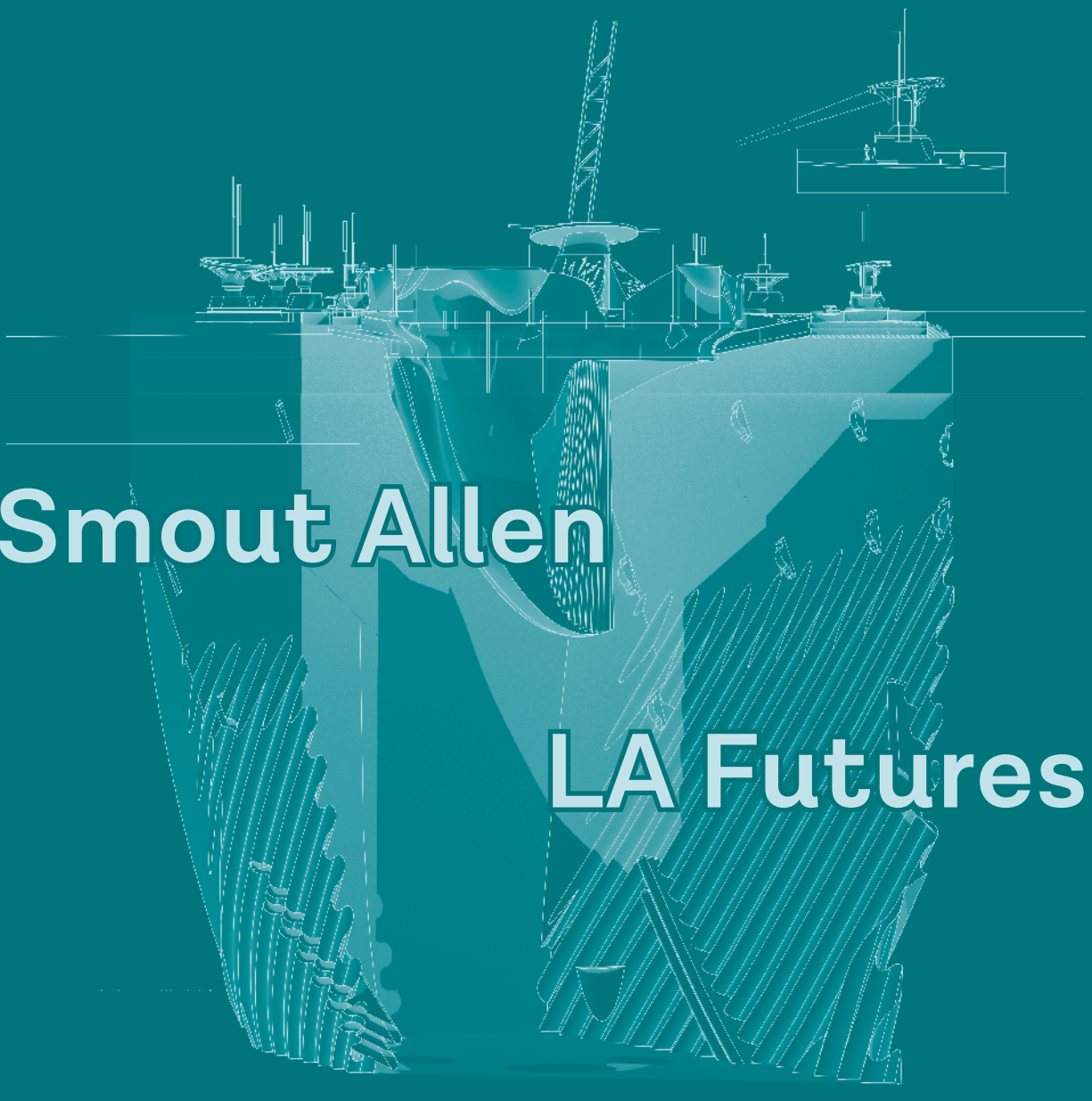
Bartlett Design Research Folios



Smout Allen

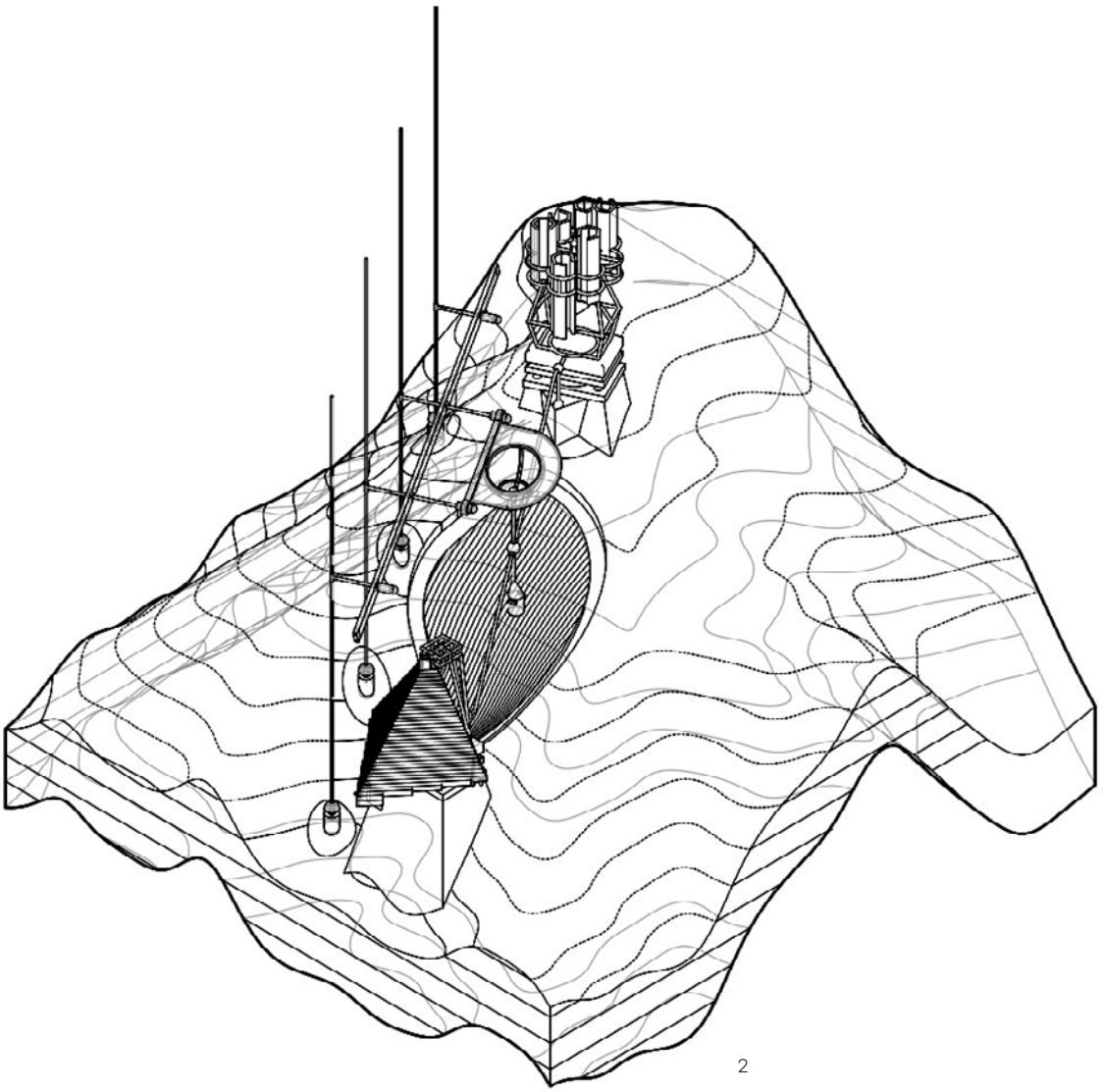
LA Futures

Smout Allen

LA Futures


TOWER OF
MEMORY & STARS


EARTH
OBSERVATORY
CROWN OF
MIRRORS



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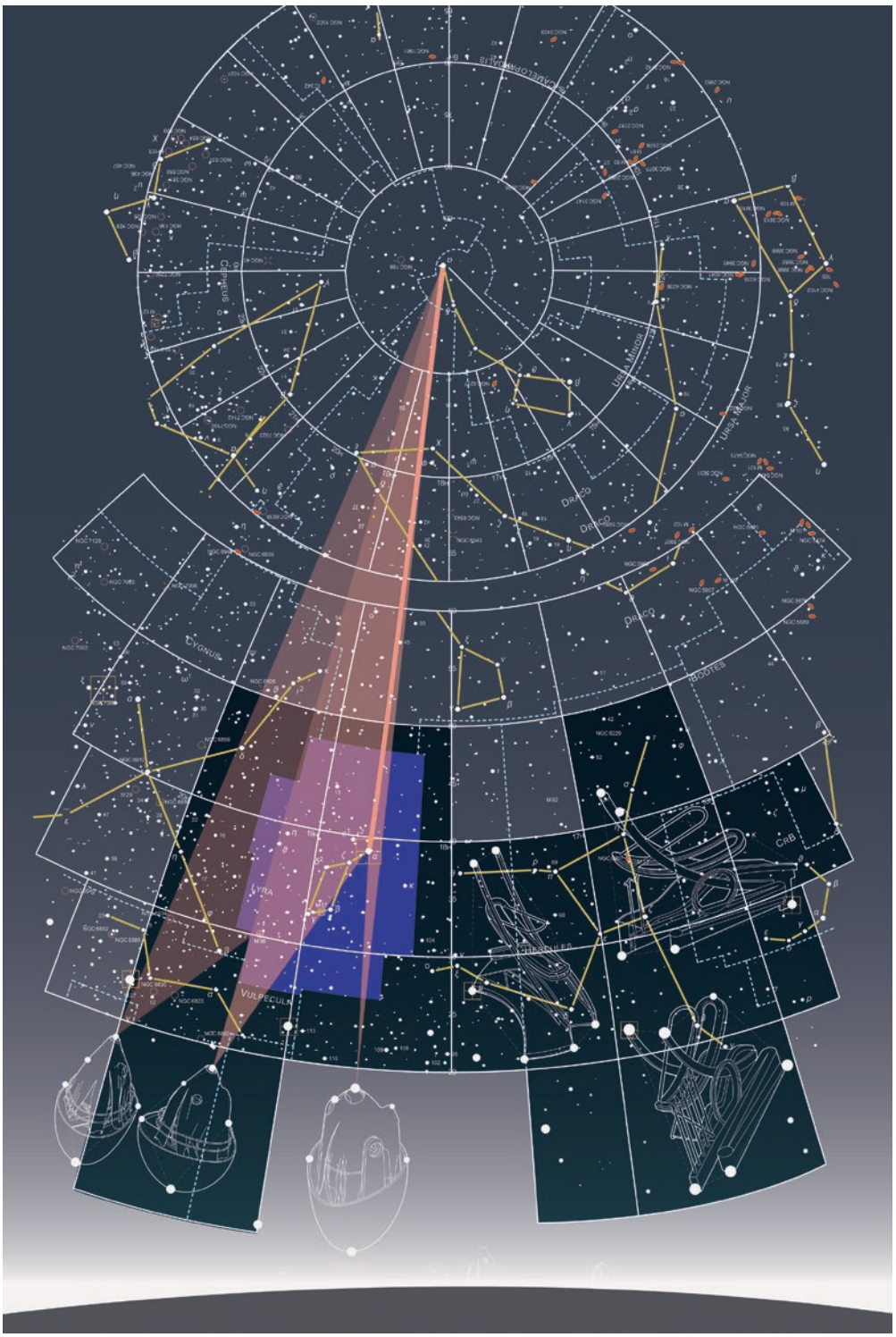
1 (previous) *#LATBD* map table and models.

2 Line drawing for Crown of Mirrors model.



3

3 As Los Angeles' demography and landscape changes, so too do the constellations above. This complex architectural zodiac gives context to a design proposal for seven projects in the city.

Project Details

Authors	Laura Allen and Mark Smout
Co-author	Geoff Manaugh
Title	LA Futures
Output Type	Design and exhibition
Research Period	2015 to 2016
Design Proposals	Freeway Astrolabe, Tower of Stars and Memory, Crown of Mirrors, Slow Fountain, Drift City, Earth Observatory, Fault Power
Exhibitions	*#LATBD,* Treasure Room, University of Southern California Libraries, Los Angeles (15 October 2015 to 31 January 2016); *LA Recalculated,* Chicago Architecture Biennial (10 March 2015 to 1 March 2016)
Curators	Nathan Masters (*#LATBD*); Joseph Grima, Creative Director of Design Academy Eindhoven, and Sara Herda, Director of the Graham Foundation for Advanced Studies in the Fine Arts for (*LA Recalculated*)
Partners	USC Libraries
Funding	£15,000 USC Libraries; £6,000 The Bartlett Architecture Research Fund (ARF); £6,000 The Bartlett Architecture Projects Fund (APF); £5,000 British Council Artists' International Development Fund (AIDF); $6,000 Chicago Architecture Biennial
Research Assistants	Doug Miller, 3D modelling and fabrication; Harry Grocott, 3D modelling, fabrication and robotic milling; Sandra Youkhana, 3D modelling

Statement about the Research Content and Process

Description

This project explores some of the key forces that have shaped Los Angeles – urbanisation, the freeway system, the history of global astronomy, the city's unstable geological substratum and the pervasive existence of oil extraction infrastructure – to propose alternative future urban scenarios. The project culminated in the design of seven architectural proposals, commissioned for two exhibitions.

Questions

1. How have LA's subterranean oil fields influenced its urban development from the late 1900s until today?

2. In what ways can architectural design and modelling integrate information and techniques from geomorphology, geology and seismography to interpret and visualise complex subterranean conditions?

3. In what ways can new infrastructures monitor the city's subterranean conditions but also constructively influence its future urban development?

4. How can experimental architecture that forms a dynamic, dependent and deep-time relationship with geomorphological processes generate greater knowledge and contribute to current architectural practice?

