

PDVO-High Altitude Volcanological Obs-Pizzi Deneri(Etna) - WP06

OU	Budget assegnati €
OU1 INFRASTRUCTURE UPGRADE	1.495.327,10
OU2 MONITORING SYSTEM UPGRADE	599.742,99
OU3 PROMOTION OF PDVO FOR VIRTUAL AND TNA	42.056,10
	2.514.934,64

Accordo di Collaborazione

TRA ENTI EX ART. 15 - LEGGE 7 AGOSTO 1990, N. 241

TRA

L'Istituto Nazionale di Geofisica e Vulcanologia, d'ora innanzi denominato INGV, con sede legale in ROMA Via di Vigna Murata 605 - P. IVA e Codice Fiscale 06838821004 – rappresentato nella persona del suo Presidente prof. Carlo Doglioni, in qualità di Legale Rappresentante,

E

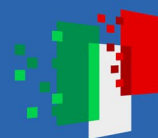
Il Politecnico di Milano - Dipartimento di Energia (c.f. 80057930150, P.IVA 04376620151), con sede in Piazza Leonardo da Vinci n. 32 c.a.p. 20133 Milano (PEC: pecenergia@cert.polimi.it), (in seguito indicato come Politecnico), rappresentato dal Direttore del Dipartimento di Energia Prof. Giovanni Lozza autorizzato alla stipula del presente atto ai sensi dell'art. dell'art. 7 del Regolamento delle Prestazioni per conto di terzi - Revisione - D.R. n. 1316 del 16.02.2021



Finanziato
dall'Unione europea
NextGenerationEU



Ministero
dell'Università
e della Ricerca



Italiadomani
PIANO NAZIONALE
DI RIPRESA E RESILIENZA



ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

Servizi

- Servizio di **progettazione esecutiva dei lavori di ristrutturazione** dell'Osservatorio di Pizzi Deneri – Etna” nell'ambito del Progetto “Monitoring Earth's Evolution and Tectonics” MEET, Piano nazionale di ripresa e resilienza (PNRR) Missione 4, componente 2, investimento 3.1 “Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione - Next Generation EU.

CIG: A0015C7973

CUP: D53C22001400005

Importo €. 139.000,00

Ditta: AIACE S.r.l. SOCIETA' DI INGEGNERIA

Data stipula del contratto 11/10/2023, attivazione del contratto 12/10/2023

Durata mesi 2

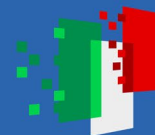
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DI GEOFISICA E VULCANOLOGIA

Servizi

- Servizio di **progettazione esecutiva degli impianti** ai fini della ristrutturazione dell'Osservatorio di Pizzi Deneri – Etna” nell'ambito del Progetto “Monitoring Earth's Evolution and Tectonics” MEET, Piano nazionale di ripresa e resilienza (PNRR) Missione 4, componente 2, investimento 3.1 “Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione - Next Generation EU.

CIG: A002898093

CUP: D53C22001400005

Importo: €. 50.000,00

Ditta: ARIATTA INGEGNERIA DEI SISTEMI S.p.A.

Data stipula e attivazione del contratto 25/10/2023

Durata: mesi 2

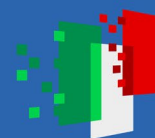
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ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

Osservatorio Pizzi Deneri: 50 anni di Ricerca

Prof. Marco Imperadori
Politecnico di Milano



2018



MEET

MONITORING EARTH'S
EVOLUTION AND TECTONICS

OSSERVATORIO VULCANOLOGICO DI PIZZI DENERI









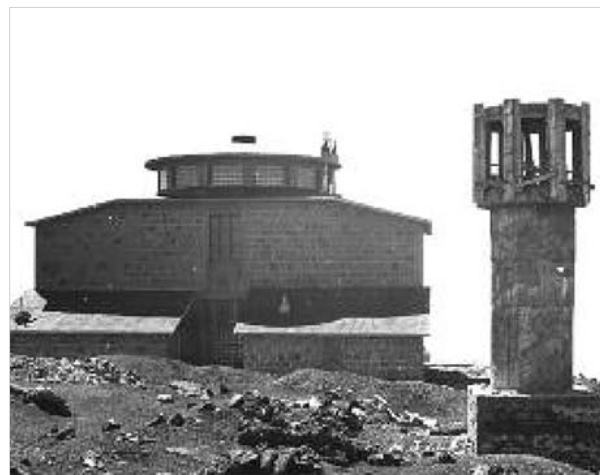


1880

1947

1971

anni →





1976



1977



1978

anni
→

Infinite Innovation

Marcus Imperadori
Professor of Building Production,
Politecnico di Milano

"Direct experience and necessary demonstrations"
Galeo Galati

The human and building adventure of Dante Bini spans two centuries but is characterized by a singular 81 route that connects the various stages: genius and passion. Fearless and curious, he has a Leonardo-like spirit and is always seeking to think laterally, or "outside the box", as he likes to say. His objective throughout all his numerous experiments is always innovation with an ethical background, and never as an end in itself.

I have been teaching design and technological innovation for years at the Politecnico di Milano, and when I was asked to write this preface, I accepted with enthusiasm. The Italian words to design (*progettare*) come from the Latin *pro-actum* (to throw forward), and to innovate means to learn into the unknown. Who embodies these qualities better than Dante Bini?

His originality is not abstract and fits into the history of architecture in a dialectical way with figures such as Richard Buckminster Fuller, Frei Otto, Félix Candela, and Pier Luigi Nervi. These last two are undoubtedly masters in the optimization of reinforced concrete in thin sections. Sergio Musmeci's bridge over the Basento river, which Bruno Zevi highlighted as an example of "pure art", must also be mentioned here.

Bini's pursuit of subtlety and optimization is art, both plastic and of building. We could call it "move with least", in which (very sustainable) aim is to use as little material (reinforced concrete) as possible for the same number of covered surfaces and volumes.

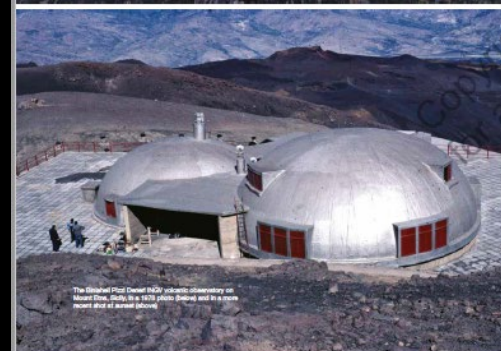
However, our author has added a further advancement to material optimization: rethinking the invention of construction processes and the drastic reduction of building times.

In 1963, in addition to marrying Adria Moroni, he invented the Biniwall, one of most well-known architectural inventions. Leaving a winter indoor tennis match, Bini realized how much snow the aerostatic dome supported. His lightning-quick mind registered the physical phenomenon in which air pressure can support notable weight, and he applied it to his own use architecture.

Investigating building processes means introducing the concept of the "construction industry" and adding the typical advancement (provided by patents) that reduces production times, optimizes performance, and improves economic efficiency. Bini is thus a contemporary master builder, and a scientist and physicist that uses air as his building tool, taking advantage of its force and pressure. He is also an experimental craftsman, similar to a builder of a Gothic cathedral, for whom "an experiment is worth more than a thousand expert opinions".

The building process, as an innovative leap between

¹ This quote is by Vilum Karm Rasmussen, a great inventor and founder of Velux.



The Biniwall (P2) covered the production laboratory on Mount Etna in 1973 (photo: Umberto Bini from the book) and at several shows.

product/material and design/distribution, brings us to the genius of Filippo Brunelleschi. For his dome in Florence, he invented the machine to lift materials. The son of a watchmaker, Brunelleschi carried out technological "transfers", changing the scale of the mechanisms and of the winches and windlasses that made his bold geometry possible.

The technical-material process starts from the search for material essence for Bini as well, where the thin spherical structures refer to natural analogies such as egg shells or sea shells, and transfers to the invention of machines and production systems. To infuse the "cellular reinforcement", he had to solve important geometric and material questions: the passage from 2D to 3D, the arrangement and combination of the steel reinforcement, the question of vibration and compaction of the concrete, the retaining membranes, the aerostatic and hydraulic seals, and so on.

The challenge was not purely about shape, as perhaps it was for Paolo Soleri in Arcata, although even there the use of vaults and domes implied construction and tectonic optimization. The thin-walled structures, whose oval geometry evokes visions of space and science fiction, create important earthquake resistance and aerodynamics, like the optimization of the surface/volume ratio volumes in terms of dispersion or thermal capture. It was precisely this exceptional and absolute innovation of the Biniwall that immediately attracted a maestro like Mario Salvadori, then professor at Columbia University. He invited a young Dante to the United States to realize his experiment, and from that moment on, the success was remarkable. His career led him to construct circular and elliptical-profile buildings with diameters ranging from 12 to 40 m (the diameter of the Pantheon in Rome is 43.5 m) all over the world.

