerbeds and fountains in the park (Talento et al., 2020, 10). The project is truly sustainable; the work has been created from naturally occurring 'waste' in situ; the paths minimise damage to the protected environment from visitors exploring the area; it exposes the natural heritage and culture of the area; it provides income from tourism to local inhabitants.

"Piedra Tosca Park/RCR Arquitectes." Arch Daily. Last modified April 7, 2016. <https://www.archdaily.com/806228/piedra-tosca-park-rcr-arquitectes> "Piedra Tosca Park, Les Preses, Catalunya, Spain." ALL CHANGE. Accessed October 1, 2018 <https://rmitalichange.weebly.com/pedra-tosca-park-les-preses-catalunya-spain.html>

66- Nineteenth-century panoramas were controlled three-dimensional illusions of 360o vistas giving the viewer a landscape they had never visited before. Visitors entered the circle by means of a tunnel or staircase. They were a popular form of entertainment.

"The Spectacle of the Panorama I British Library - Picturing Places." The British Library. Accessed 18 Aug, 2018. <https://www.bl.uk/picturing-places/articles/the-spectacle-of-the-panorama>

67- "Art and the Landscape I TClF 2014 Landscape." The Cultural Landscape Foundation I Connecting People to Places. Accessed August 18, 2018. <https://tcif.org/sites/default/files/microsites/art-landscape/opus-40.html>

68- Ibid.

69- "Art Park: Spoils' Pile Reclamation, 1976-1978: Ongoing." The Harrison Studio – Helen Mayer Harrison and Newton Harrison Environmental & Ecological Artists. Accessed June 19, 2018. <http://theharrisonstudio.net/art-park-spoils-pile-reclamation-1976-1978-ongoing>

70- Ibid.

71- Ibid.

72- William Bennett, emails to Jared Fantasia, May 02, 2020 and May 14, 2020

73- Ibid.

74- Ibid.

75- Ibid.

76- Ibid.

77- Ibid.

78- "Robert Morris Completes Construction of His Untitled Earthwork (Johnson Pit #30) in SeaTac on November 2, 1979." The Free Online Encyclopedia of Washington State History - HistoryLink.org. Accessed June 27, 2018. <https://www.historylink.org/File/20691>.

79- "Untitled (Johnson Pit No.30)." The Cultural Landscape Foundation I Connecting People to Places. Accessed June 27, 2018. <https://tcif.org/landscapes/untitled-johnson-pit-no-30>

80- Ibid.

81- Nye, D.,1994. *American Technological Sublime*. Cambridge, Mass : MIT Press1967).

82- "Copper: the first metal mastered by man." In Focus on Economics. 2017. Accessed June 20, 2018. <https://www.focus-economics.com/blog/copper-facts-commodity-explainer>

83- Powers of Ten and the Relative Size of Things in the Universe." Eames Office. Accessed July 20, 2018. <https://www.eamesoffice.com/the-work/powers-of-ten/>

84- CGIAR Consortium for Spatial Information (CGIAR-CSI) SRTM 90m Digital Elevation Database v4.1 Accessed July, 20 2018. <https://cgiarcsi.community/data/srtm-90m-digital-elevation-database-v4-1/#:~:text=The%20SRTM%20digital%20elevation%20data,areas%20of%20the%20developing%20world.>

85- "Clearcut, Humber Mountain, Clatsop County, Oregon." National Gallery of Art. Accessed July, 20 2018. <https://www.nga.gov/collection/art-object-page.168280.html>

86- Joseph Meehan (2006). *The Magic of Digital Photography: Close-up*. Sterling Publishing Company, Inc. ISBN 978-1-57990-662-8.

87- The hydro-electric dam of Itaipu is situated on the Paraná River between Brazil and Paraguay. The name was taken from an island on the river nearby, with the meaning of indigenous word, meaning "sounding stone"
"The World's Largest Generator of Renewable Clean Energy." ITAIPU BINACIONAL I A Maior Geradora De Energia Limpa E Renovável Do Planeta. Accessed June 20, 2018. <https://www.itaipu.gov.br/en>

88- Frederick o' Harvey, was part of the vast team of Cornwall experts who started S. Domingos mine exploration work and was Mine Captain. The map is by Richard o'Harvey (grandson of Frederick o' Harvey) and was designed based on the notes in Frederick o' Harvey's mining book where the latter recorded the underground exploration works at the mine.

"Frederick Harvey." Centro De Estudos Da Mina De São Domingos I. Accessed September 5, 2018. <https://www.cemsd.pt/node/5179>

89- Pedro Victor da Costa Sequeira (1845 -1905) was a graduate in mathematics from the University of Coimbra and qualified as mining engineer in the École des Mines de Paris. He rose to a senior position in the Portuguese Ministry of Public Works and Trade and Industry and was also civil governor of the district of Beja where, as engineer and administrator, he oversaw work carried out at the S. Domingos Mine.

"Pedro Victor Da Costa Sequeira - Wikipédia, a Enciclopédia Livre." Wikipédia, a Enciclopédia Livre. Last modified August 1, 2018. https://pt.wikipedia.org/wiki/Pedro_Victor_da_Costa_Sequeira

90- Étienne-Jules Marey (1830 - 1904), was a French scientist, physiologist and chronophotographer is seen as a pioneer in the fields of photography and cinema as well as graphical techniques.

"Étienne-Jules Marey" Wikipédia, the Free Encyclopedia. Last modified January 24, 2005. https://en.wikipedia.org/wiki/Étienne-Jules_Marey

91- The S. Domingos mine itself can be considered a monument - just as Robert Smithson, in *A Tour of the Monuments of Passaic, New Jersey* (1967), documented (photographically and in philosophical writing) suburban decay as an inevitable process through time with sites becoming monuments of the post-industrial.

Smithson, Robert. "A Tour of the Monuments of Passaic, New Jersey." Originally Published as "The Monuments of Passaic." *Artforum* Vol.6, No.4 (December, 1967).

"A Tour of the Monuments of Passaic, New Jersey." The Foundation I Holt/Smithson Foundation. Accessed July 20, 2018. <https://holtsmithsonfoundation.org/tour-monuments-passaic-new-jersey>

92- The Alentejo region, Portugal, is ideal for stargazing due to its limited light pollution. e.g. an initiative such as "Dark Sky Alqueva" promotes starlight tourism in this region.

"Dark sky Alqueva" Accessed July 20, 2018. <https://darksyalqueva.com>

93- "Mina De São Domingos, an Open Hole to a Chemical Universe @ Astrophotography by Miguel Claro." Astrophotography by Miguel Claro. Accessed July 20, 2018. <https://www.miguelclaro.com/wp/portfolio/mina-de-sao-domingos-an-hole-to-the-universe/>

94- De Oliveira, D. P. S. 2013. "International EarthCache Day 2013 (GC4CYB4) 13 October 2013/ 13 Outubro 2013 Mina de São Domingos." geopt.org - Portugal Geocaching and Adventure Portal. Accessed July 20, 2018. http://www.geopt.org/files/Varias/International_EarthCache_Day_2013.pdf

95- This data has been calculated with the understanding that 20 million tons of ore (the amount extracted from S. Domingos orebody since modern operations began in 1854 and ending in 1966) and, that 1.25 % of the S. Domingos ore contains 1.25 % copper. These calculations are an approximation given the data on the mine and therefore may have some degree of inaccuracy. Mine Exploration, Exploring Disused Mines and Quarries, Mining History, Photographs and Information for Explorers, Historians and Industrial Archaeologists. Accessed November 22, 2018. https://www.aditnow.co.uk/documents/Mina-de-São-Domingos-Mixed-Mine/IGM_MSD.pdf

96- Interpretation of Nicholas Poussin's *Et in Arcadia Ego* (1637-1638) can be found in the writings of Giovan Pietro Bellori, André Félibien (Poussin's biographer) and Erwin Panofsky.

Bellori, Giovanl. *The lives of the Modern Painters, Sculptors and Architects*: Translation and Critical Edition. Cambridge University Press, 2006.

Dionne Ugo, « Félibien dialoguiste : les Entretiens sur les vies des peintres », *Dix-septième siècle*, 2001/1 (n° 210), p. 49-74. DOI : 10.3917/dss.011.0049. URL : <https://www.cairn-int.info/revue-dix-septieme-siecle-2001-1-page-49.htm>

Panofsky, Erwin. 1955. *Et in Arcadia Ego: Poussin and the Elegiac Tradition. Meaning in the Visual Arts*. Doubleday Anchor Books. p. 295-320.

97- *Master Class with Alessandro Poli*. Uploaded July 20, 2019. CCA Channel video, 22:19 min. <https://www.youtube.com/watch?v=YMOrOUSRfKE>

98- Take the liberty of putting forward that the current architectural project undergone in this thesis, is a work of conceptual art/ conceptual architecture based on the concepts in José Capela's thesis titled, *Conceptual Art/ Conceptual Architecture* (Capela, 2012).