Methodology

1. Identify and reflect on histories of geological and scientific relevance specific to LA by researching cartographic and photographic material at the USC Libraries and Archives;

2. Interdisciplinary collaboration between two designers and a writer to share and expand on ecological and hydrological knowledge, including critically studying a set of interviews;

3. Model design, drawing and making as tools of research interpretation, integration and proposition.

Dissemination

LA Futures has been exhibited five times in the US and the UK, including at the USC Doheny Memorial Library, the Chicago Biennial and the Royal Academy of Arts, London. The project has featured in numerous articles, including one authored by Smout Allen published in the journal *Hidden*. Other articles and reviews have featured in the national and international press, including *The Architect's Newspaper* and *Vice*. It has been the subject of invited talks in the US and UK, including UC Berkeley, College of Environmental Design and the American Institute of Architects – Baltimore Chapter.

Project Highlights

LA Futures was commissioned by two venues with important international and intellectual reach: The USC Doheny Memorial Library in LA and the inaugural Chicago Architecture Biennial in 2015. The Biennial invited over 100 practices from 30 countries to participate, and attracted more than 500,00 visitors.


CALIFORNIA DIVISION OF MINES AND GEOLOGY
JAMES F. DAVIS, STATE GEOLOGIST
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION
GRAPEVINE QUADRANGLE
CALIFORNIA-KERN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
TEJON OIL FIELD
FAULT MAY EXTEND TO EAST UNDER LANDSLIDE DEPOSITS
AREA OF MASSIVE LANDSLIDES
MASSIVE LANDSLIDES
SCALE 1:24,000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 50 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
MAP EXPLANATION
Potentially Active Faults
Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.
Special Studies Zone Boundaries
These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.
Seaward projection of zone boundary.
STATE OF CALIFORNIA
SPECIAL STUDIES ZONES
Delineated in compliance with
Chapter 7.5, Division 2 of the California Public Resources Code
(Alquist-Priolo Special Studies Zones Act)
GRAPEVINE QUADRANGLE
REVISED OFFICIAL MAP
Effective: January 1, 1985
State Geologist
REFERENCES USED TO COMPILE FAULT DATA
IMPORTANT - PLEASE NOTE
1) This map may not show all faults that have the potential for surface fault rupture, either within the special studies zones or outside their boundaries.
2) Faults shown are the basis for establishing the boundaries of the special studies zones.
3) The identification and location of these faults are based on the best available data. However, the quality of data used is varied. Traces have been drawn as accurately as possible at this map scale.
4) Fault information on this map is not sufficient to serve as a substitute for the geologic site investigations (special studies) required under Chapter 7.5 of Division 2 of the California Public Resources Code.

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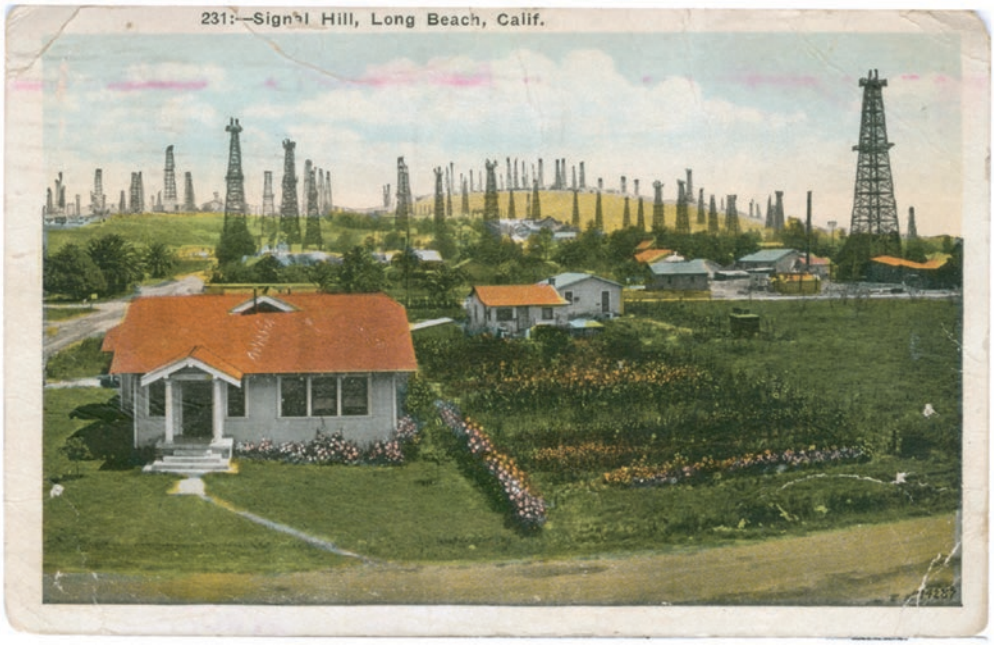

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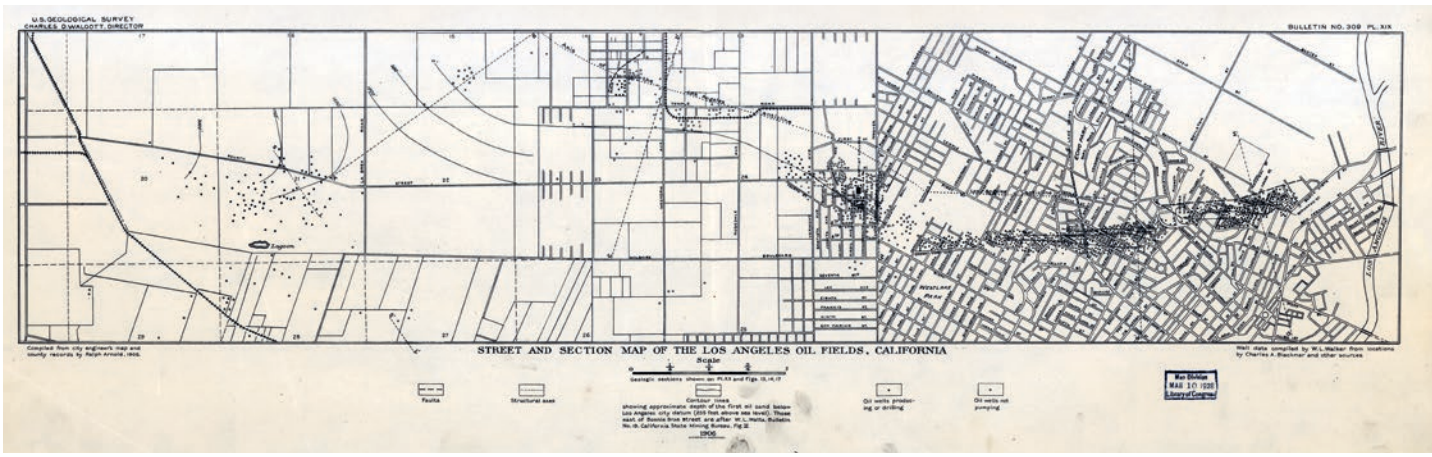


6

4 Fault Evaluation Report Map, 1985. The fault-zone boundary is indicated in yellow; fault traces in red.

5 Postcard showing Signal Hill, also known as 'Porcupine Hill', c.1920.

6 Street and Section Map of the Los Angeles Oil Fields, 1906.

Introduction

LA Futures stems from Smout Allen's long-standing interest in landscapes that are undergoing dynamic transformation as a result of environmental processes and emerging cultural and climate change.