Dante Bini's innovation journey starts in the Po Valley and his creativity has been appreciated throughout the world, including in Australia, Japan, and the USA. Many years ago, he gave a lecture called "On the automation" at Stanford University and pioneered what we now call lean construction and construction site 4.0. The Japanese (he had a very important relationship with the Shimizu Corporation) saw his work and introduced the concept of "mechanotronics" where mechanics and electronics are applied to construction.

In his technological "Odyssey", he has worked with all

materials (not just reinforced concrete), inverted systems, and actually stepped out urban visions, as well as utopic, terrestrial and lunar ones. Bini calls himself an "inventor architect", which comes from the Latin *inventio*, that is, "I find, I discover" - just as he has always done, discovering things that remained invisible to others, like the force of air that becomes a building instrument¹.

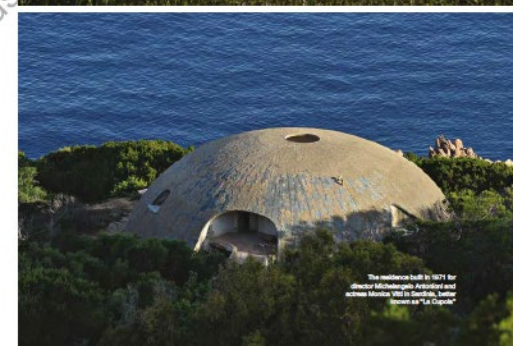
This book celebrates a "Ulysses" named Dante (who also knows something about journeys into the unknown), whose return, with this book, to *ItaloCalvi*, serves to protect the legacy of his work. The *Giornale dell'Architettura* recently reported that some of his domes in Castelfranco Emilia are at risk of demolition, and this summer, the celebrated home of Michelangelo Antonioni and Monica Vitti in Costa Paradisi in Sardinia, was vandalized².

Personally, I was lucky enough to have been invited by the director of the INGV (National Institute of Geophysics and Volcanology), Stefano Branca, along with other colleagues from the Politecnico di Milano, Mario Mastrorillo and Carmelo Gentile, to join the PNRR project coordinated by Giulio Salvaggio and called MEET (Monitoring Earth's Evolution and Tectonics), aimed to conserve the extraordinary P2 (Dante's observatory on Mount Etna, among other objectives. Thanks to Nicola Leonardi, I was able to have a long phone chat with Dante Bini, who was at Stanford with him, and he gave me valuable information that we will use. The observatory on the slopes of the volcano, composed of two very thin domes that sparkle like two white pearls in a black sea of lava, is located at 2,950 m above sea level. Built during 1974, it has been functioning perfectly since 2018. Every time that I visit it, I better understand its "lunar visions" and its built utopias, under the active pluff of Etna.

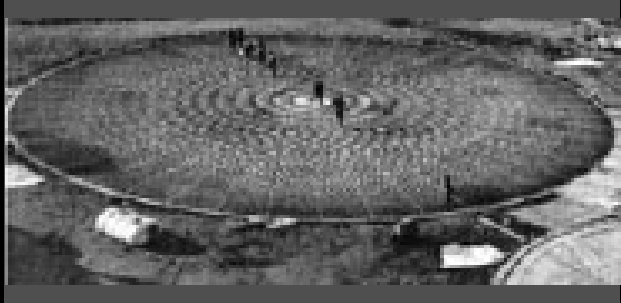
It is lovely that this book begins with a dialogue with Mario Cucinella. Embellish through experience the "80" (his office in Bologna) and the designer of many world-advancing 3D-printed domes know earth and concrete. The *Onassis Expo* that these two men, in 1970, Dante Bini built some Biniwalls that generated great interest and in 2020 Mario will create the Italy Pavilion.

There could not be a better input to synthesize the journey of a creative mind, conscious and always open to the future.

¹ See also Antonio Pennacchi, *Giulia Ricci, Dante Bini - Mechatronics Milan: Postmedia Books, 2019*.
² Dante Bini, *Building with Air* London: Bloomsbury/McMillan, 2016. With essays by Shaheenah Chagpar, WB McGraw, Nicola Bini and Lucio Fontana.

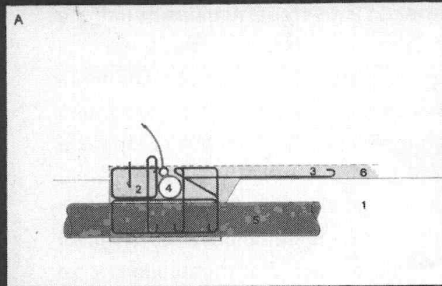


The mediterranean hall in 1971 for director Michelangelo Antonioni and actress Monica Vitti in Sardinia, later known as "La Capella".

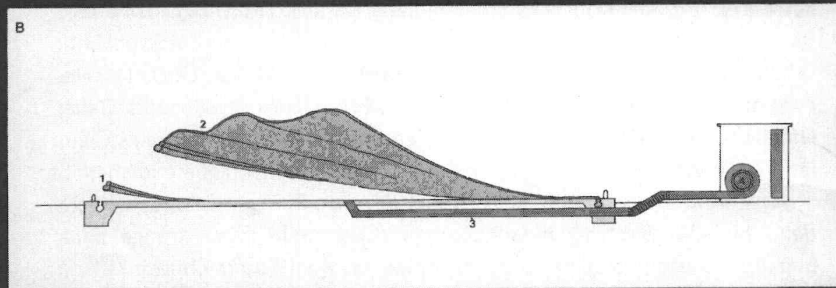


Villa Antonioni-Vitti, sistema Binishell di Dante Bini in Sardegna, Italia (Fonte: theplan.it).

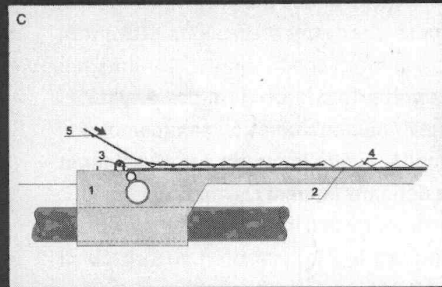
THE BINISHELLS TECNOLOGY



A. Sezione verticale del cordolo di fondazione perimetrale attraversato dalla tubazione necessaria al pompaggio dell'aria al di sotto della membrana interna

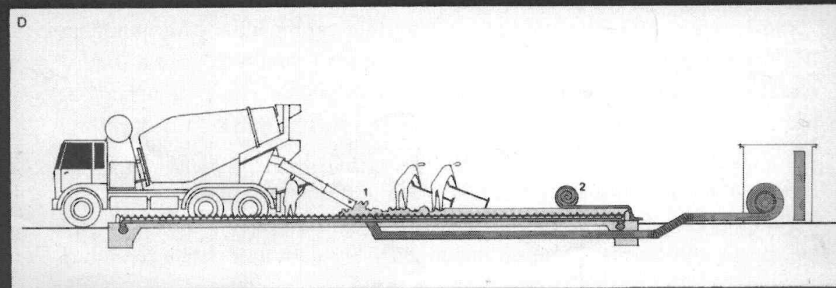


B. Stesura della pneumoforma e stazione di pompaggio dell'aria

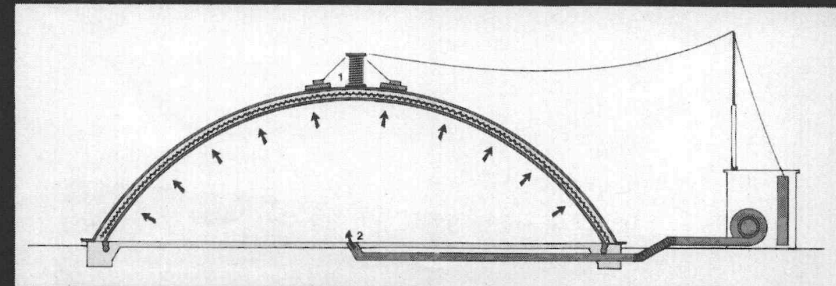


C. Posizionamento delle armature al di sopra della membrana interna

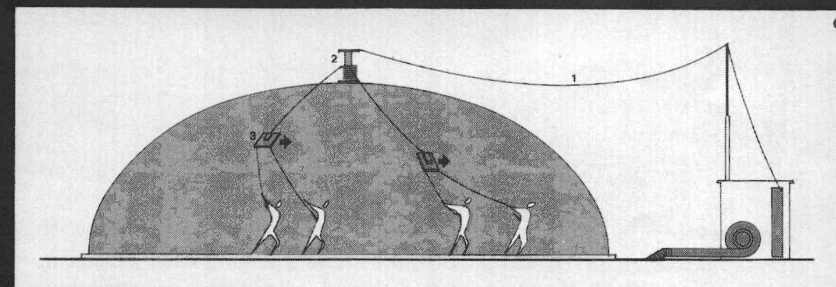
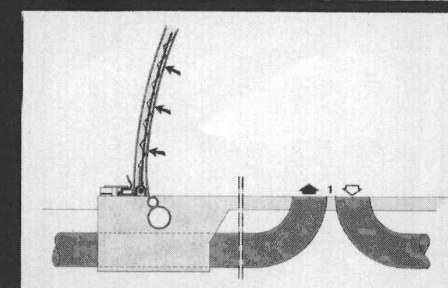
D. Distribuzione del calcestruzzo al di sopra delle armature e ricopertura con la membrana esterna