99- The architect and urban planner Paulo Mendes da Rocha, on the topic of the *41st anniversary of the Itaip Cultural Programme* - comments on his project to transform Praça da República, in São Paulo (Brazil) by building a public swimming pool on the site. He was recorded in São Paulo in July 2018. "Proposta para a Praça da República – Ocupação Paulo Mendes da Rocha (2018)." Accessed October 1, 2018. <https://www.youtube.com/watch?v=vzeBaxRp90E>.

Honoured at the *41st anniversary of the Itaip Cultural Programme*, architect and urban planner Paulo Mendes da Rocha talks about his field of work as an encounter between art, science and technique. He highlights the fact that construction should not be understood as isolated facts, since they presuppose the city in which they are inserted. He was recorded in São Paulo in July 2018.

"Arquitetura para quê? – Ocupação Paulo Mendes da Rocha (2018)." Accessed October 1, 2018. <https://www.youtube.com/watch?v=vzeBaxRp90E>.

100- Wendy Thompson. "Giovanni Battista Piranesi (1720-1778)." The Met's Heilbrunn Timeline of Art History. Last modified January 1, 2001. https://www.metmuseum.org/toah/nd/pira/nd_pira.htm

101- "Building Brunelleschi's Dome: A Practical Methodology Verified by Experiment Author(s): Barry Jones, Andrea Sereni and Massimo Ricci." *Journal of the Society of Architectural Historians*, Vol. 69, No. 1 (March 2010), pp. 39- 61

102- Richard Serra. *Verblist. 1967-68 | MoMA.* The Museum of Modern Art. Accessed January 10, 2018. <https://www.moma.org/collection/works/152793>.

103- Weiss, Jeffrey. "Due Process: Richard Serra's Early Splash/Cast Works." Artforum International. Last modified November 1, 2015. <https://www.artforum.com/print/201509/due-process-richard-serra-s-early-splash-cast-works-55532>.

104- This case study, *Reinforced soft site closures: Mine tailings pond closure, Huelva, Spain*, in *TENGATE: Reinforced Soil Case Studies* can be consulted in: Attachments (pp.082 - 089).

105- "Ai Weiwei, With Milk ___find Something Everybody Can Use." Fundació Mies Van Der Rohe. Accessed February 10, 2018. <https://miesbcn.com/project/ai-weiwei-intervention/>.

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"Nazca Lines." Wikipedia, the Free Encyclopedia. Accessed September 8, 2018 https://en.wikipedia.org/wiki/Nazca_Lines.

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Research through design. (2019, March 20). Thursday Night Live! at Het Nieuwe Instituut. <https://thursdaynight.hetnieuweinstituut.nl/en/activities/research-through-design>

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012 [p.055] 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).

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016 [p.060] Chillida, Eduardo. *Tindaya, Fuerteventura*. 1985.

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017 [p.061] James Turrell's elevation and plan view for the eye of the *Roden Crater*, 1997.

"Roden Crater Site Models and Drawings." James Turrell | Roden Crater. Accessed September 8, 2018. <https://theroden crater.org/cnstruct/plans/01.htm>.

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"Robert Smithson: Death of the Art Object." Surplus Jouissance. Accessed September 8, 2018. <https://surplusjouissance.wordpress.com/2015/01/30/select-ed-writings-and-essays-2014-1015/>.

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"Lawrence Weiner. A 36" X 36" REMOVAL TO THE LATHING OR SUPPORT WALL OF PLASTER OR WALLBOARD FROM A WALL. 1968 | MoMA." The Museum of Modern Art. Accessed September 8, 2018. <https://www.moma.org/collection/works/137437>.

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020 [p.070] Image used by Robert Smithson (showing Bladen, Ronald. Untitled. 1965. In "Primary Structures" exhibition. Fischbach Gallery) in "The New Monuments and Entropy."

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021 [p.071] The section of the Overton Down Experimental Earthwork showing its changing profile between 1960 and 1992.

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022 [p.072-073] 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.

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"Eartrhise." Wikipedia, the Free Encyclopedia. Accessed September 3, 2018. <https://en.wikipedia.org/wiki/Eartrhise>.

023 [p.074-075] *King Kong meets the Gem of Egypt* (left) and *Partially Buried Wood Shed* (right) from *Entropy and the New Monuments* by Robert Smithson (1966).

Smithson, Robert., Jack D. Flam. 1996. Robert Smithson, the Collected Writings. Berkeley: University of California Press.

024 [p.076-077] *Bulldozers, not paintbrushes...* Charles Ross building Star Axis. Photograph: Elizabeth Ginsberg

Needham, Alex. "Thunderbolts and Time Travel: My Journey to the Cosmic Heart of Land Art." The Guardian. Accessed July 20, 2018. <http://www.theguardian.com/artanddesign/2016/may/11/deserts-and-dynamite-my-journey-to-the-cosmic-heart-of-land-art>.

025 [p.078] *In Search of Geologic Time* with captions taken from Deleuza's, *Chaos, Territory, Art* and the *Framing of the Earth* by Elizabeth Grosz.

"Geologic City." Urban Omnibus. Accessed July 20, 2017. <https://urbanomnibus.net/2010/12/geologic-city/>.

026 [p.079] *B, Sequence of tilted strata at 1-70 road cut through the hogback, Jefferson County, Colo., 1972.* Photograph by W.R.Hansen.

Arbogast, B.F., Daniel H. Knepper, Jr., et al. "The Human Factor in Mining Reclamation" U.S. Geological Survey Circular 1191, 2000

Available at: pubs.usgs.gov/circa/c1191/c1191.pdf

027 [p.080-081] Gorgoni, Gianfranco. *Michael Heizer standing on Double Negative, North Las Vegas, Nevada*. 1970.

"Michael Heizer Standing on Double Negative, North Las Vegas, Nevada (Getty Museum)." The J. Paul Getty in Los Angeles. Accessed September 8, 2018. <https://www.getty.edu/art/collection/objects/130398/gianfranco-gorgoni-michael-heizer-standing-on-double-negative-north-las-vegas-nevada-italian-1970/>.

Reclaiming the post-industrial landscape

028 [p.086] Images showing various landscapes of human activity 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."

"The Anthropocene | Welcome." Accessed July 9, 2018. <https://www.anthropocene.info>.

029 [p.087] 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).

"Epochal Aesthetics: Affectual Infrastructures of the Anthropocene." E-flux. Accessed November 1, 2018. <https://www.e-flux.com/architecture/accumulation/121847/epochal-aesthetics-affectual-infrastructures-of-the-anthropocene/>.

030 [p.088-089] *16 milliseconds after the beginning of the Anthropocene: The Trinity nuclear test.*

Williams, Mark. "First Atomic Bomb Test May Mark the Beginning of the Anthropocene." *The Conversation*. Last modified January 30, 2015. <https://theconversation.com/first-atomic-bomb-test-may-mark-the-beginning-of-the-anthropocene-36912>.

031 [p.090] "A pair of the ear 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. "Black Country." Wikipedia, the Free Encyclopedia. Accessed June 9, 2018. https://en.wikipedia.org/wiki/Black_Country.

032 [p.091] *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. "Endangered Earth." Global Challenges. Accessed July 14, 2018. <https://globalchallenges.cn/issue/6/abandoned-mines-the-scars-of-the-past/>.

033 [p.092-093] 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: Aerial 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.

Design and construction of Tailings Dams by Leo Casagrande professor of the practice of foundation Engineering, Harvard University and Bruce N. Melver Partner, Casagrande Consultants, Arlington, Mass.

"CHAPTER 11 DESIGN AND CONSTRUCTION OF TAILINGS DAMS." AuthorSTREAM. Accessed September 8, 2018. <https://www.authorstream.com/Presentation/elmer404400-2820799-chapter-11-design-construction-tailings-dams/>.

034 [p.098] Prigann, Herman. Photograph of former coal mine. Ruhr Valley, Germany.

"Old Mining Area." Herman Prigann. Last modified May 8, 2018. <https://hermanprigann.com/rheinlbe-sculpture-woods/old-mining-area/>.

035 [p.097] Aerial view of Botayama (slag heap) towering over Iizuka City below in 1960s.

"Spoil Tip." Wikipedia, the Free Encyclopedia. Accessed June 10, 2018. https://en.wikipedia.org/wiki/Spoil_tip.

036 [p.101] Two contrasting images: Opencast Coal Mine Near Plains in 2006 (top) and in 2008 after having undergone reclamation (below).

"Mine Reclamation." Wikipedia, the Free Encyclopedia. Accessed June 4, 2018. https://en.wikipedia.org/wiki/Mine_reclamation.

037 [p.104] Plan showing the general view of the sub-aventine plain with *Mont Testaccio, Rome*.