There are currently few cities which are more affected by the climate emergency than LA. The city has long been defined by its dense urban landscape and notorious suburban sprawl, which has grown simultaneously with the boomtown infrastructure of petrochemical extraction. Although extraction has now declined, urban life remains interwoven with a network of 41 active oil fields and 3,000 active wells (Barragan 2014). The city is constantly breached by seeps of toxic hydrocarbons, some permanent, such as the La Brea Tar Pits, where crude oil has formed large pools of liquid asphalt which release clouds of methane gas. In addition, LA is situated in the most seismically active region in the US – the notorious San Andreas Fault and many others converge and dissect the city – and it experiences as many as 10,000 earthquakes a year. LA's history of ecological and terrestrial fragility is paralleled with developments in planetary sciences, ecological monitoring and astronomical observation. The extreme LA landscape is, therefore, perfectly suited to Smout Allen's focus on hydrogeological issues, and offered the opportunity to advance the practice's research with reference to USC's archival holdings.

LA Futures continues Smout Allen's working relationship with writer Geoff Manaugh who is an LA-based writer and author on issues relating to cities, design, crime, infrastructure and technology. Manaugh regularly contributes to *The New York Times Magazine, The New Yorker, New Scientist, Wired* and many other publications. He has been the author of BLDGBLOG since 2004, exploring architecture and the built environment through an expansive lens. His bestselling *BLDGBLOG Book* (Chronicle Books) was one of Amazon's 'Books of 2009'. LA Futures was commissioned by the University of Southern California (USC) Libraries at the end of a 12-month Discovery Fellowship by Manaugh. The brief was to respond to the USC archival holdings and consider the intersection of artistic and scientific disciplines on the theme of the LA landscape. The project was subsequently exhibited in *#LATBD* (LA To Be Determined) at USC **(1)**.

LA's future is one of intense speculation; its development influenced by the risk of catastrophic earthquakes and shifting ground alignments. Reflecting on the 'deep context' of the city, the project explores landscape conditions that are geological and astronomical in nature, and typically fall outside the remit of architectural design. It responds to two main themes: LA as a site of astronomical observation and scientific experiment, and of shifting alignments and unstable ground conditions. Geological information and the city's relationship with urban crude are critical to the design investigation, and can inform our understanding of fragile and threatened landscapes in the future. Speculative architectural design in the earthquake zones of south California by American architect Lebbeus Woods are an influence, and are referenced here.

LA Futures asks if the city can be an urban-scale research facility; a living device in which hypothetical instruments and influential architectures are developed. Diverse futures for LA are examined – narrative, scientific, architectural and landscape – and realised in the design of seven architectural proposals. These were presented in the form of 3D-modelled architectural landscapes atop a large graphic map table for the exhibition *#LATBD.* Fictional and factual items were

7

woven together and were accompanied by speculative game design, narrative writing, interactive text, extracts of interviews, as well as collections from the USC Archives. The developed proposals were also presented at the inaugural Chicago Architecture Biennial as a series of eight lightbox paintings **(67)**. See pp. 18–28 for a brief summary of each design proposal.

8

7 Playa del Rey oil field, looking north on Pacific Avenue, 1930.

8 Tar pushes up through cracks in the sidewalk on Wilshire Boulevard, near the La Brea Tar Pits.

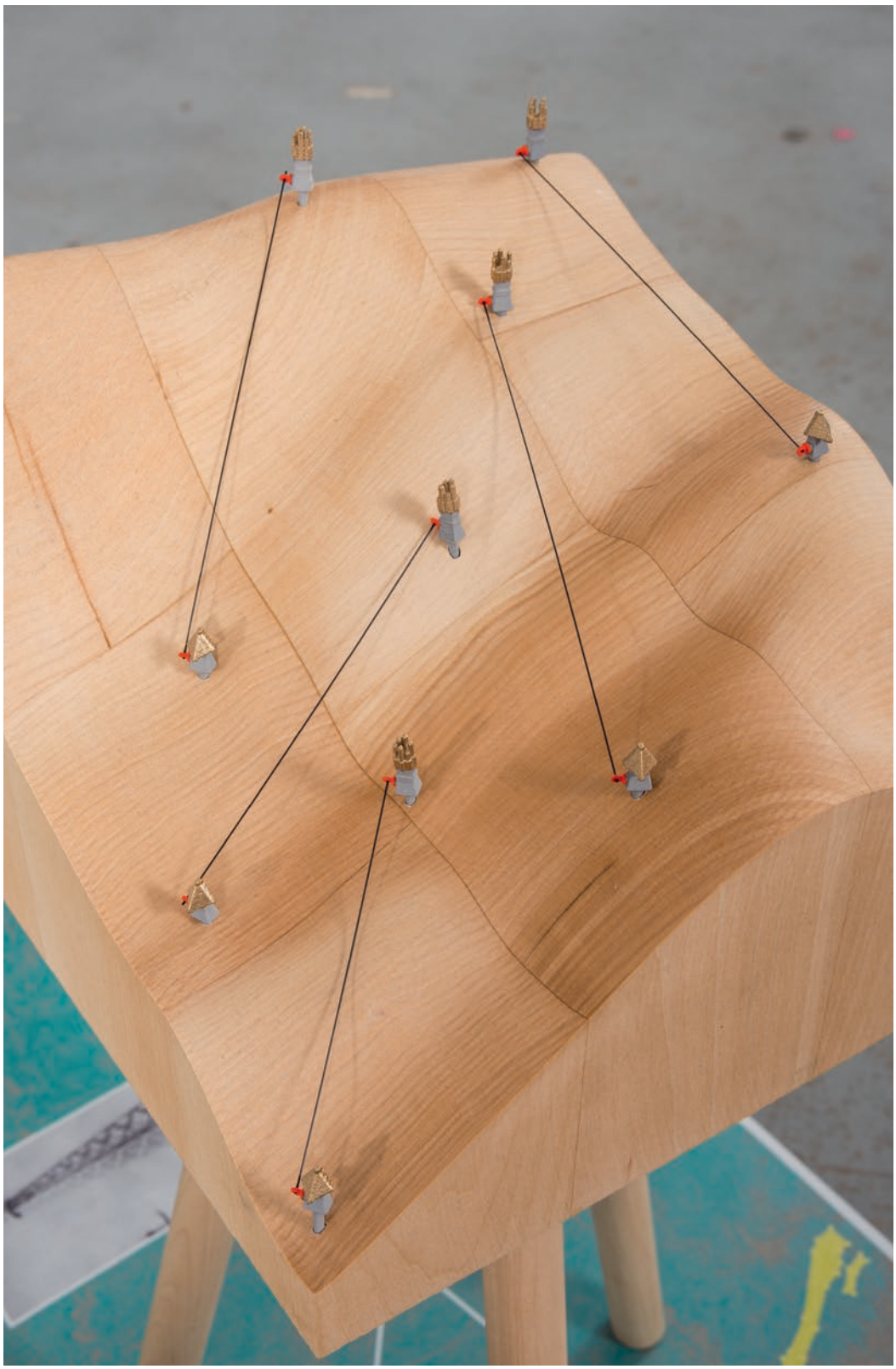
9

10

9 Tower of Stars and Memory crystal model. Past and future events are sub-surface laser etched onto a glass block.

10 Slow Fountain model. Slow fountains attuned to percolating ground fluids gather and mix in pools and reservoirs. The model shows oil, tar and liquid asphalt seeping up to the surface.