WORKING SEQUENCES



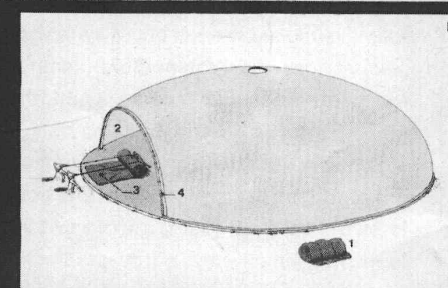
E. Sollevamento della struttura grazie all'afflusso dell'aria, immessa attraverso delle tubature collegate alla stazione di pompaggio, al di sotto della membrana interna. Nella parte superiore della volta sono visibili i vibratori che vengono utilizzati in una delle fasi successive



F. Stabilizzazione della cupola attraverso il mantenimento di una pressione costante interna alla cupola

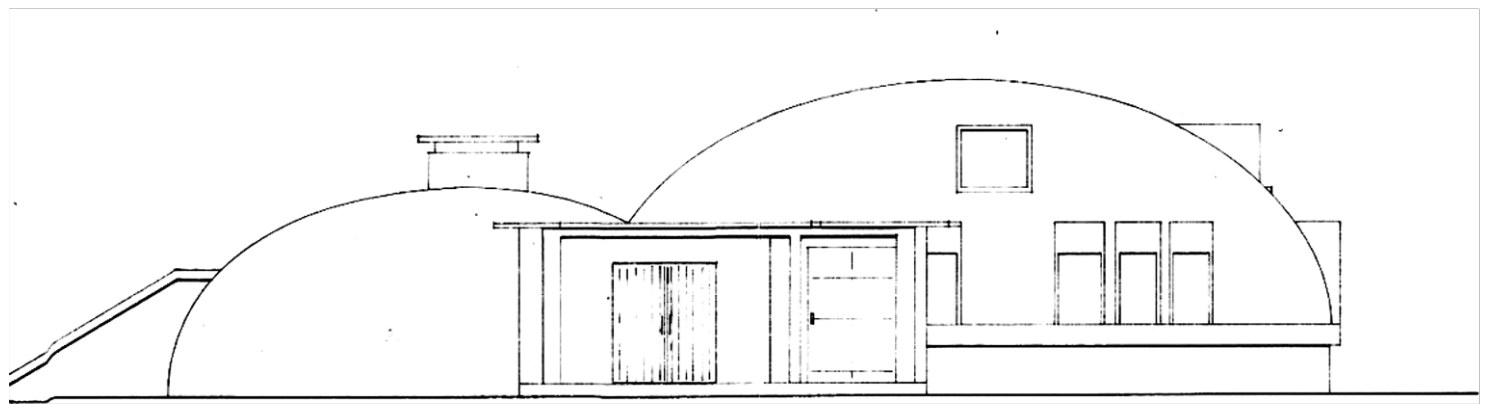
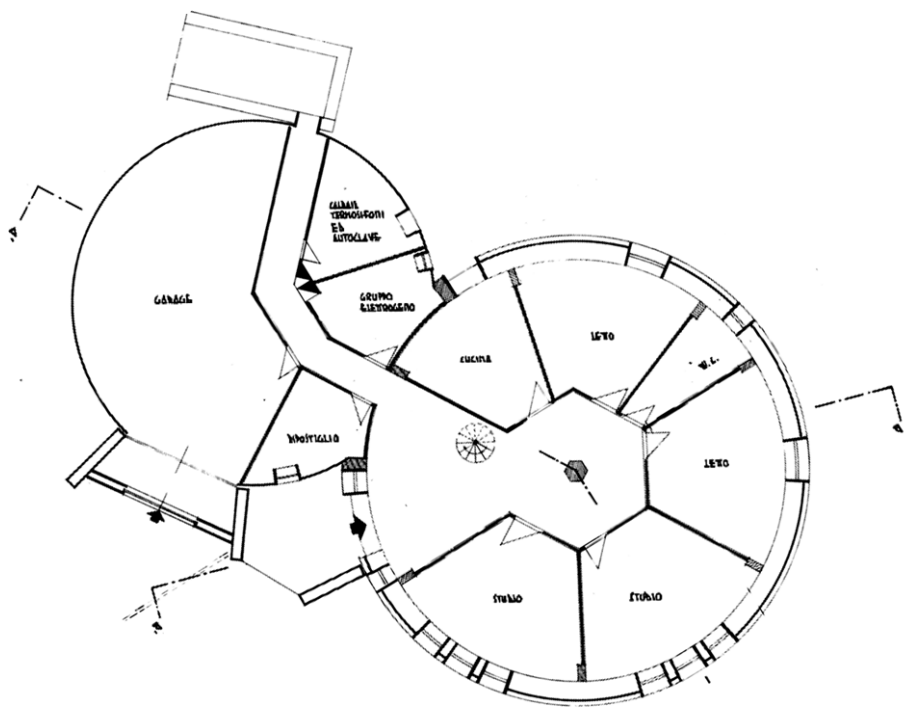
G. Vibrazione del calcestruzzo della cupola attraverso lo scorrimento di speciali vibratori lungo la sua superficie

H. Sgonfiaggio della membrana interna, definizione della prima apertura e rimozione della membrana per un eventuale successivo riutilizzo

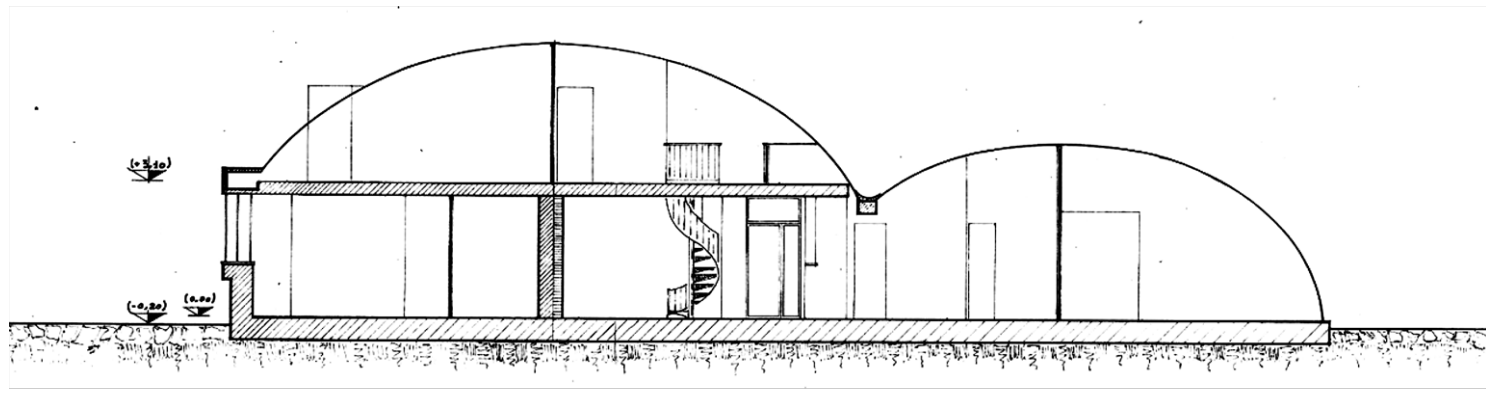






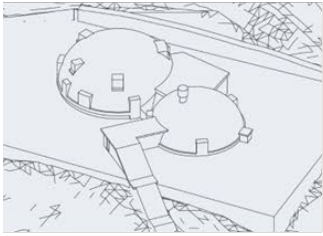


PROSPETTO OVEST



SEZIONE A-A'