"Estudios Sobre El Monte Testaccio (Roma) VI." Academia.edu - Share Research. Accessed June 4, 2018. https://www.academia.edu/26713307/Estudios_sobre_el_Monte_Testaccio_Roma_

038 [p.105] 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.

"Print | British Museum." The British Museum. Accessed June 18, 2018. https://www.britishmuseum.org/collection/object/P_1999-U-11.

039 [p.106-107] 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.

Pina. 2011 [Documentary] Wenders, Wim dir. [IFC film] Germany.

040 [p.108-109] 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 ?

041 [p.115] Copy of the first page of the Surface Mining Control and Reclamation Act of 1977 (SMRA) in the United States of America.

Govinfo | U.S. Government Publishing Office. Accessed June 9 2018. <https://www.govinfo.gov/content/pkg/STATUTE-91/pdf/STATUTE-91-Pg445.pdf>.

042 [p.116-117] Combination of photographs from *Monuments of the Passaic* taken by Robert Smithson outside the Passaic High School football stadium, New Jersey,USA in 1967.

"Robert Smithson: A Tour of the Monuments of Passaic, New Jersey." KABUL Magazine. Accessed June 8, 2018. <https://www.kabulmagazine.com/robert-smithson-monument-passaic-new-jersey/>.

043 [p.118-119] Gorgoni, Gianfranco. *Robert Smithson on the Spiral Jetty, 1970.*

"Komplaint Dept. - A Tour of the Monuments of Salt Lake City: Robert Smithson, the Melvins, and the Mormons." VICE - VICE is the Definitive Guide to Enlightening Information. Accessed June,10, 2018. https://www.vice.com/en_au/article/3b5j3b/komp-br-laintr-br-deptbr-robert-a-tour-of-the-monuments-of-salt-lake-citybr-robert-smithson-the-melvins-and-the-mormons.

044 [p.120] 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

"Basin and Range." Todd Stewart | Studio. Accessed June 8, 2018. <https://todd-stewart.format.com/basinrange#1>.
"UPPER LEVEL." HOME. Accessed June 8, 2018. https://www.125nuckleberry.com/timber_history.html.

045 [p.121] 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 crystallisation of salt on the edges of jetty over time - both which were an integral part of the work.

046 [p.122] Sequence of photographs by Gianfranco Gorgoni showing the inherent process of construction (by sequential dumping of basalt rock into the salt lake)employed in Robert Smithson's Spiral Jetty in 1970.

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 showed knowledge of the heights of fluctuating water levels and the crystalization of salt on the edges of jetty over time - both which were an integral part of the work.

"Figure 2. Constructing the Spiral Jetty, 1970. Photographs By..." ResearchGate. Accessed June 8, 2018. https://www.researchgate.net/figure/Constructing-the-Spiral-Jetty-1970-Photographs-by-Gianfranco-Gorgoni-Reprinted-with_fig2_232243480.

"Robert Smithson. Crosssection of Spiraling Jetty. (c. 1970) | MoMA." The Museum of Modern Art. Accessed June 8, 2018. https://www.moma.org/collection/works/38535?artist_id=5497&iocale=en&page=1&sov_referrer=artist.

047 [p.123] 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 Phillips 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, 149-160)

"Bob Phillips, Contractor on Spiral Jetty, Dies at 75." *The Salt Lake Tribune*. Accessed June 10, 2018. <https://archive.sitrib.com/article.php?id=3791137&type=CMSID>.

048 [p.124] Front page of the article, *Notes on Art as/and Land Reclamation* by Robert Morris published in 1979.

Morris, Robert. "Notes on Art As/and Land Reclamation." October 12 (1980): 87-102. Accessed June 10, 2018. doi:10.2307/778576.

049 [p.125] 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. 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.

"Asphalt Rundown." The Foundation | Holt/Smithson Foundation. Accessed June 8, 2018. <https://holtsmithsonfoundation.org/asphalt-rundown>.

"Schurenbachhalde." Startseite - Baukunst-nrw. Accessed June 8, 2018. <https://www.baukunst-nrw.de/en/projects/Schurenbachhalde--1542.htm>.

050 [p.126-127] Still image from *Digging for Robert Smithson's "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 2016*.

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.

Karstieß, Markus. "Was Die Erde Sieht/ With the Eyes of the Earth." Vimeo. Accessed January 10, 2018. <https://vimeo.com/119447487>.

051 [p.128-129] 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.

Smith, William S. "One to One." ARTnews.com. Accessed July 15, 2018. <https://www.artnews.com/art-in-america/features/one-to-one-63152/>.

052 [p.130] 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.

"Erased De Kooning Drawing." SFMOMA. Accessed July 3, 2018. <https://www.sfmoma.org/artwork/98.298/>.

Reference situations

053 [p.140-141] 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.

"Jencks' Theory of Evolution, an Overview of 20th Century Architecture." *Architectural Review*. Accessed July 15, 2018. <https://www.architectural-review.com/archive/jencks-theory-of-evolution-an-overview-of-20th-century-architecture>.

054 [p.142-143] Overlapping 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 from 1970s (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.

"Jencks' Theory of Evolution, an Overview of 20th Century Architecture." *Architectural Review*. Accessed July 15, 2018. <https://www.architectural-review.com/archive/jencks-theory-of-evolution-an-overview-of-20th-century-architecture>.

055 [p.144-145] 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 innovative.

"In What Style Shall We Build?" *Architectural Review*. Accessed July 15, 2018. <https://www.architectural-review.com/essays/postmodernism/in-what-style-shall-we-build>.

056 [p.146-147] 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.

"20thcentury.jpg (702x915) | Art History Timeline, History Timeline, Art Movement." Pinterest. Last modified 23, 2015. <https://www.pinterest.pt/pin/565201821964042235/>.

057 [p.148-149] 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.

"Robert Morris: Para-Architectural Projects — Hunter College Art Galleries." Hunter College Art Galleries. Accessed July 15, 2018. <https://huntercollegeartgalleries.org/events/2019/9/26/robert-morris-para-architectural>.

058 [p.152-153] 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.

"Broken Circle/Spiral Hill." The Foundation | Holt/Smithson Foundation. September 3, 2018. <https://holtsmithsonfoundation.org/broken-circlespiral-hill>.

059 [p.154-155] 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

"Broken Circle/Spiral Hill." The Foundation | Holt/Smithson Foundation. Accessed September 3, 2018. <https://holtsmithsonfoundation.org/broken-circlespiral-hill>.

060 [p.156] 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 be 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 foam. 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.

"Drawing for 'Spiral Hill Broken Circle' – Kröller-Müller Museum." Uniek in Elk Seizoen – Kröller-Müller Museum. Accessed September 4, 2018. <https://kroeller-muller.nl/en/robert-smithson-drawing-for-spiral-hill-broken-circle>.

061 [p.157] 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.

Vidani, Peter. "PLANS OF ARCHITECTURE." PLANS OF ARCHITECTURE. Accessed September 4, 2018. <https://plansofarchitecture.tumblr.com/post/145737431630/robert-smithson-broken-circle-1971-emmen-the>.

062 [p.158] Map illustrating the physio-graphic divisions of The Netherlands. It shows the municipality of Emmen, where, on a glacial ridge, 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.

Tesch, P. 1923. Physiographic Regions of the Netherlands in *Geographical Review*, Oct., 1923, Vol. 13, No. 4 (Oct., 1923), pp. 607-617 Taylor & Francis, Ltd. Accessed September 9, 2018 <http://www.jstor.com/stable/208169>

063 [p.159] Excerpt from Smithson, Robert. *Untitled* (1971) (Smithson 1996, 376) Written after the *Sonspeak 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.

Smithson, Robert., Jack D. Flam. 1996. Robert Smithson, the Collected Writings. Berkeley: University of California Press.

064 [p.162-163] *Panoramic view of Bingham Canyon Open Pit Copper Mine, looking South TICA Negs. #1348, 1349 - 29 Oct 74*

"NPGallery Asset Detail." NPGallery Search. Accessed September 4, 2018. <https://npgallery.nps.gov/AssetDetail/NRIS/66000736>.

065 [p.164-165] Smithson, Robert. *Bingham Copper Mining Pit - Utah Reclamation Project*. 1973.

"Jennifer Padgett on Robert Smithson." Notations: Contemporary Drawing As Idea and Process. Accessed September 4, 2018. <https://notations.aboutdrawing.org/robert-smithson/>.

066 [p.167] Top: 1938? Photo of quarry. Harvey Fite bought the quarry from Rosalie Calson; Middle: 1903? Photo of Van Berner Brothers quarrying before Harvey 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*.

"History." Opus 40. Accessed September 8, 2018. <https://opus40.org/about/history/>.

067 [p.168-169] (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.

"Lost in Opus 40." Art [and Other] Ramblings. Accessed September 8, 2018. <https://kristenieoneblog.wordpress.com/2016/04/11/lost-in-opus-40/>.