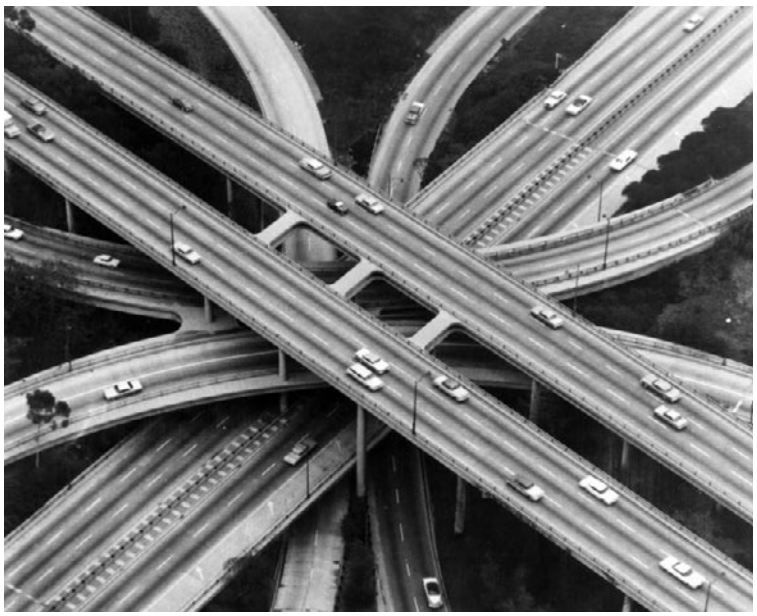
11



11–2 Models representing Mount San Antonio and Mount Wilson, and their experimental apparatus. 12

Freeway Astrolabe

To revitalise and extend LA's sense of celestial responsibility, the city's infamous freeway system is transformed into a functioning, urban-scale astronomical observatory. Frames, gates and other ornamental structures, including acid-engraved lines on various roads and bridges, align the fabric of the city with the stars **(13–4, 31)**.



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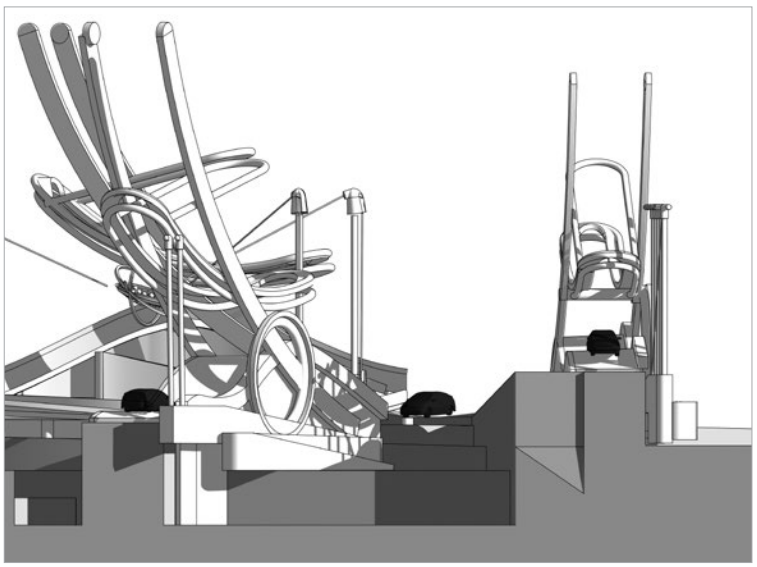

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13 Aerial view of the Four Level Interchange in downtown LA, 1959.

14 Digital drawing of Freeway Astrolabe model, road view.

Tower of Stars and Memory

This design is sited in the parking lot of the Dodger Stadium. The stadium was built in the 1950s during a notorious period of development in LA. The Chavez Ravine Mexican-American community were displaced to make way for the stadium and are subsequently commemorated there. A series of 360-degree planetariums resembling shrouded chapels observe geological and astronomical deep time **(15–6, 32)**.

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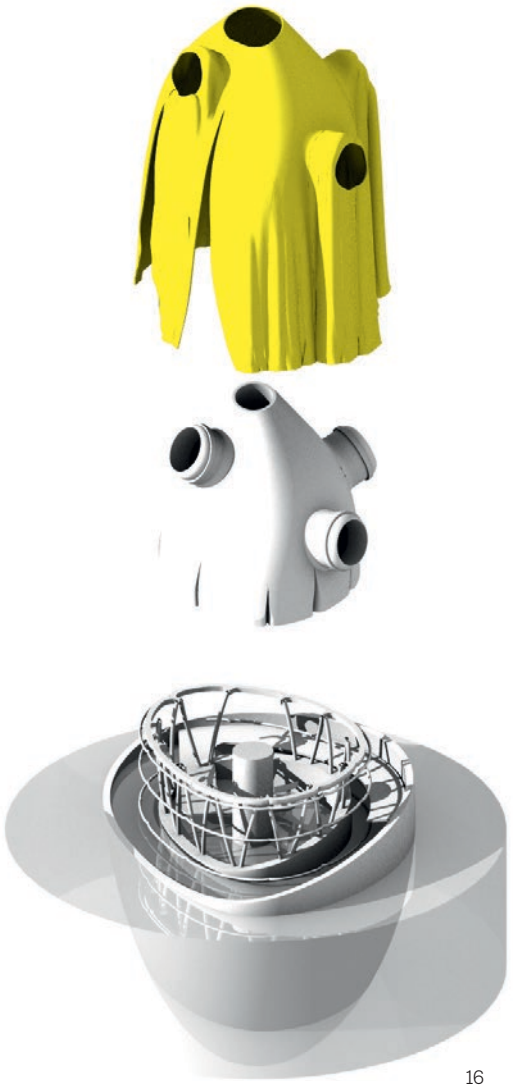
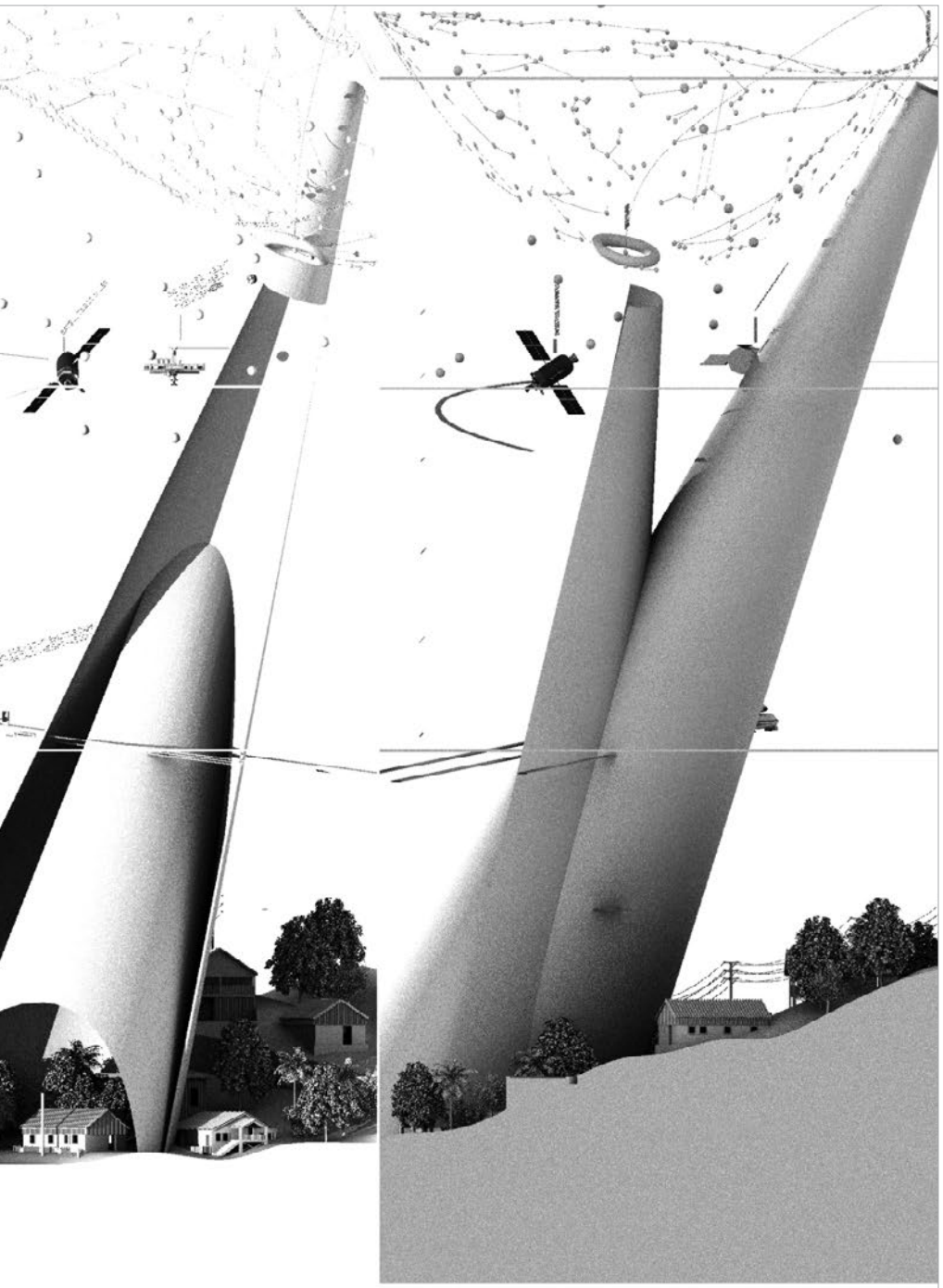