2011



2013

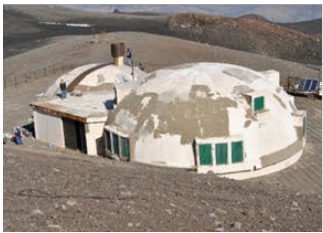


2016



2022

→
anni



Rilievo del degrado e condizioni dell'Osservatorio Pizzi Deneri dal 2011 al 2022



Sopralluogo Ottobre 2022



Sopralluogo Ottobre 2022



Sopralluogo Ottobre 2022



Sopralluogo Ottobre 2022



Sopralluogo Ottobre 2022



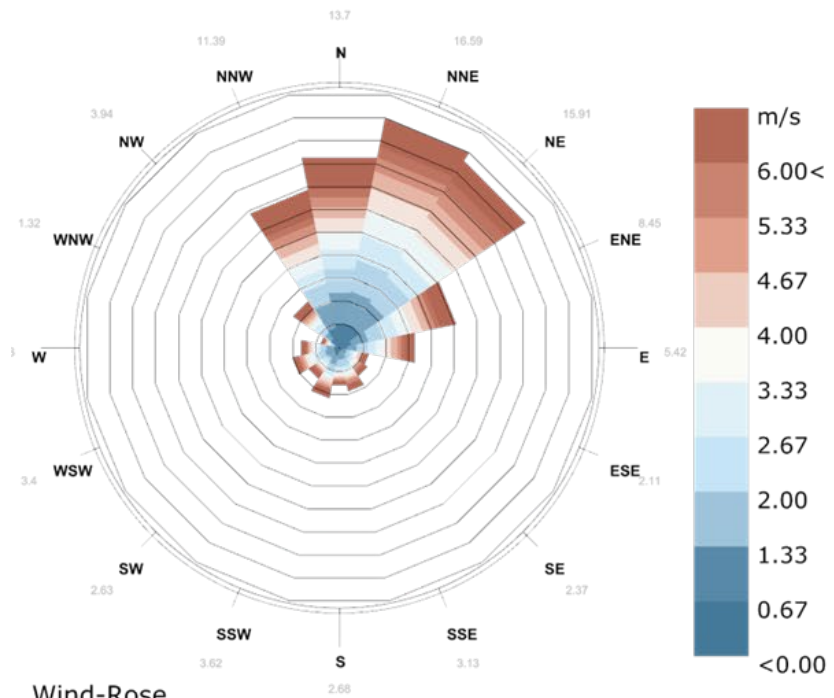
Sopralluogo Giugno 2023



Attività di indagine svolte durante il sopralluogo di Giugno 2023



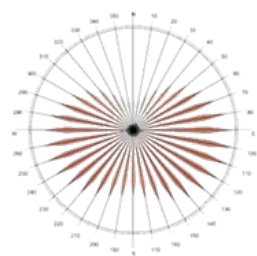




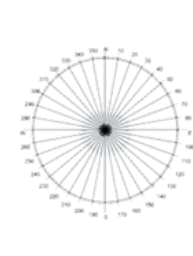
Wind-Rose

Etna
 1 JAN 1:00 - 31 DEC 24:00
 Hourly Data: Wind Speed (m/s)
 Calm for 0.61% of the time = 53 hours.
 Each closed polyline shows frequency of 1.7%. = 145 hours.

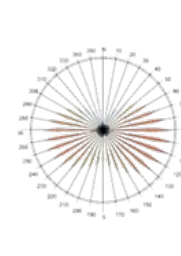
Estate



Total Radiation(kWh/m2)
 Etna_2005
 21 JUN 1:00 - 22 SEP 24:00

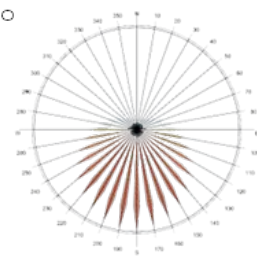


Diffuse Radiation(kWh/m2)
 Etna_2005
 21 JUN 1:00 - 22 SEP 24:00

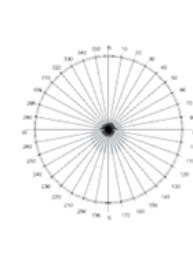


Direct Radiation(kWh/m2)
 Etna_2005
 21 JUN 1:00 - 22 SEP 24:00

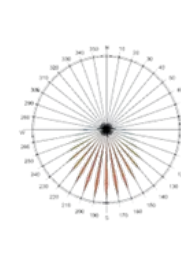
Autunno



Total Radiation(kWh/m2)
 Etna_2005
 23 SEP 1:00 - 21 DEC 24:00

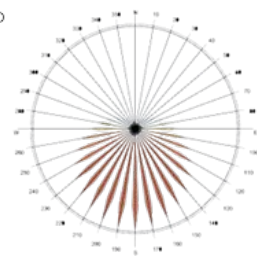


Diffuse Radiation(kWh/m2)
 Etna_2005
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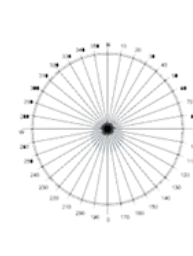


Direct Radiation(kWh/m2)
 Etna_2005
 23 SEP 1:00 - 21 DEC 24:00

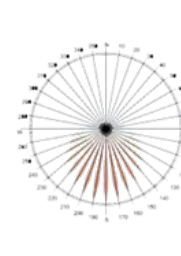
Inverno



Total Radiation(kWh/m2)
 Etna_2005
 22 DEC 1:00 - 20 MAR 24:00

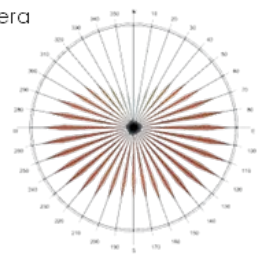


Diffuse Radiation(kWh/m2)
 Etna_2005
 22 DEC 1:00 - 20 MAR 24:00

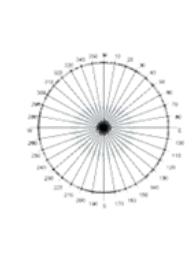


Direct Radiation(kWh/m2)
 Etna_2005
 22 DEC 1:00 - 20 MAR 24:00

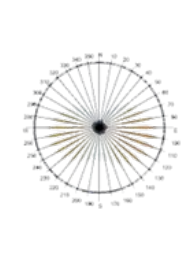
Primavera



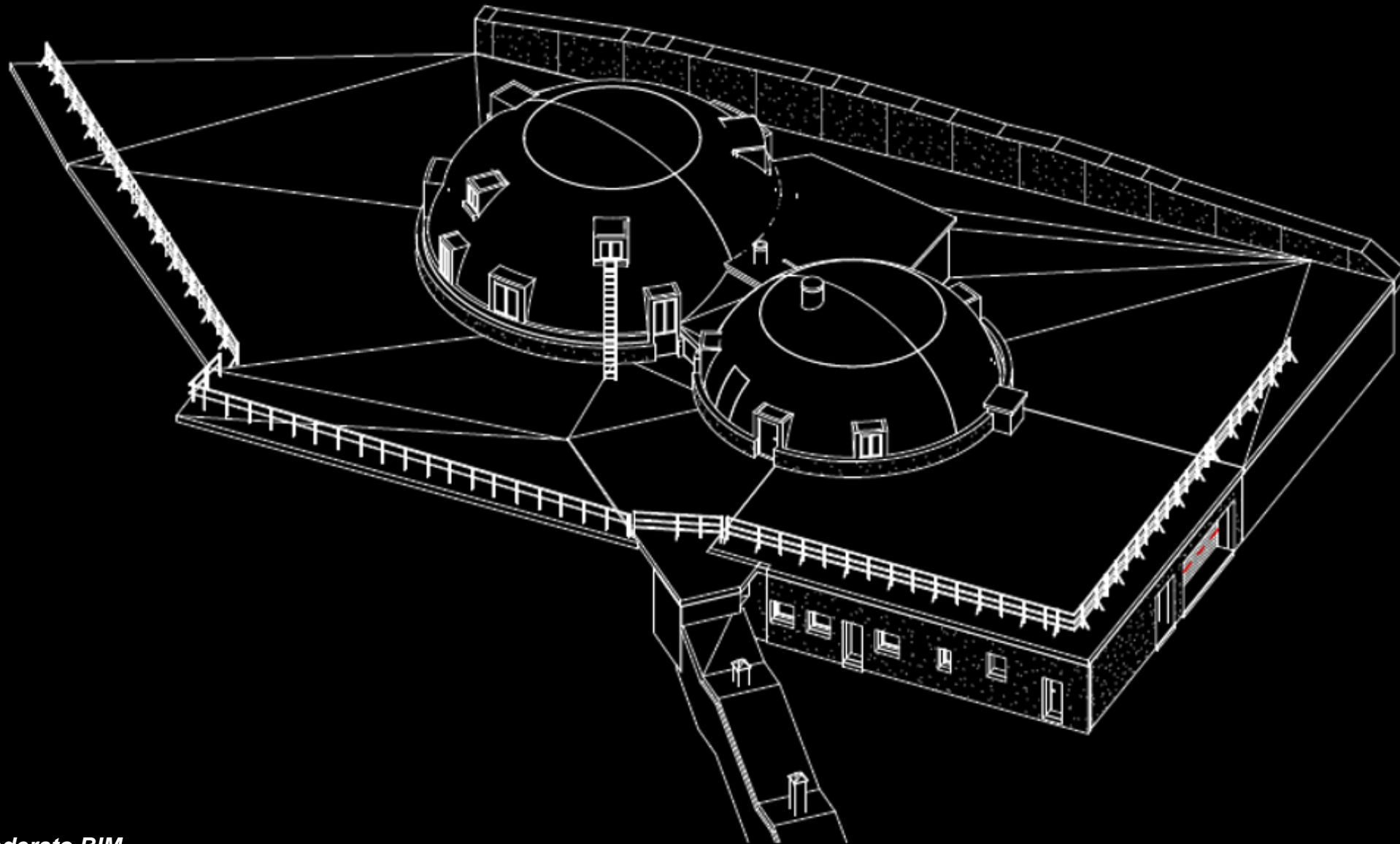
Total Radiation(kWh/m2)
 Etna_2005
 21 MAR 1:00 - 20 JUN 24:00