068 [p.170-171] An aerial view of the Monolith at *Opus 40* in Saugerties. Devin Ross Aerials.

"Stonehenge of North America" to Open This Week; Restrictions in Place." The Poughkeepsie Journal. Accessed September 8, 2018. <https://eu.poughkeepsiejournal.com/story/life/2020/05/14/stonehenge-north-america-open-public-may-23/3117962001/>.

069 [p.173] Mounted sign showing the *Art Park: Spoils' Pile Reclamation*. 1976-1978.

Available at: "Art Park: Spoils' Pile Reclamation, 1976-1978: Ongoing." The Harrison Studio – Helen Mayer Harrison and Newton Harrison Environmental & Ecological Artists. Accessed September 3, 2018. <https://theharrisonstudio.net/art-park-spoils-pile-reclamation-1976-1978-ongoing>.

070 [p.174-175] 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.

Available at: "Art Park: Spoils' Pile Reclamation, 1976-1978: Ongoing." The Harrison Studio – Helen Mayer Harrison and Newton Harrison Environmental & Ecological Artists. Accessed September 3, 2018. <https://theharrisonstudio.net/art-park-spoils-pile-reclamation-1976-1978-ongoing>.

071 [p.179] *Quarry II*, Large wall and Artist, 1975, carvings into wall and floor surfaces of an abandoned Limestone Quarry, Bloomington Indiana.

Image sent by artist William Bennett, emails to Jared Fantasia, May 02, 2020 and May 14, 2020

072 [p.180-181] Aerial view of the abandoned Limestone Quarry, Bloomington Indiana.

Google Maps. Accessed November 3, 2018. <https://www.google.com/maps/@39.1327533,-86.5665846,135a,35y,168.43n,37.66t/data=!3m1!1e3>

073 [p.182] 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.

Geocaching. "Onondaga Formation: Ruthven." Geocaching. Accessed November 3, 2018. https://www.geocaching.com/geocache/GC24NYZ_onondaga-formation-ruthven?guid=4d026f06-fd47-401a-8088-e1e34ae50a68.

"Geology." Welcome. Accessed November 3, 2018. <https://www.amherststatepark.org/ASP/geology.html>.

074 [p.183] Quarry III. Photo Simulation. *Wedge/ Stone Boat*, foreground; simulation of *Inverted Pyramid*, background.1976-1988.

Real Spaces, World Art History and the rise of Western Modernism, 2003 Phaidon Press

075 [p.184-185] Aerial view of the Southwest corner of Jamesville Quarry - Jamesville, New York.

Google Maps. Accessed November 3, 2018. <https://www.google.com/maps/place/Syracuse,+NY,+USA/@42.9927401,-76.0632815,14a,35y,104.96h,78.26t/data=!3m1!1e3!4m5!3m4!1s0x89d9f39bbf979a0d:0xd50ca2d7ad954518m2!3d43.0481221!4d-76.1474244>

076 [p.186-187] Views looking into facing east (left) and within (right) of Quarry III - *Wedge* within the Jamesville Quarry, Jamesville, New York.

"The Center for Land Use Interpretation." The Center for Land Use Interpretation. Accessed November 3, 2018.. <https://clui.org/udb/site/jamesville-quarry-sculpture>.

077 [p.188-189] View facing Quarry III - *Wedge* within the Jamesville Quarry, Jamesville, New York.

"The Center for Land Use Interpretation." The Center for Land Use Interpretation. Accessed November 3, 2018.. <https://clui.org/udb/site/jamesville-quarry-sculpture>.

078 [p.192-193] Cover of the Earthworks Symposium brochure, 1979. King County Archives Series 278

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>

079 [p.194-195] 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. Toit 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.

"Enough Already About The Next Seattle Mayor — What About Dow?" Hugesccity. Last modified November 9, 2009. <https://hugesccity.com/2009/11/09/enough-already-about-the-next-seattle-mayor-what-about-dow/>.

080 [p.198-199] King County Department of Public Works proposal for Johnson Pit # 30 Temporary Erosion and Sediment Control. King County Archives Series 1747.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

081 [p.200-201] Morris, Robert. *Johnson Pit #30*. Left: under construction. Right: Just after completion. Photos by Colleen Chartier.

"Robert Morris Completes Construction of His Untitled Earthwork (Johnson Pit #30) in SeaTac on November 2, 1979." The Free Online Encyclopedia of Washington State History - HistoryLink.org. Accessed July 3, 2018. <https://historylink.org/File/20691>.

082 [p.203] Aerial photos of Iain Baxter's intervention site (top and below). King County Archives Series 1747.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

083 [p.204-205] Design drawings for the Toit River Steppes Earthwork by Iain Baxter. In the various drawings above we can see a design similar to that of an ancient Greek amphitheatre where the seating or steppes utilizes the naturally occurring semi-circular contour and incline of the terrain in the quarry site.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

084 [p.206-207] Design drawings for the Toit 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.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

085 [p.209] Aerial photos (top and below) of Lakeside Sand and Gravel site.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

086 [p.210-211] Model (left) and drawing (right) for Richard Fleischer's earthwork.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

087 [p.213] Lawrence Hanson at work.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

088 [p.214] Aerial photo of Lawrence Hanson's intervention site.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

089 [p.215] Site plan for Lawrence Hanson's Snoqualmie Pit earthwork.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

090 [p.217] Picture showing four models for Mary Miss's Earthwork, *Enclosure for Viewing with Passage and Courts*.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

091 [p.218-219] Two Site plans (left and right) for Mary Miss's *Enclosure for Viewing with Passages and Courts*.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

092 [p.221] Model for proposed Earthwork by Dennis Oppenheim.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

093 [p.222-223] 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.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

094 [p.224-225] 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.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

095 [p.227] Montlake Landfill site.1979

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

096 [p.228-229] Model for Montlake Landfill Proposal by Beverly Pepper.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

097 [p.230-231] Drawing and cross section of earth from Montlake Landfill showing refuse by Beverly Pepper.

"King County Earthworks: Land Reclamation As Sculpture." King County, Washington - King County. Accessed September 8, 2018. <https://www.kingcounty.gov/depts/records-licensing/archives/exhibits/earthworks.aspx>.

098 [p.238-239] Photographs (left and right) of the Buffalo Rock property before commissioning of the Michael Heizer's *Effigy Tumuli*.

McGill,D., 1990. *Michael Heizer / Effigy Tumuli*. New York: Harry N. Abrams

099 [p.240-241] Composition of four photographs showing the final dirt construction of Michael Heizer's *Catfish Effigy*.

McGill,D., 1990. *Michael Heizer / Effigy Tumuli*. New York: Harry N. Abrams

100 [p.242] 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.

Kahoe, Alice Beck. "North America Before the European Invasions." Accessed September 3, 2018. <https://docplayer.net/151146248-North-america-before-the-european-invasions.html>.

101 [p.243] 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 clearly 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.

McGill,D., 1990. *Michael Heizer / Effigy Tumuli*. New York: Harry N. Abrams

102 [p.244-245] Photograph showing Michael Heizer's final model for the completed project.

McGill,D., 1990. *Michael Heizer / Effigy Tumuli*. New York: Harry N. Abrams

103 [p. 246] Aerial Photograph showing the five completed *Effigy Tumuli* and the subsequent establishment of growing grass.

McGill,D., 1990. *Michael Heizer / Effigy Tumuli*. New York: Harry N. Abrams.

104 [p.247] Aerial Photograph of an individual walking upon the *Water Strider* effigy.

McGill,D., 1990. *Michael Heizer / Effigy Tumuli*. New York: Harry N. Abrams

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

105 [p.255] 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.

Regional geology map of the Iberian Pyrite Belt (modified after Carvalho et al, 1999).

106 [p.256-257] 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).

"Everything You Need to Know About VMS Deposits." Visual Capitalist. Accessed November 3, 2018. <https://www.visualcapitalist.com/everything-you-need-to-know-on-vms-deposits/>.

107 [p.258-259] Two Graphic illustration s 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).

"Everything You Need to Know About VMS Deposits." Visual Capitalist. Accessed November 3, 2018. <https://www.visualcapitalist.com/everything-you-need-to-know-on-vms-deposits/>.

108 [p.260-261] Conceptual sketch (in blue) of 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 due to the opencast mining that took place there.

Google Maps. Accessed November 3, 2018. <https://www.google.com/maps/place/Sao+Domingos+Mine,+7750-162+Achada+do+Gamo/@37.6730691,-7.5046098,271a,35y,97.33h,75.86t/data=!3m1!1e3!4m5!3m4!1s0x10613c56e771d9:0xa00ebc04f80599018m2!3d37.6729124!4d-7.4966456>

109 [p.262-263] 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.

"The Project Gutenberg EBook of *De Re Metallica*, by Georgius Agricola." Free EBooks | Project Gutenberg. Accessed November 19, 2018. <https://www.gutenberg.org/files/38015/38015-h/38015-h.htm>.