16

15 Dodger Stadium construction site, 1961.

16 Tower of Stars and Memory. Exploded 3D drawing of planetarium.

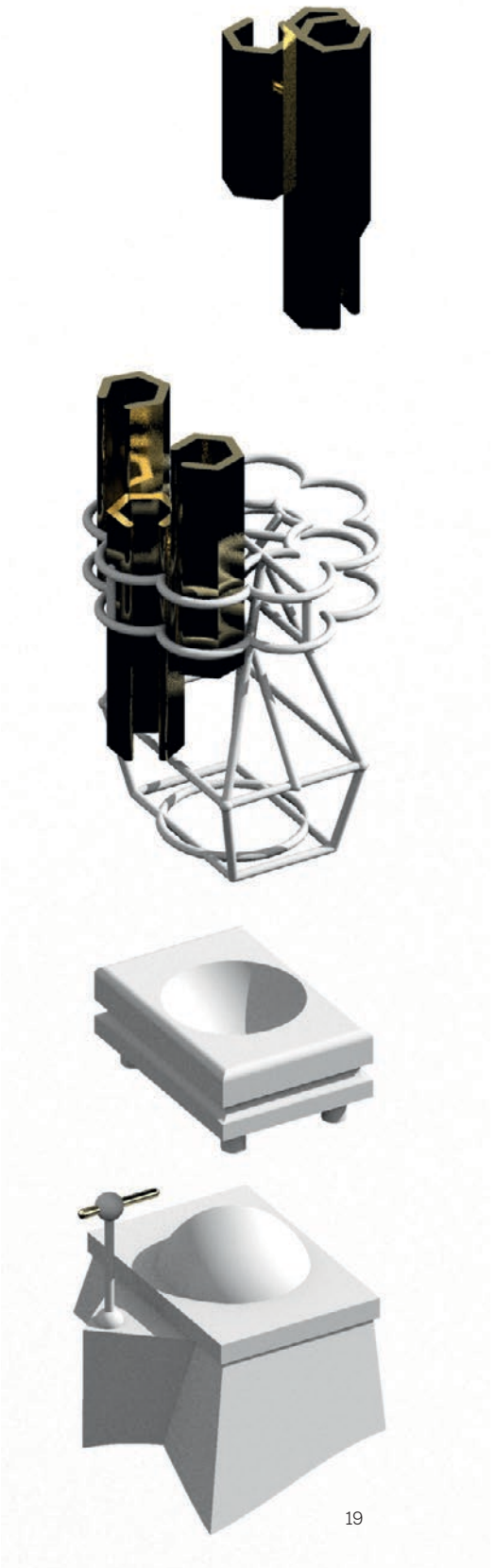


17 Tower of Stars and Memory, unfolded drawing. Information is arranged in logarithmic height scale and includes the streets of Chavez Ravine, a NASA Space Shuttle Endeavour memorial flight, the Kármán Line, the International Space Station and the Lyra Constellation.

Crown of Mirrors

This design responds to American physicist Albert A. Michelson's apparatus to measure the speed of light at an architectural scale. An assemblage of rotating hexagonal prisms and parabolic mirrors, partially veiled by slatted timber enclosures, align with an observation platform that looks towards Mount Wilson. A zone of surrounding rock face is slowly but continually scoured by a polishing stone, which is attached to armatures that record a physical trace of planetary time **(18–20, 33)**.