Diffuse Radiation(kWh/m2)
 Etna_2005
 21 MAR 1:00 - 20 JUN 24:00



Direct Radiation(kWh/m2)
 Etna_2005
 21 MAR 1:00 - 20 JUN 24:00



Il modello federato BIM

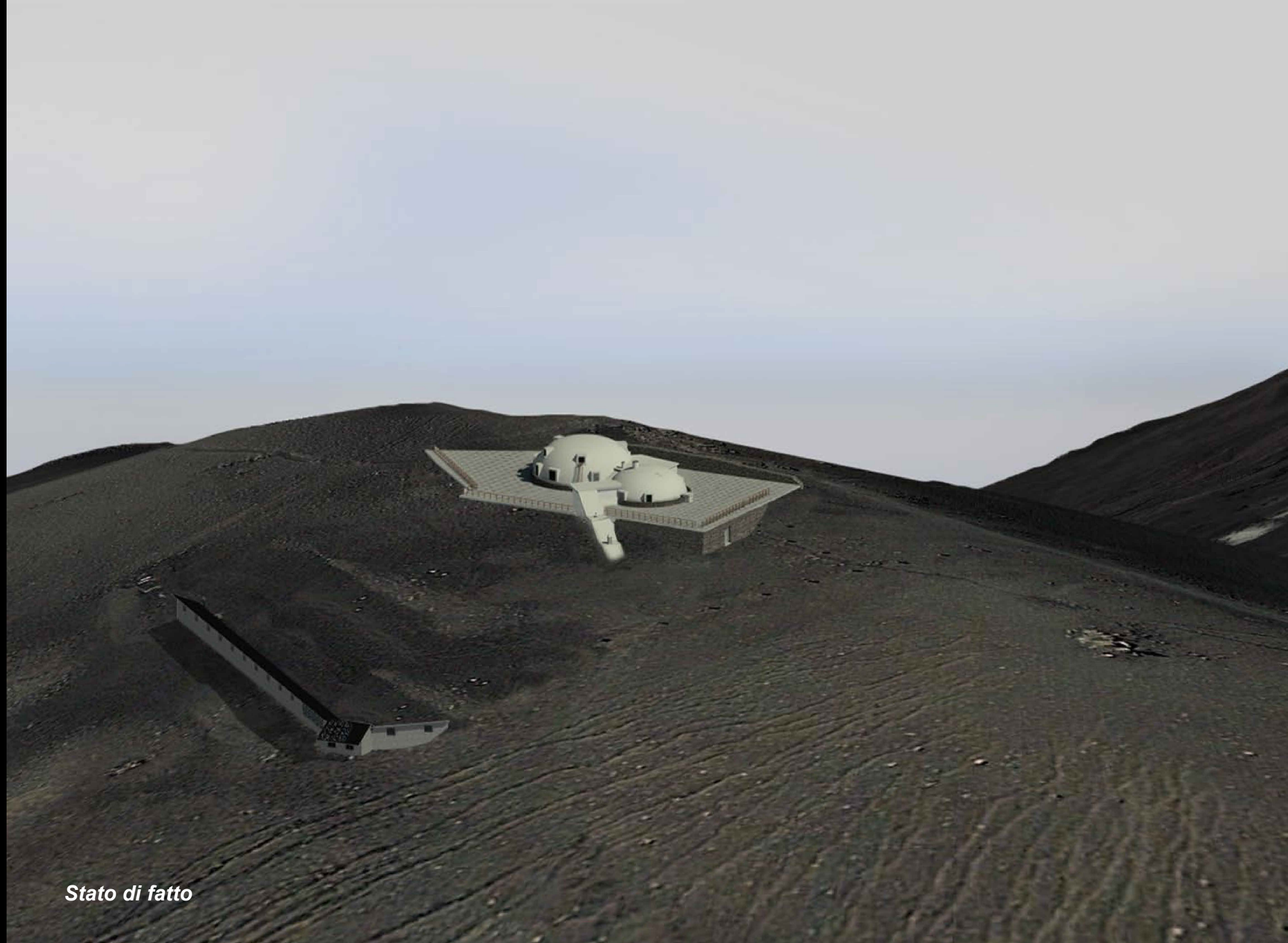




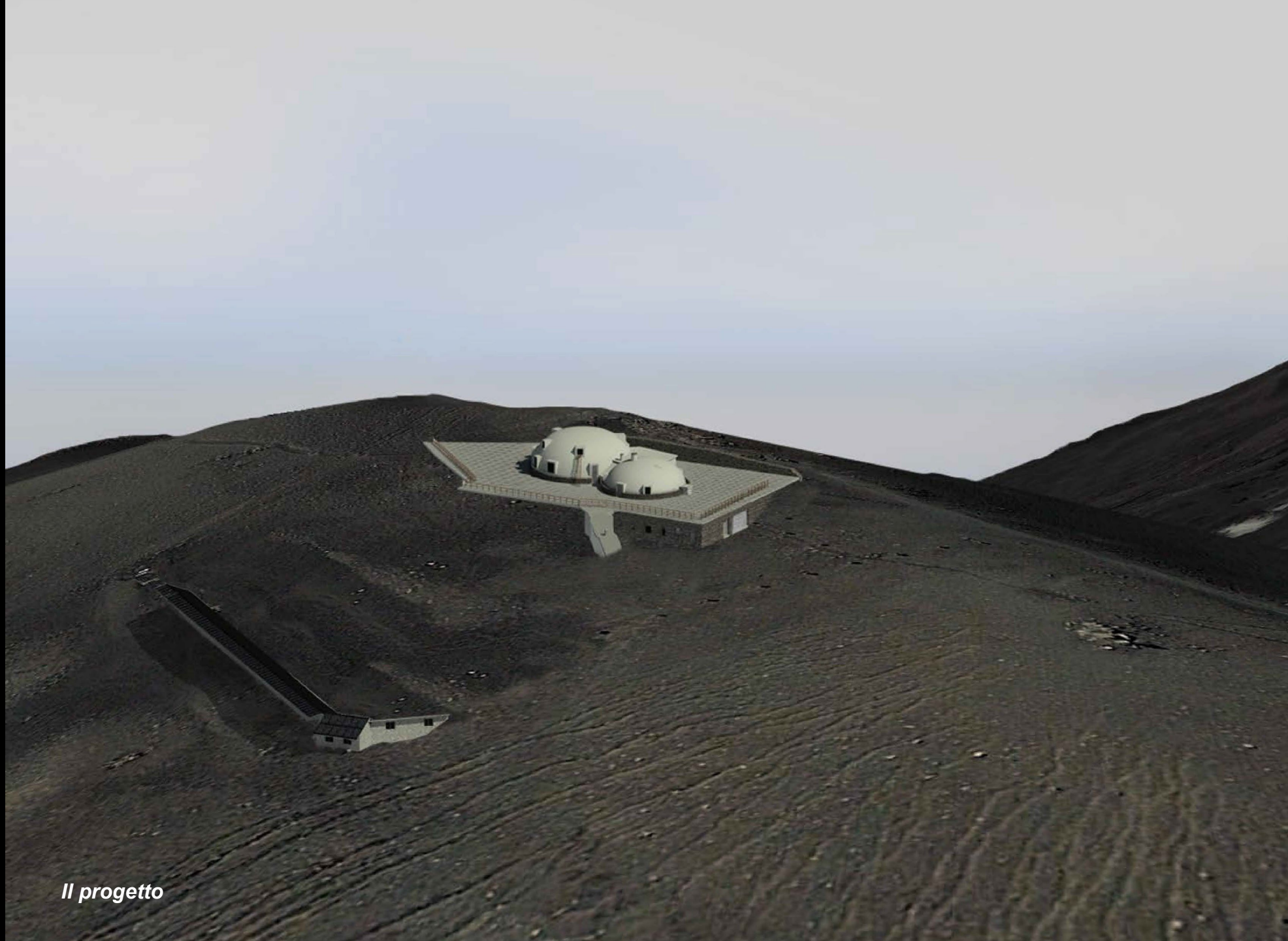
Stato di fatto