110 [p.264-265] 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). We can see man's increasing usage through time 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.

"The Coldeco Collection." Official Site of Copper Development Association, Inc. (USA). Accessed September 3, 2018. https://www.copper.org/publications/pub_list/pdf/civilization-and-copper.pdf.

111 [p.266-267] "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 see 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 copper deposits were of strategic importance as their access by sea and by river (easy access inland due to the Guadiana River) facilitated acquisition of the metal.

"Anadolu Coğrafyası." Avri ALANYALI. Accessed November 19, 2018. <https://gezginmimar-merze.blogspot.com/2016/12/anadolu-cografyas.html>.

112 [p.268] "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-Kelttoi: Journal of Interdisciplinary Celtic Studies: Vol. 6 , Article 11.

"Lecture 1. Celts and the Roman Transition." Home. Accessed November 19, 2018. <https://gahtc.org/lectures/218>.

113 [p.269] 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-Kelttoi: 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 [p.270] 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).

"Northeast Passage." Wikipedia, the Free Encyclopedia. Accessed September 3, 2018. https://en.wikipedia.org/wiki/Northeast_Passage.

115 [p.271] 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).

Adapted from Garcia, J.C. "A navegação no baixo Guadiana durante o ciclo do minério (1857-1917)" Vol 1, Dissertação de Doutoramento em Geografia Humana apresentada à Faculdade de Letras da Universidade do Porto. Portugal, 1996

116 [p.272] 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.

Adapted from Garcia, J.C. "A navegação no baixo Guadiana durante o ciclo do minério (1857-1917)" Vol 1, Dissertação de Doutoramento em Geografia Humana apresentada à Faculdade de Letras da Universidade do Porto. Portugal, 1996

117 [p.273] 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.

Adapted from Garcia, J.C. "A navegação no baixo Guadiana durante o ciclo do minério (1857-1917)" Vol 1, Dissertação de Doutoramento em Geografia Humana apresentada à Faculdade de Letras da Universidade do Porto. Portugal, 1996

118 [p.274-275] 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.

Adapted from Garcia, J.C. "A navegação no baixo Guadiana durante o ciclo do minério (1857-1917)" Vol 1, Dissertação de Doutoramento em Geografia Humana apresentada à Faculdade de Letras da Universidade do Porto. Portugal, 1996

119 [p.276-277] 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.

"Corta (vista Para Oeste)." Centro De Estudos Da Mina De São Domingos J. Accessed September 3, 2018. <https://cemsd.pt/node/1364>.

120 [p.278-279] 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.

"Primeiro Túnel." Centro De Estudos Da Mina De São Domingos. Accessed September 3, 2018. <https://cemsd.pt/node/2204>.

"Boca Da Mina." Centro De Estudos Da Mina De São Domingos. Accessed September 3, 2018. <https://cemsd.pt/node/2206>.

"Trabalhos D'exploração | Centro De Estudos Da Mina De São Domingos." Centro De Estudos Da Mina De São Domingos J. Accessed September 3, 2018. <https://cemsd.pt/node/2114>.

"Corta." Centro De Estudos Da Mina De São Domingos |. Accessed September 3, 2018 <https://cemsd.pt/node/2212>.

"Fábrica Da Enxofre - Forno Nº 2." Centro De Estudos Da Mina De S. Domingos |. Accessed September 3, 2018. <https://cemsd.pt/node/1316>.

"Porto Do Pomarão." Centro De Estudos Da Mina De São Domingos. Accessed September 3, 2018. <https://cemsd.pt/node/2306>.

121 [p.280-281] 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.

"Boca Da Mina E Serro Do Hospital." Centro De Estudos Da Mina De S. Domingos. Accessed September 3, 2018. <https://cemsd.pt/node/2213>.

122 [p.282] Aerial photograph of 2013 by Duarte Fernandes Pinto showing the terrils at the area of Achada do Gamô. 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.

"Vista Aérea." Centro De Estudos Da Mina De S. Domingos. Accessed September 3, 2018. <https://cemsd.pt/node/2291>.

123 [p.283] 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.

"Corta Da Mina, São Domingos Mines, Mértola." Panorama Palace. Accessed September 3, 2018. <https://www.panoramapalace.com/corta-da-mina-sao-domingos-mines-mertola/>.

124 [p.285] Composition of 16 still images from the short documentary film "Powers of Ten" directed by Charles and Ray Eames and distributed by IBM. 1977.

Vacker, Barry. "'Powers of Ten' : Honoring the 40th Anniversary of the Existential Masterpiece." Medium. Accessed August 15, 2018. <https://medium.com/@baryvacker/powers-of-ten-honoring-the-40th-anniversary-of-the-existential-masterpiece-5c5affa46249>.

125 [p.286-287] 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 [p.288-289] Map showing the southwestern region of the Iberian Peninsula with: major river systems; Iberian Pyrite Belt; metal deposits; coit 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

127 [p.290-291] 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 [p.292-293] 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

129 [p.294-295] 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 Albermaz (deceased 1662) who published a general map of Portugal in 1662. Here we can clearly see the town of Corta 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.

"Portuguese Empire." Wikipedia, the Free Encyclopedia. Last modified May 20, 2003. https://en.wikipedia.org/wiki/Portuguese_Empire.

130 [p.296-297] 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

131 [p.298-299] 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

132 [p.300-301] Geological map, sheet 46-D Mértola scale 1:50000 (Oliveira & Silva & colaboradores, 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.

133 [p.302-303] 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 [p.304-305] 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 [p.306-307] 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 [p.308-309] 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

Adapted from: Mateus, A., Pinto, A., Alves, L.C., Matos, J.X., 2011. "Roman and modern slag at S. Domingos mine (BP, Portugal): compositional features and implications for their long-term stability and potential reuse." In: Int. J. Environment and Waste Management, Vol 8, Nos. 1/2, 2011.148

137 [p.310-311] 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.

"Carta Militar De Portugal, Folha 559." Centro De Estudos Da Mina De São Domingos | Accessed September 3, 2018. <https://www.cemsd.pt/node/62>.

138 [p.312-313] 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.

"Planta Geral Do Terreno Em Que Se Acha Situado O Estabelecimento Mineiro De S. Domingos E Seus Anexos." Centro De Estudos Da Mina De São Domingos J. Accessed September 3, 2018. <https://www.cemsd.pt/node/198>.

139 [p.314-315] 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.

140 [p.316-317] 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.

"Plan of Mina De São Domingos." Centro De Estudos Da Mina De São Domingos J. Accessed September 3, 2018. <https://www.cemsd.pt/node/965>.

141 [p.318-319] 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 overshoot 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 Da Mina De Cobre Da Serra De S. Domingos No Concelho De Mértola." Centro De Estudos Da Mina De São Domingos. Accessed September 3, 2018. <https://www.cemsd.pt/node/223>.

142 [p.320-321] 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

"Longitudinal Section of Orebody." Centro De Estudos Da Mina De São Domingos. Accessed September 3, 2018. <https://www.cemsd.pt/node/962>.

143 [p.322-323] 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

"Longitudinal Section of Orebody." Centro De Estudos Da Mina De São Domingos J. Accessed September 3, 2018. <https://www.cemsd.pt/node/962>.

144 [p.324-325] 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 310 to 311.

"Uncategorized - S. Domingos' Blog." S.domingos' Blog. Accessed September 3, 2018. <https://minadasaodomingos.wordpress.com/category/uncategoriz>

145 [p.326-327] 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

"Longitudinal Section of Orebody." Centro De Estudos Da Mina De São Domingos. Accessed September 3, 2018. <https://www.cemsd.pt/node/962>.

146 [p.328-329] Adaptation of the longitudinal section of the S. Domingos orebody and mining exploitation drawn in 1945 showing the current orebody. © Jared Miguel Fantasia. 2018

"Longitudinal Section of Orebody." Centro De Estudos Da Mina De São Domingos. Accessed September 3, 2018. <https://www.cemsd.pt/node/962>.

147 [p.331] Adams, Robert. *Clearcut, Humburg Mountain, Clatsop County, Oregon. 1999-2001*. From the series "Turning Back".

"Robert Adams – Recording the American West." Digital Photographic Practice. Accessed August 14, 2018. <https://khsdpp.wordpress.com/2014/03/04/robert-adams-recording-the-american-west/>.

148 [p.332-333] Photograph of Robert Smithson (to the right) and Nancy Holt in the background (to the left) gathering slate in Bangor, Pennsylvania in 1968 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 Garmo in the mining area of S. Domingos.

"Photograph of Robert Smithson Gathering Slate in Bangor, Pennsylvania, 1968." Archives of American Art, Smithsonian Institution. Accessed November 2, 2020. <https://www.aaa.si.edu/collections/items/detail/photograph-robert-smithson-gathering-slate-bangor-pennsylvania-11611>.

149 [p.334-335] 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 Garmo in the mining 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.