18



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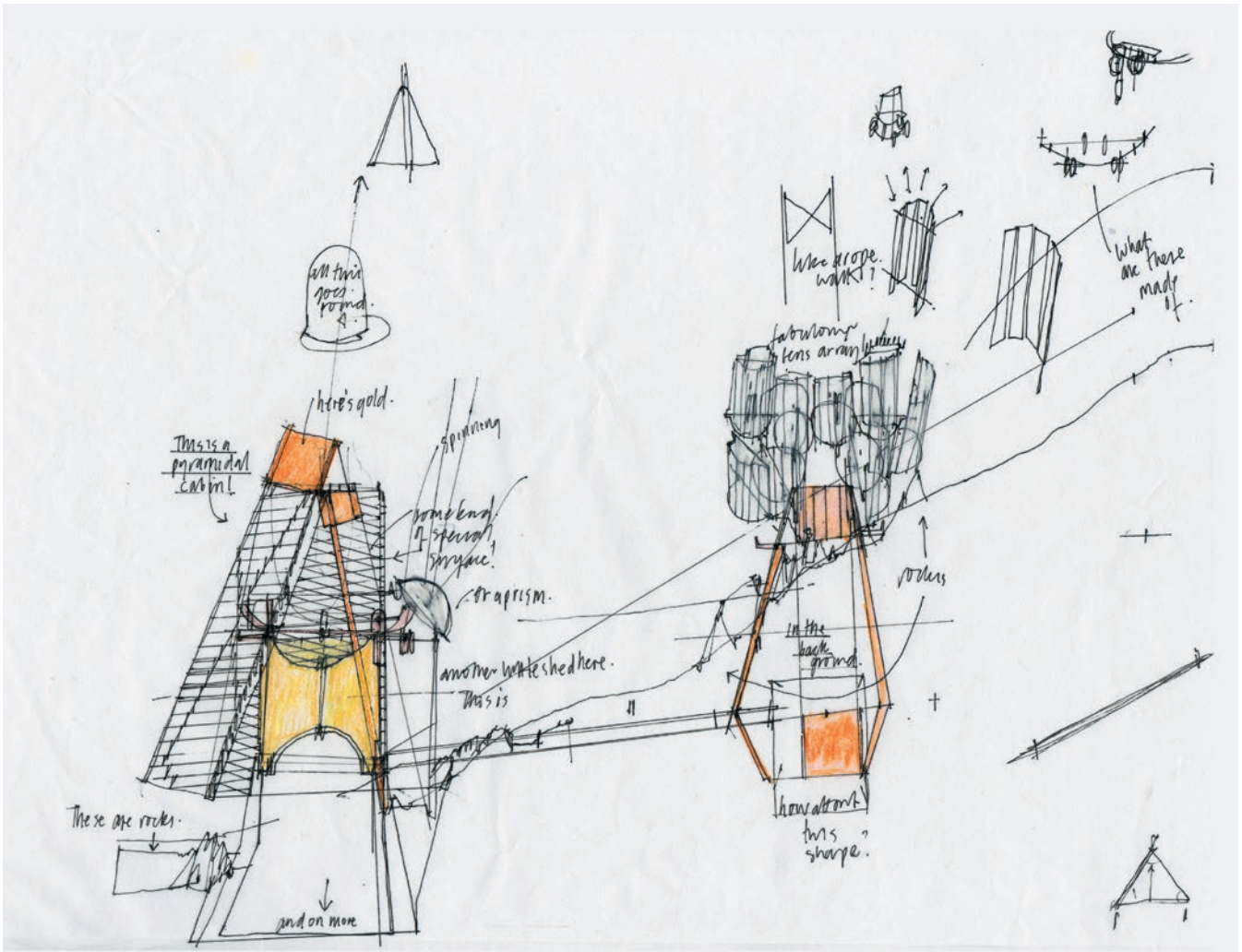
18 Foundation column of an old observation hut on Mount San Antonio, 2014.

19 Crown of Mirrors, exploded axonometric.

20 Sketch by Smout Allen incorporating remnants of Michelsen's experiment.


here's gold.
This is a pyramidal cabin!
spinning
some kind of special surface?
or a prism.
another watershed here.
This is
These are rocks.
and on more
rocks
in the back ground.
how about this shape?
What are these made of.

20

Slow Fountain

Slow Fountain reinterprets LA's civic fountains, capturing a plentiful supply of hydrocarbons in liquid and gaseous forms. A large central fountain, constructed from the pipes and valves of LA's oil industry, performs a choreography of flows and drips against a landscape of terraformed hills and valleys, palm trees and methane 'pools' **(21–3, 27, 34)**.