Il progetto



Stato di fatto

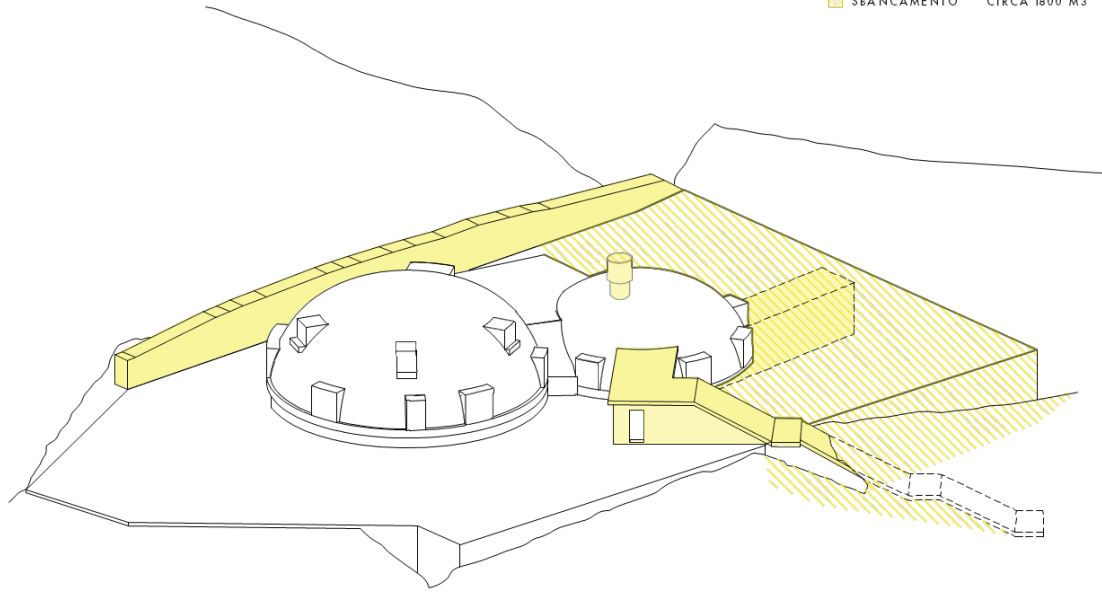


Il progetto

Concept demolito/costruito

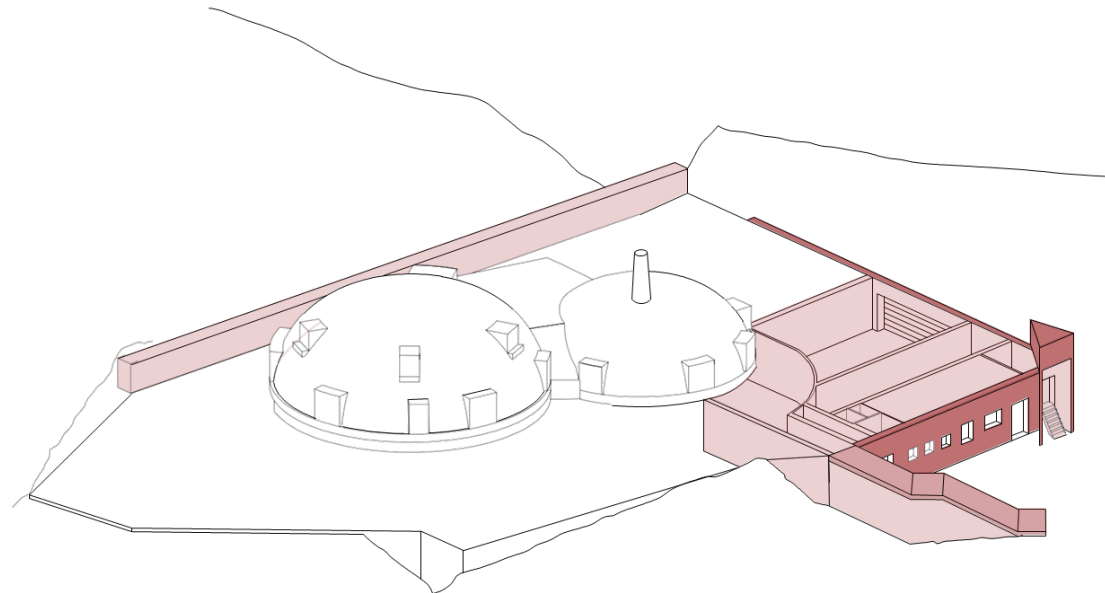
LEGENDA

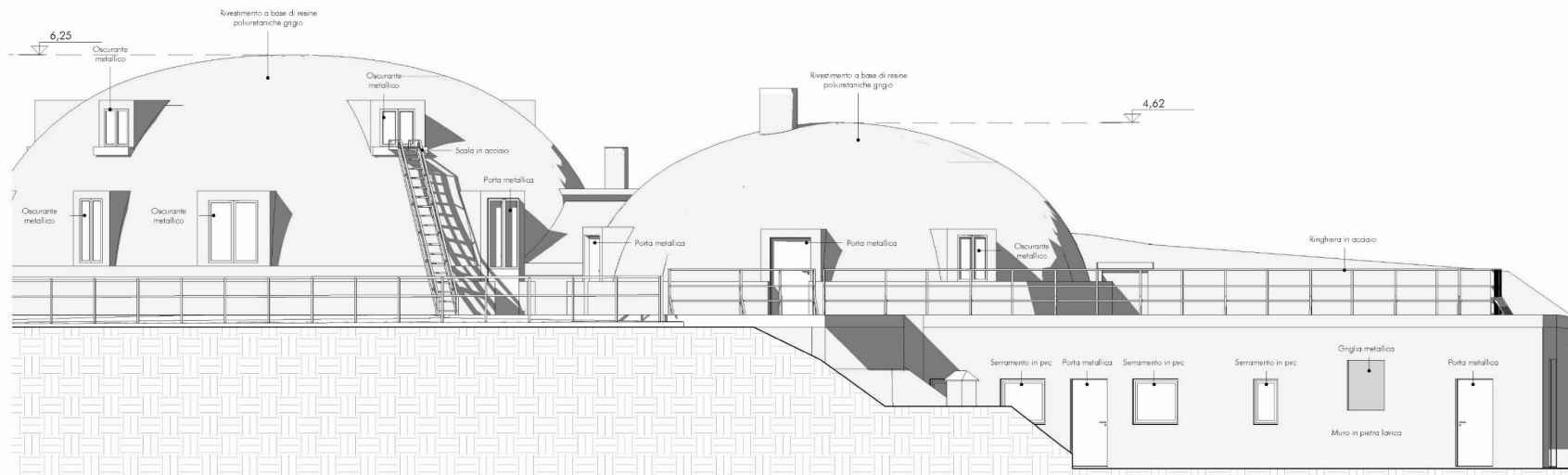
- DEMOLITO CIRCA 300 M2
- SBANCAMENTO CIRCA 1800 M3