"Projects - My Work is My Body... Helena Almeida." R2 Design. Accessed November 4, 2019. <https://www.r2design.pt/projects/my-work-is-my-body-helena-almeida/>.

150 [p.336-337] 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.

Twitter." Bienvenue Sur Twitter. Accessed November 4, 2019. <https://twitter.com/GuerotP/status/629044045801476007/photo/1>.

151 [p.338-339] 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 [p.340-341] 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 [p.342-343] 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 [p.344-345]** 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 [p.346-347]** 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 [p.348-349]** 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 [p.350-351]** 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 [p.352-353]** 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 [p.354-355]** 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 [p.356-357]** 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 [p.358]** 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 [p.359]** 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 [p.360-361]** Digital Scans of three pieces of slag collected from the mining area of S. Domingos, Portugal © Jared Miguel Fantasia. 2018
- 164-169 [p.362-373]** Scanography 6/6 - *Body, Hand and Slag - S. Domingos non-sties, using slag as a medium* - © Jared Miguel Fantasia. 2018
- 170 [p.376]** 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 [p.377] 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 [p.378-379] 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 [p.380] 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 [p.381] 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 [p.382-383] 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.

176 [p.384-385] Photograph taken on 16th of June 1854 showing Piedmontese Nicolau Blava on the VMS orebody (in and east to west direction) which later became the site of the S. Domingos mine pit. Nicolau Blava, 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.

*Nicolau Blava (Biografia).- Centro De Estudos Da Mina De São Domingos |. Accessed November 20, 2018. <https://www.cemsd.pt/node/6861>.

177 [p.386-387] Photomontage depicting Nicolau Blava on the previously existing Serra da 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.

178 [p.388-389] 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 appears 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.

179 [p.390-391] 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.

180 [p.392] 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 metaphorical. 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.

181 [p.393] 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.

"Musée D'Orsay: Gustave Courbet The Origin of the World." Musée D'Orsay: Accueil. Last modified March 25, 2009. https://www.musee-orsay.fr/en/collections/works-in-focus/search/commentaire/commentaire_id/the-origin-of-the-world-3122.html.

"Doris Salcedo: Shibboleth - Exhibition at Tate Modern in London." ArtRabbit. Accessed November 27, 2019. <https://www.artrabbit.com/events/doris-salcedo-shibboleth>.

182 [p.394-395] 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

183 [p.396-397] 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 [p.398-399] 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 [p.400-401] 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).

186 [p.402-403] 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.

187 [p.404-405] 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 [p.406] 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.

"The Peggy Guggenheim Collection in Venice." PRINSEPS. Last modified May 3, 2018. <https://prinseps.com/research/peggy-guggenheim-collection/>.

189 [p.407] 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.

Bj. "San Marco in Boccalama." Laguna Venezia. Accessed November 20, 2018. <https://venedig.vanligt.se/lagunens-oar/san-Marco-in-Boccalama.htm>.

190 [p.408-409] 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 [p.410-411] 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 [p.412-413] 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 [p.414-415] 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.

Geosynthetic Solutions in Civil Engineering - TenCate Geosynthetics. Accessed June 1, 2019. <https://www.tencatageo.us/media/d86ed1d7-f3af-41e6-b1b7-7aa19133511c/0k770g/TenCate%20Geosynthetics/Documents%20AMER/Case%20Studies%20by%20Solution/Engineered%20Structures/Miraf%20Reinforced%20Soils/Reinforced%20Soil%20Case%20Studies.pdf>.

"The Roman Antiquities, T. 3, Plate LIV. Way in Which They Were Raised Big Travertine, Marble and Other Produce in the Large Tomb of Cecilia Metella. - Giovanni Battista Piranesi - WikiArt.org." www.wikiart.org. Accessed November 20, 2018. <https://www.wikiart.org/en/giovanni-battista-piranesi/the-roman-antiquities-t-3-plate-liv-way-in-which-they-were-raised-big-travertine-marble-and>.

"Our History." Reinforced Earth. Last modified October 19, 2018. <https://reinforcedearth.com/who-we-are/our-history/>.

"Our History." Reinforced Earth Canada. Accessed November 20, 2018. https://www.recoCanada.com/ta/wRECO_en.nsf/sb/company-our-history.

194 [p.416-417] 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.

Masters of Engineering, episode 7, "Mega Dams & Channels" realization by Boyenval Marina, producer Daniel Carson, Year of production : 2017 - 2019, <http://www.lucky-you.tv/program/masters-of-engineering/>

- 195 [p.418-419]** 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. © Jared Miguel Fantasia. 2018
- 196 [p.420]** Marey, Étienne-Jules with Georges Demeny, *Untitled (Sprinter)* After 1893
- "Étienne-Jules Marey, Georges Demeny. *Untitled (Sprinter)*. After 1893 | MoMA." The Museum of Modern Art. Accessed July 12, 2018. <https://moma.org/collection/works/50087>.
- 197 [p.421]** MRI scan images of an individual consisting of horizontal and vertical section.
- "Figure 1 MRI Scan Images of Patient NM720. Brain MRI in a Normal..." ResearchGate. Accessed July 12, 2018. https://www.researchgate.net/figure/MRI-scan-images-of-patient-NM720-Brain-MRI-in-a-normal-3-year-old-child-A-E-and-in_fig1_236977480.
- 198 [p.422-423]** 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 [p.424]** Digital scan of sections of the S. Domingos open pit made for the construction of architectural study models. © Jared Miguel Fantasia. 2018
- 200 [p.425]** 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 [p.426-427]** Model composed of a rhythm of multiple vertical sections revealing the form of the S. Domingos orebody. © Jared Miguel Fantasia. 2018
- 202 [p.428-429]** 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.
- 203 [p.430-431]** 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 [p.432-433]** 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 [p.434-435]** Process model consisting of the S. Domingos open pit sliced at the 130m above sea level. © Jared Miguel Fantasia. 2018
- 206 [p.436]** 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 [p.437]** Conceptual cross section adapted to the N-S cross section through the S. Domingos orebody (Mateus et. al. 2011, 130)
- 208 [p.438-439]** 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 S. domingos orebody on top of the 130 meter above sea level surface. © Jared Miguel Fantasia. 2018
- 209 [p.440]** 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. © Jared Miguel Fantasia. 2018

210 [p.441] 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

211 [p.446] Smithson, Robert. *Yucatan mirror displacements (1-9) / Nine locations on a trail, Yucatan, Mexico, 1969*

"Yeryüzü Sanatı / Sanatçı "Robert Smithson". BesteSakman. Accessed June 12, 2018. <https://bestesakman.blogspot.com/2014/01/yeryuzu-sanat-san-atc-robert-smithson.html>.

212 [p.447] Smithson, Robert. *Mirror / Salt Works, Installation View, 1976*

The Renaissance Society. "Robert Smithson: Mirror/Salt Works Exhibitions. Accessed June 12, 2018. <https://renaissancesociety.org/exhibitions/288/robert-smithson-mirror-salt-works/>.

213 [p.448] 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.

"São Domingos Mine - a Short Summary of a Long Story." Mindat.org - Mines, Minerals and More. Accessed June 12, 2018. <https://www.mindat.org/article.php/1686/São+Domingos+Mine++a+short+summary+of+a+long+story>.

214 [p.449] 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.

National Geographic. "Minas Desactivadas Em Portugal E a Sua Radioactividade: Perigos E Alertas." National Geographic Portugal. Accessed June 12, 2018. <https://nationalgeographic.sapo.pt/natureza/grandes-reportagens/1205-minas-desactivadas-em-portugal-e-a-sua-radioactividade-perigos-e-alertas>.

215 [p.450-451] 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.

"Astrophotography by Miguel Claro." Astrophotography by Miguel Claro. Accessed September 20, 2018. <https://www.miguelclaro.com/wp/>.

216 [p.452-453] 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.

"Slag Pebble Stone - Free Texture." Free Stock Textures. Accessed June 12, 2018. <https://freestocktextures.com/texture/slag-pebble-stone,79.html>.

217 [p.454-455] 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 $4 \text{FeS}_2 + 15 \text{O}_2 + 14 \text{H}_2\text{O} = 4 \text{Fe}(\text{OH})_3 + 8 \text{H}_2\text{SO}_4$. 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.)

Staff, WIRED. "The Art of Acid Mine Drainage." WIRED. Accessed June 1, 2018. <https://www.wired.com/2011/03/the-art-of-acid-mine-drainage/>.

218 [p.456-457] "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.)

Image depicting the above taken from: <http://www2.aeserpa.pt/site/images/Escolas/mina.pdf>

219 [p.458-459] *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.

Celant, G. 1997. *Michael Heizer*. Milan: Fondazione Prada.