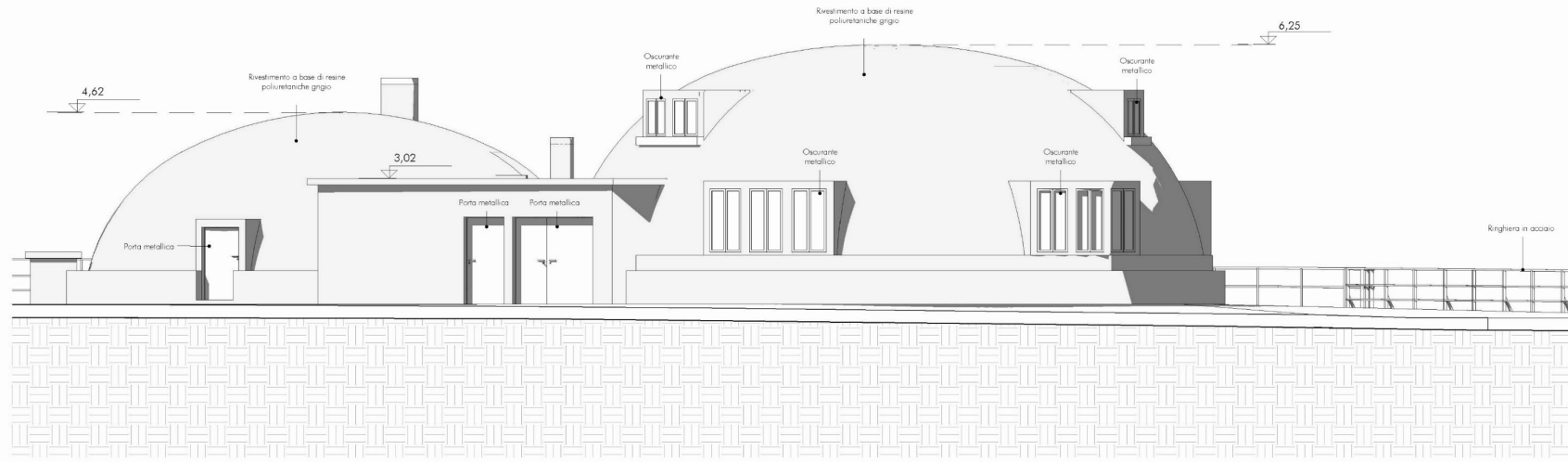
LEGENDA

- COSTRUITO CIRCA 300 M2

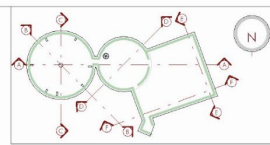




Prospetto Nord




Prospetto Sud

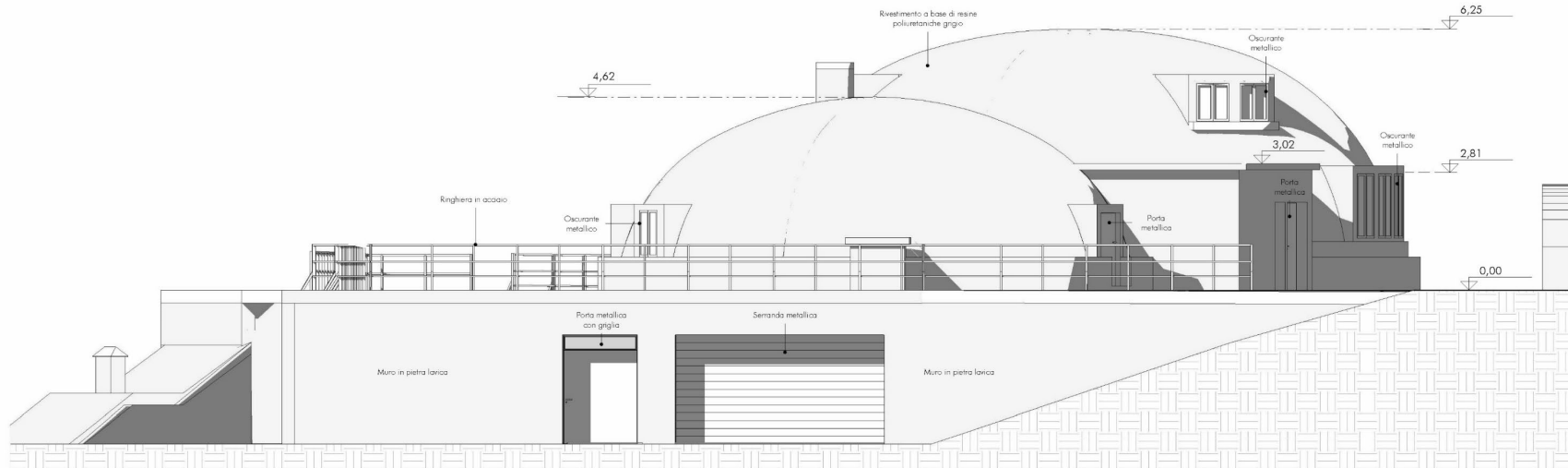


BOZZA

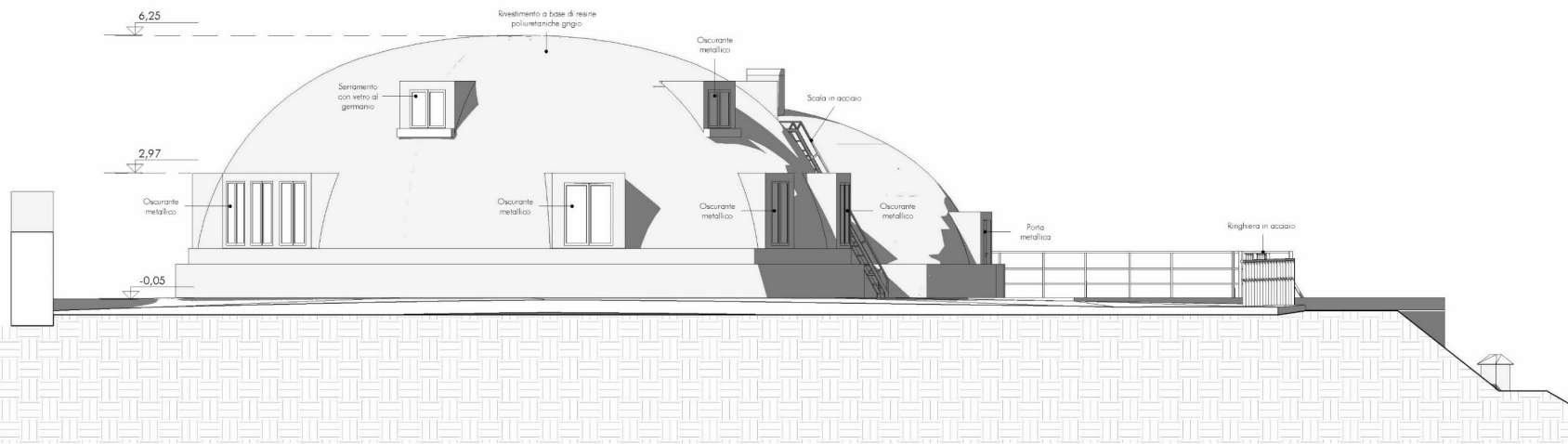
SCALA: 1 : 100
 FORMATO: A3
 PROGETTO: 4361 AIACE 221 ZZ D A 2100b
 CLIENTE: AIACE
 ARCHITETTO: Progetti Prospetti
 DATA: 2024


AIACE
 ASSOCIAZIONE ITALIANA ARCHITETTI

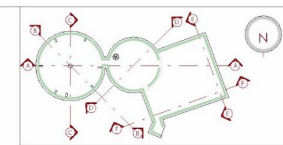
Un progetto di grande design, innovativo e tecnico è sempre il risultato di un lavoro in parallelo e coordinato con il progettista.



Prospetto Ovest



Prospetto Est



BOZZA

SCALA
1 : 100
FORMATO
A3

NUMERO
A 2100a

INDICAZIONE
ZZ D A

ELABORAZIONE
ZZ 221

COMPLESSO
4361

PROGETTO: **Prospetti**
COMPLESSO
AIACE



Il complesso del palazzo Bozza è costituito da un unico lotto di terreno di proprietà della società AIACE S.p.A. - Via S. Maria, 1 - 00187 Roma, Italia. Il progetto è stato elaborato dalla società AIACE S.p.A. - Via S. Maria, 1 - 00187 Roma, Italia. Il progetto è stato elaborato dalla società AIACE S.p.A. - Via S. Maria, 1 - 00187 Roma, Italia.



INGV Istituto Nazionale di Geofisica e Vulcanologia
Sezione di Catania
Etna, misure temperatura della lava foto D. Andronico

Pele's hair – Maui, Hawaii; Fonte: Rockwool



Fonte: Isopan



Fonte: Foamglass



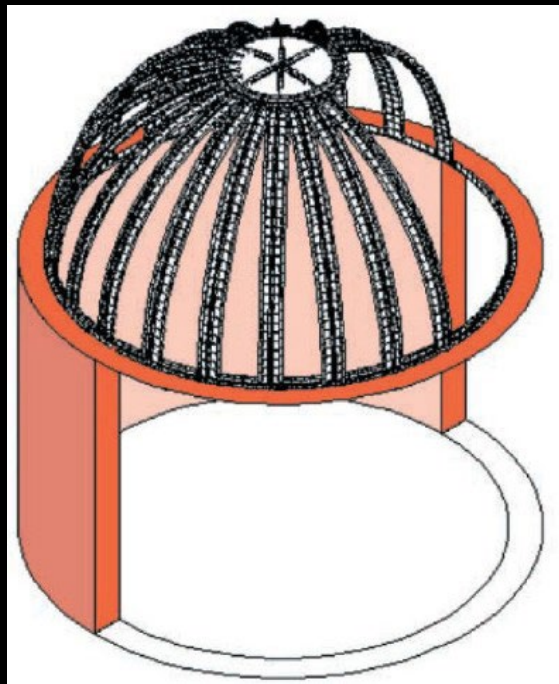


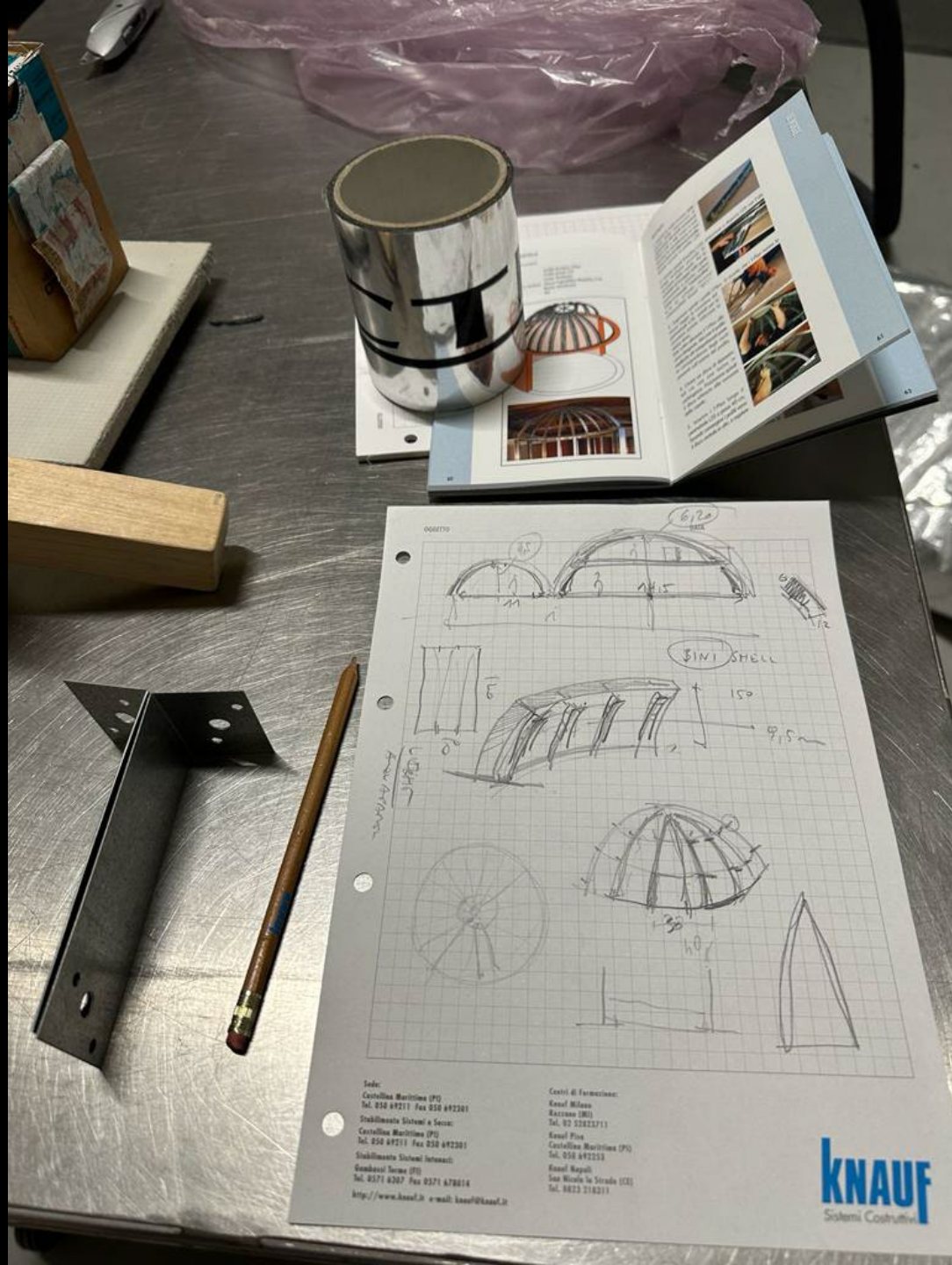
Strategie progettuali: i materiali



Foto dell'applicazione di un isolante termo riflettente nel Rifugio Gervasutti,
Fonte: Actis

Strategie progettuali: i materiali





Prototipazione del sistema a secco per il rivestimento e isolamento delle cupole



Sopralluogo di Novembre 2023



Sopralluogo di Novembre 2023



Attività di indagine svolte durante il sopralluogo di Novembre 2023

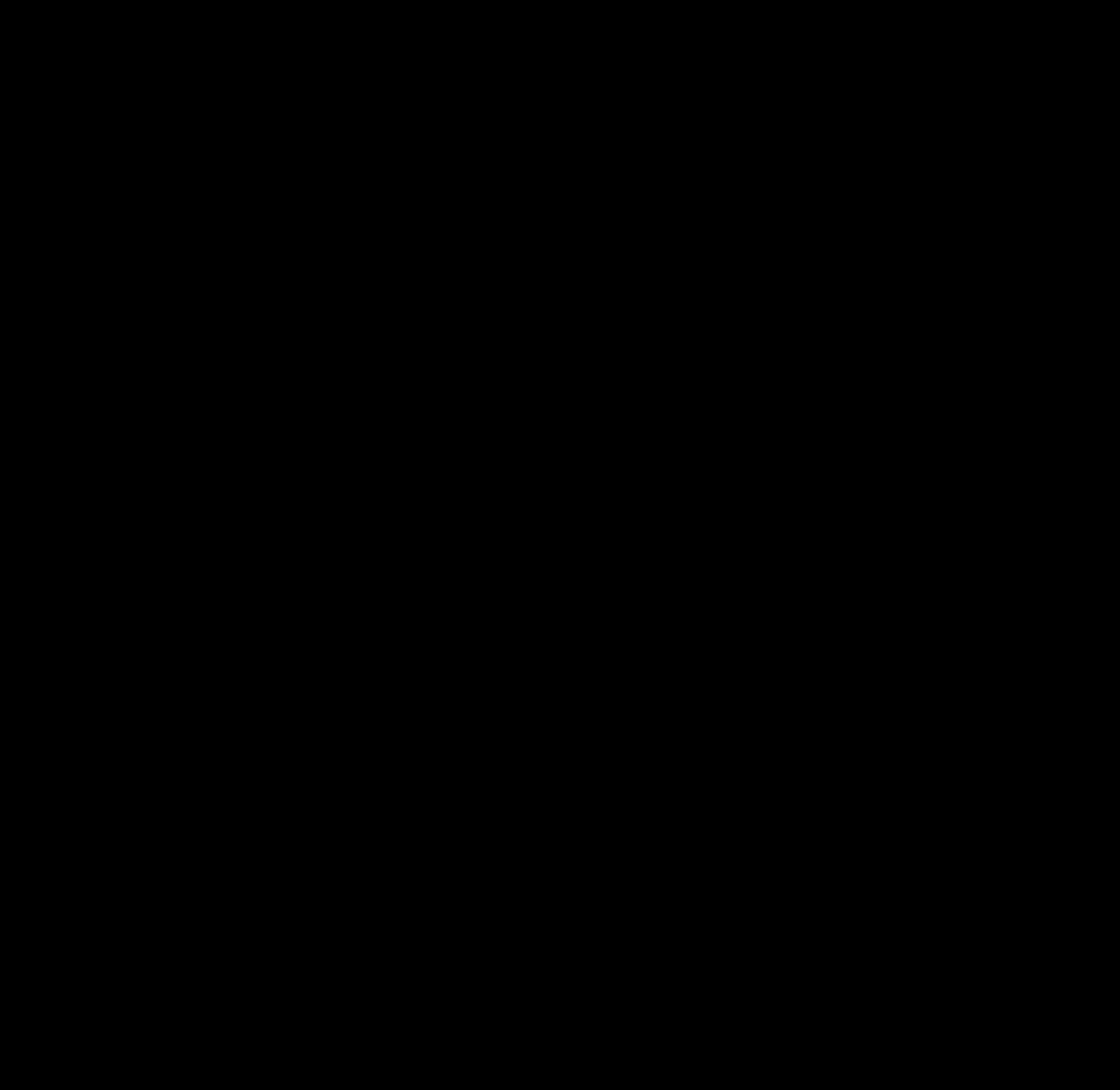


Attività di indagine MASW (multi channel analysis of surface waves) del team dello studio tecnico Carlo Cassaniti durante il sopralluogo di Novembre 2023 svolto con INGV



Attività di indagine MASW (multi channel analysis of surface waves) del team dello studio tecnico Carlo Cassaniti durante il sopralluogo di Novembre 2023 svolto con INGV





***“Ciclope, mi chiedi il nome famoso, ed io
ti dirò: tu dammi, come hai promesso, il dono ospitale.
Nessuno è il mio nome. Nessuno mi chiamano
mia madre e mio padre e tutti gli altri compagni”.***

Omero, Libro IX dell’Odissea

Grazie!