220 [p.460-461] 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 [p.462-463] 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 [p.464-465] 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 [p.466-467] 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 [p.468-469] 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 [p.470-471] Rendering 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 [p.472-473] Poussin, Nicolas. *Et in Arcadia ego* (1637-38)

"Et in Arcadia Ego." Wikipedia, the Free Encyclopedia. Last modified July 29, 2018. https://en.wikipedia.org/wiki/Et_in_Arcadia_ego.

227 [p.474-475] Rendering (© Jared Miguel Fantasia. 2018) showing the 3m³ cuboid copper bench placed on top of the terris. 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 [p.476-477] Rendering (© Jared Miguel Fantasia. 2018) showing the 3m³ 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 477) and to the right we can see an inscription, "Et in Arcadia ego".

229 [p.478-479] 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)

230 [p.480-481] Comparison of two photographs showing construction on terrils at the S. Domingos mine. Left: The first S. Domingos industrial mine settlement in 1877 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.

(Left) "Povoação Primitiva." Centro De Estudos Da Mina De São Domingos]. Accessed February 6, 2021. <https://cemsd.pt/node/2061>.

231 [p.482-483] 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.

GILI, Mónica, et al. Eduardo Souto de Moura, obra reciente - 2G Revista internacional de Arquitectura; no5. Barcelona: Editorial Gustavo Gili, SA, 1998.

232 [p.484-485] 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 the 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.

233 [p.486-487] 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. 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 says, "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.

"Tacita Dean. Trying to Find the Spiral Jetty. 1998 | MoMA." The Museum of Modern Art. Accessed February 6, 2018. <https://www.moma.org/collection/works/183946>.

234 [p.488-489] 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 terrill. 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 terrill 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 3m³;
- 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 terrill into the open pit;
- 5 - Concrete pile foundation.

235 [p.490-491] 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.

"Scrap Metal Prices Adelaide." Pooraka Bottle & Can Recycling Depot | Recycling Centre Adelaide. Last modified January 28, 2018. <https://www.recyclingdepotadelaide.com.au/scrap-metal-prices-adelaide>.

"Future of Mount Isa Copper Smelter Open to Question." Commodity Market Analysis | Commodity Prices, News, Consulting & Events | CRU. Accessed February 6, 2018. <https://www.crugroup.com/knowledge-and-insights/insights/2020/future-of-mount-isa-copper-smelter-open-to-question/>.

236 [p.492-493] 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.

237 [p.494-495] Left and right: Two drawings (© Jared Miguel Fantasia. 2018), scale 1:2, showing the intention of engraving on the two corners of the proposed 3m³ solid copper bench which can be seen in rendering from pages 268 to 471. The size of the engraving can be compared to a Euro 5 cent copper coin in the right hand corner.

238 [p.496-497] 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 1,26 %, 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 [p.498-499] 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.

Source: Why does copper turn green? (2019, August 21). Crescent City Copper New Orleans Louisiana. <https://crescentcitycopper.com/why-does-copper-turn-green/>

"Why Does Copper Turn Green?" Crescent City Copper New Orleans Louisiana. Last modified August 21, 2019. <https://crescentcitycopper.com/why-does-copper-turn-green/>.

240 [p.500] Marsh, Dillon. *west o'okiep mine, okiep*. "1862 to the early 1970s over 600m deep, 284,000 tonnes of copper extracted." Dillon Marsh combines photography and computer generated technologies to create copper spheres in arid mining landscapes. Dillon Marsh combines photography and computer generated technologies to create copper spheres in arid mining landscapes.

Designboom | Architecture & Design Magazine. Accessed June 10, 2018. <https://www.designboom.com/art/dillon-marsh-copper-spheres-mining-landscapes-04-22-2014/>.

241 [p.501] Image from the exhibition of Julian Charrière at GASAG Kunstpreis 2018 – Berlinische Galerie, Berlin

"Julian Charrière at GASAG Kunstpreis 2018 – Berlinische Galerie, Berlin." Contemporaneities.com – Contemporary Art Exhibitions. Accessed July 11, 2019. <https://contemporaneities.com/julian-charriere-at-gasag-kunstpreis-2018-berlinische-galerie-berlin/>.

242 [p.506-507] da Rocha, Paulo Mendes. Proposal for public swimming pool. 2001

São, São P. "Tributo a Paulo Mendes Da Rocha, Expõe 11 De Seus Projetos Mais Radicais E Experimentais." As Coisas Boas Que São Tão Nossas! - São Paulo São. Accessed July 11, 2019. <https://saopaulosao.com.br/contudos/recomendados/4082-tributo-a-paulo-mendes-da-rocha,-expõe-11-de-seus-projetos-mais-radicalis-e-experimentais.html#>.

243 [p.508] 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.

244 [p.510-511] 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 Scarpa. Contrary to other architects, Scarpa was renowned for leaving detailed annotations through sketches along the sides of the technical drawings that were handed to the constructors. These annotations consisted of additional information of what Scarpa 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.

245 [p.512-513] 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.

"Carlo Scarpa, Cimitero Brion, San Vito Di Altivole (1970/75) - a Photo on Flickrriver." Flickrriver - A New Way to View Flickr Photos and More... Accessed March 23, 2018. <https://www.flickrriver.com/photos/21158327@N05/2116951887/>.

260 [p.533] 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.

ROADEx Network. Accessed April 13, 2018. <https://www.roadex.org/wp-content/uploads/2014/01/Guidelines-on-Road-Drainage.pdf>.

261 [p.534-535] 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.

Accessed February 6, 2018. https://www.usbr.gov/tsc/techreferences/hydraulics_lab/pubs/PAP/PAP-0812.pdf.

262 [p.536-537] Still image from *Mies on Scene*, a 2018 Spanish documentary directed by Pep Martín & Xavi Campesió. 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.

"Mies on Scene – Concéntrico." Concéntrico. Last modified November 15, 2019. <https://concentrico.es/en/mies-on-scene/>.

263 [p.538-539] 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.)

Riccardo Manzoni 1735861 | academic work | barcelona pavilion mies van der rohe analysis, research, drawings & renders. swinburne university of technology digital representation accessed february 7, 2018. https://riccardomanzoni.files.wordpress.com/2012/09/foiomanzoni_digitalrepresentation.pdf.

264 [p.540-541] 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.

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

265 [p.542 -543] 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 Pavilion 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."¹⁸

Ai Weiwei considers Mies van der Rohe's Barcelona Pavilion 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 pavilion (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.

Title: Ai Weiwei: With Milk, find something everybody can use (Intervention at the Mies van der Rohe Pavilion) Publisher: Actar / Fundacio Mies Van Der Rohe, Barcelona Publication Date: 2010 Edition: 1st Edition.

266 [p.544] Detailed Section through the backfilling and covering of a tailing pond, in Huelva Spain.

Geosynthetic Solutions in Civil Engineering - TenCate Geosynthetics. Accessed June 1, 2018. <https://www.tencategeo.us/media/d86ad1d7-f3af-41e6-b1b7-7aa19133511c/0k770g/TenCate%20Geosynthetics/Documents%20AMER/Case%20Studies%20by%20Solution/Engineered%20Structures/Miraf@%20Reinforced%20Soils/Rainforcea%20Soil%20Case%20Studies.pdf>.

267 [p.545] Detailed section through backfilling of the proposed project for the open pit at S. Domingos, Portugal. This detail was adapted from a detailed section 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.

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

268 [p.546-547] 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.

269 [p.548-549] 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 [p.550-551] 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.

271 [p.552-553] 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.

Tomas Castelazo. High density polyethylene pipe installation in storm drain project in Mexico. 5 October 2012, 15:14:01 https://en.wikipedia.org/wiki/File:H-dpe_pipe_installation.jpg#file

272 [p.554-555] 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.

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

273 [p.556-557] 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.

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.

274 [p.558-559] 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.

Legend:

- 1 - 20mm mirror of water;
- 2 - 25mm topping composed of mining slag troweled and bound with resin;
- 3 - Asphalt overlay mixed with surrounding mining slag;
- 4 - layer of Fortifix® and Rotaflex®;
- 5 - Asphalt overlay;
- 6 - Slag accumulation.

275 [p.560-561] 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.

Legend:

- 1 - 20mm mirror of water;
- 2 - 25mm topping composed of mining slag troweled and bound with resin;
- 3 - Asphalt overlay mixed with surrounding mining slag;
- 4 - layer of Fortifix® and Rotaflex®;
- 5 - Asphalt overlay;
- 6 - 20mm x 100mm copper sheet inlaid into the asphalt overlay.

Final considerations

276 [p.568-569] Photograph (© Jared Miguel Fantasia, 2018) from on top of the abandoned mining terrils at Achada do Garmo, S. Domingos, Portugal.

Volume 02

Back & front cover

© Jared Miguel Fantasia. 2018

Endpapers

001 Digital scanography of slag waste collected from the mining area of S. Domingos © Jared Miguel Fantasia. 2018

026 Digital scan of slag waste collected from the mining area of S. Domingos © Jared Miguel Fantasia. 2018

Attachments

002 [p.012-013] Two documents showing the curriculum and syllabus relative to the 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, which was directed by the teachers and architects Sofia Salema and José Adrião.

SIUE: Sistema De Informação Integrado Da Universidade De Évora. Accessed November 30, 2018. <https://siue.uevora.pt>.

003 [p.014-015] Extract from the collection of Robert Smithson's writings on "Some void thoughts on museums (1967)".

Smithson, Robert., Jack D. Flam. 1996. *Robert Smithson, the Collected Writings*. Berkeley: University of California Press.

004 [p.016-024] Extracts from the collection of Robert Smithson's writings. "What is a Museum?" is a dialogue between Allan Kaprow and Robert Smithson.

Smithson, Robert., Jack D. Flam. 1996. *Robert Smithson, the Collected Writings*. Berkeley: University of California Press.

005 [p.025-031] Architect, Mira Engler's proposal for the Hirfiya waste mound in Tel Aviv, Israel was an influence in the development of the initial project, for post-industrial mining site of S. Domingos.

"Design Competitions & Exhibitions." Mira Engler. Last modified September 30, 2016. <https://miraengi.wordpress.com/design-competitions-exhibitions/>.

006 [p.032-033] Composition of eight pages from the first edition of the *Revista de Arquitectura e Urbanismo Académico Português* published on June 30th, 2013 where (to the left) images of the initial project, by the design studio 2012/2013 for the S. Domingos open pit, can be seen.

007 [p.034-053] Digitalization of the initial part of the programme for the 5th *International Workshop of Landscape and Architecture, Iglesias Monteponi, 1/6 luglio 2019*, given at the outset and, explaining the territory and outlining the different themes that could be explored in this vast mining territory.

008 [p.054-055] Pages taken from the group project presentation at the 5th *International Workshop of Landscape and Architecture, Iglesias Monteponi, 1/6 luglio 2019*. Left: The names of participants and the date and place where the presentation took place. Right: The title of the group project - *Frammentare la continuità del sistema minerario cancellando le tracce. Introdurre frammenti per indurre la continuità dei sistemi naturali*. This could be translated into English as, "Framing the continuity of the mining system by eliminating its trace. Introducing the framework for the continuity of the natural environment".

009 [p.056-057] Two images (sources unknown) discussed in the group project at the 5th *International Workshop of Landscape and Architecture, Iglesias Monteponi, 1/6 luglio 2019*. Here we can clearly see the contrast between vegetated and non-vegetated pathways, the latter which have created by man across the terrain.

010 [p.058-059] Plan showing the intention of the group project. Here we can see the coastal post-industrial site of Masua with its contrast of vegetated area with that of contaminated soil (on the right) as well as the abandoned harbour of Porto Flavia embedded into the cliff (on the left). The lines that are drawn show the proposed access of Port Flavia from land.

011 [p.060-061] Photograph of conceptual drawing on chalk board relating to the initial discussion, in the group project for the workshop, elaborating on the intention to re-vegetate Masua.

012 [p.062-063] Comparison of two photographs. Left: A picture of a landscape with a lack of vegetation taken in 1940 by the Portuguese geographer, Oriando Ribeiro (at Fórnea, Alcaria, Porto de Mós, Leiria, Portugal). Right: A photograph of the same view of this landscape, taken much later by Portuguese photographer Duarte Belo, showing that after time the vegetation reclaims its way back into the landscape. The discussion of these two pieces was a pivoting point in the group project in relation to the post industrial site of Masua, Sardinia (Italy).

013 [p.064-065] Composition of four images (sources unknown) used in the elaboration of the group project within the workshop of the 5th *International Workshop of Landscape and Architecture* (2019) held in Iglesias, Monteponi (Italy) showing the coastal post-industrial site of Masua, Sardinia. Here we can see a strong contrast between the native covering of vegetation and the toxic eroded land affected by mining activities where no vegetation grows.

014 [p.066-067] Sequence of four conceptual cross sections - left to right - intended for the coastal region of Masua (Sardinia, Italy) showing the conceptual aim of the group project which was to facilitate the transformation of the post-industrial mining site and re-vegetate it, thus bringing back indigenous fauna and flora.

015 [p.068-069] Sequence of two conceptual images - left to right - intended for the coastal region of Masua (Sardinia, Italy) showing the conceptual aim of the group project which was to facilitate the transformation of the post-industrial mining site and re-vegetate it, thus bringing back indigenous fauna and flora.

016 [p.070-071] Horizontal section of Porto Flavia mining harbour at Masua, Italy (source unknown) showing the interior compartments of the mining structure within the cliff and the subterranean passage to Masua. This plan was used in the following workshop.

017 [p.072] Drawing that was part of the development stage of the group project showing three individuals exploring the interior of dark cave. (Source unknown.) The intention of the project was for the individual to be able to access and explore the Porto Flavia post-industrial mining area through the subterranean tunnel built into the cliff from Masua.

018 [p.073] Horizontal section of the post-industrial harbour of Porto Flavia (created in the group project). Here we can see the intention of placing a steel platform that will allow access to the diverse empty compartments (voids) within the structure in the cliff face.

019 [p.074-075] Two vertical section (left and right) of the post-industrial harbour of Porto Flavia (created in the group project). Here we can see the intention of placing a steel platform that will allow access to the diverse empty compartments (voids) within the structure in the cliff face.

020 [p.076-077] Two conceptual axonometric views (left and right), produced during the group work, showing the post-industrial harbour of Port Flavia embedded in the cliff face. Left: The project of a towering concrete structure rising from the ocean floor to the height of the port. Right: The entrance to the subterranean gallery that allows access to Porto Flavia.

021 [p.078] Top and Middle: Historical photos of Porto Flavia showing the loading of ore into ships.(Source unknown) Bottom: Image showing a work of Richard Long's exhibition piece (2009) consisting circle of gathered stones in the retrospective exhibition, 'Heaven and Earth' at Tate Britain, London, UK. 2009

022 [p.079] "The Island." A conceptual drawing © Jared Miguel Fantasia. 2018) from a personal proposal for a project at Porto Favia Sardinia, created in the 5th *International Workshop of Landscape and Architecture, Iglesias Montepani, 1/8 luglio 2019*. The work consisted of the creation of an artificial island with the action of continuous depositing of debris from the mine into a steel cylinder caisson delivered by boat. The project evokes the sublime technological beauty of the place where mineral ore was deposited into ships which transported it for transformation. The project was created through the idea of the filling of a steel cylinder caisson with rock to create an artificial island that can be visited. The island acts as a sort of non-site earthwork piece and, as a stage to understanding this landscape as a place of beauty dominated by the ingenuity of man i.e. the nature and capacity of Anthropocene man to overcome obstacles.

023 [p.080-081] Two drawings which were produced during the group work, showing the post-Industrial harbour of Port Favia embedded in the cliff face. Left: A cross section of the project of a towering concrete structure rising from the ocean floor to the height of the port, allowing access to the post-Industrial structure from the sea and vice versa. Right: An axonometric view of the entrance to the subterranean gallery that allows access to Porto Favia where a circular mirror of water is placed in front of the access.

024 [p.082-089] Pages copied from the *TenCate Geosynthetics* company brochure showing products used for soil reinforcement - along with case studies where they have been applied in mining reclamation globally. These techniques show not only the products used but they provide information pertaining to the site and the specific application of the products in the engineering solution.

Source: "Geosynthetic Solutions in Civil Engineering - TenCate Geosynthetics." Accessed June 1, 2019. <https://www.tencategeo.us/media/d86ed1d7-f3af-41e6-b1d7-7aa19133511c/0K770g/TenCate%20Geosynthetics/Documents%20AMER/Case%20Studies%20by%20Solution/Engineered%20Structures/Mirafal%20Reinforced%20Soils/Reinforced%20Soil%20Case%20Studies.pdf>.

025 [p.090-095] Standard sections and plans of drainage inlets and sewer manholes. These technical drawings were fundamental in understanding the working of pluvial road drainage systems and inlets and applied during the design of the inherent process of construction (see page 533).

"Standard Specifications For Public Works Construction - 1986 Incorporating Update No. 8 Volume 2 of 2 Standard Detail Drawings January 2011." Homepage - City of Albuquerque. Accessed February 7, 2021. <https://www.cabq.gov/planning/documents/StandardSpecs2011Vol2062811reduced.pdf>.

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- “Geosynthetic Solutions in Civil Engineering - TenCate Geosynthetics.” Accessed June 1, 2019. <https://www.tencategeo.us/media/086ed1d7-f3af-41e6-b1b7-7aa19133511c/0K770g/TenCate%20Geosynthetics/Documents%20AMER/Case%20Studies%20by%20Solution/Engineered%20Structures/Mirah@%20Reinforced%20Soils/Reinforced%20Soil%20Case%20Studies.pdf>.
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