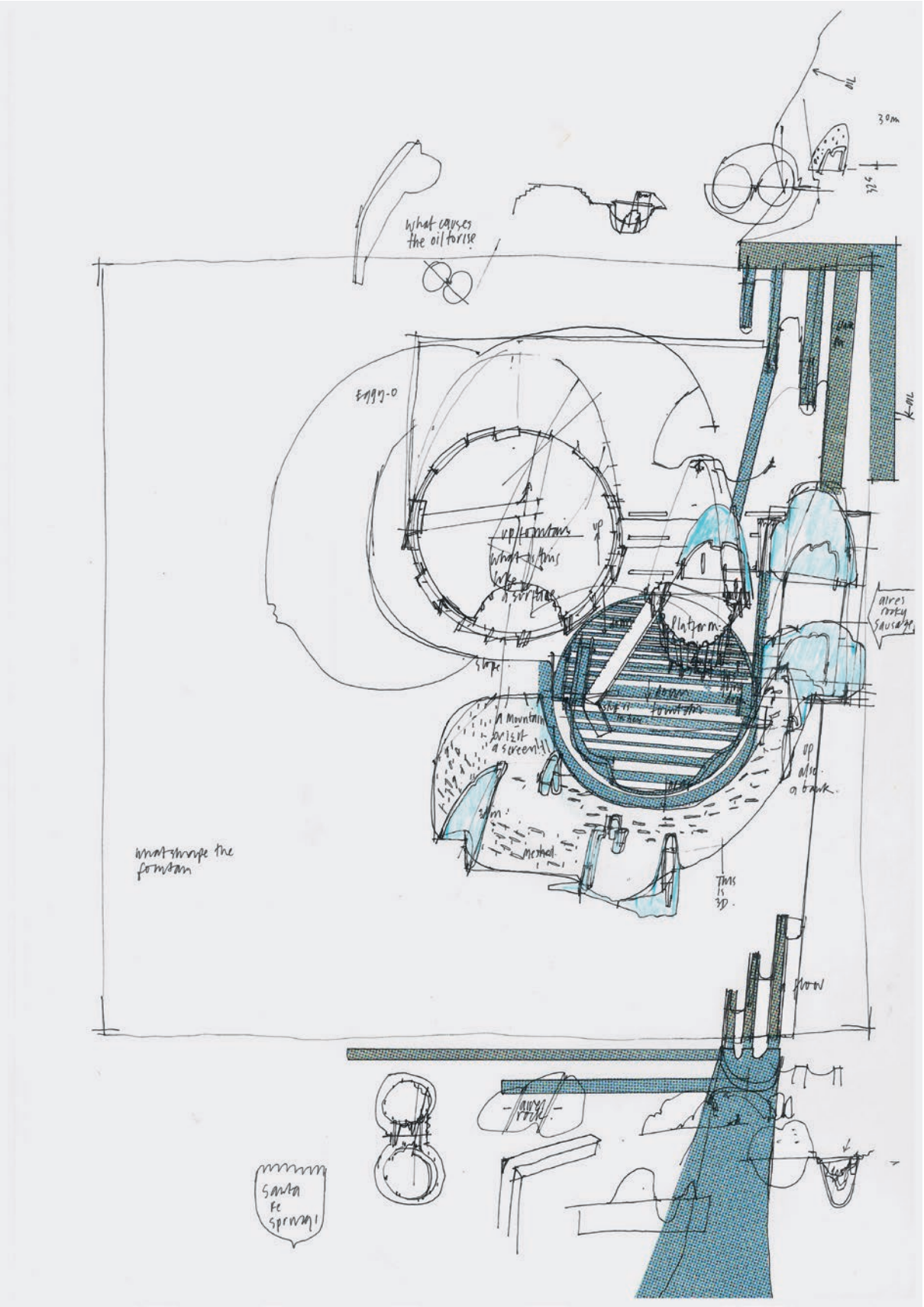
21

22

21 Colour linen postcard depicting the William Mulholland Memorial Fountain at the entrance to Griffith Park, c.1940.

22 Slow Fountain, exploded drawing.

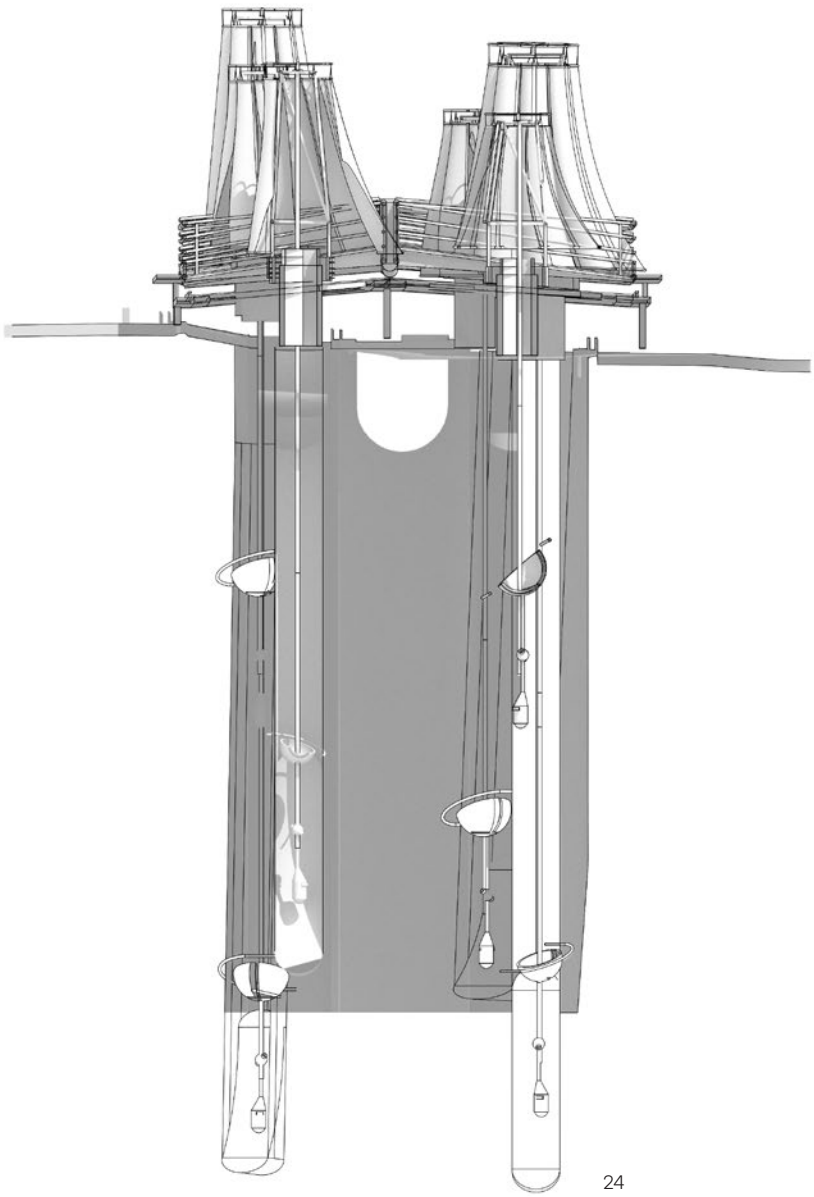
23 Slow Fountain, early sketch drawing.


what causes the oil to rise
Eggy-O
platform
Mountain
30m
what shape the formation
Santa Fe Spring!
this is 3D.
glow
up

23

Drift City

A field of deep subterranean pendulums, borrowing the technology of tuned mass dampers – typically large and heavyweight swinging pendulums of concrete or steel that stabilise buildings by responding to movement and oscillating freely at the natural frequency of the structure – are hung beneath the city to sway and counter sway with every quake. Above street level, a platform of umbrella-like structures mirrors underground movements **(24, 29)**.

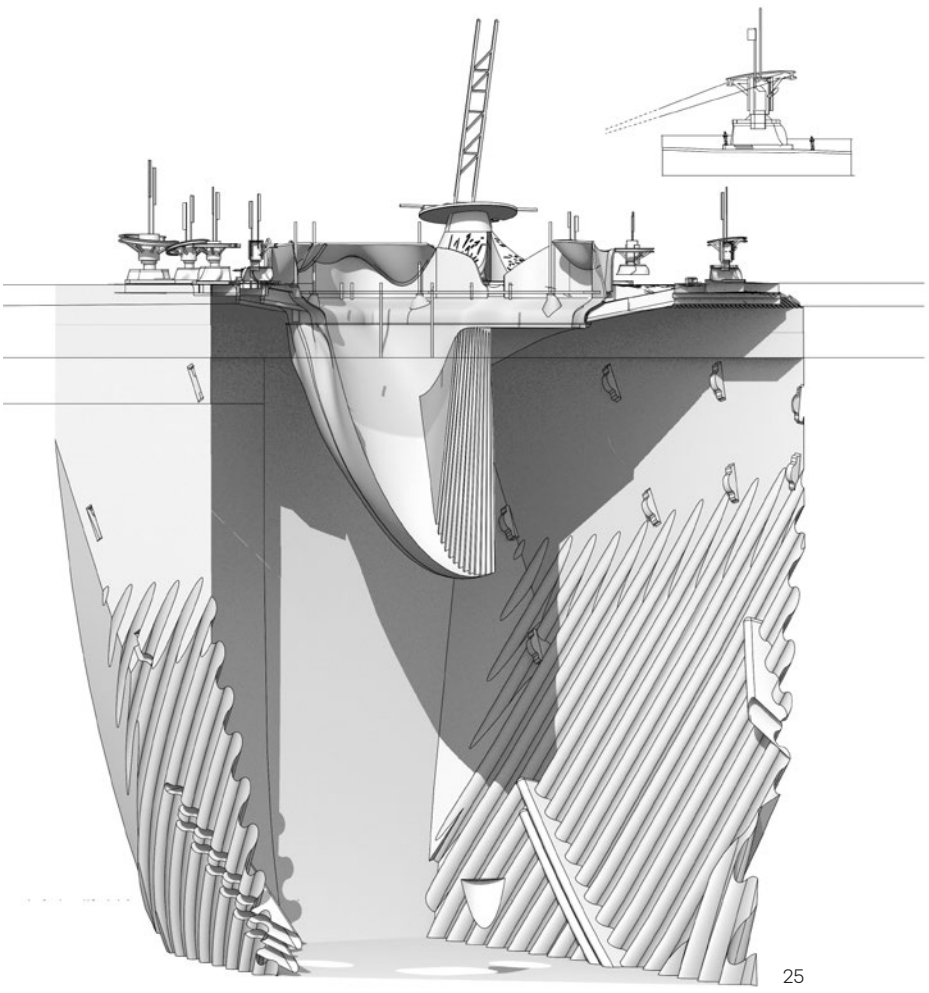


24 Drift City section drawing.

24

Earth Observatory

The United States Geological Survey (USGS) deploy a variety of fault monitoring instruments from which spatial and temporal data is collected. In this design, eight sets of creep metres are laced across the void of a deep fault trench. The slackening and tightening movement of these creep metres monitors the slow displacement of the geological substrata of the city and can be observed from above ground and subterranean laboratories **(25, 28, 30)**.

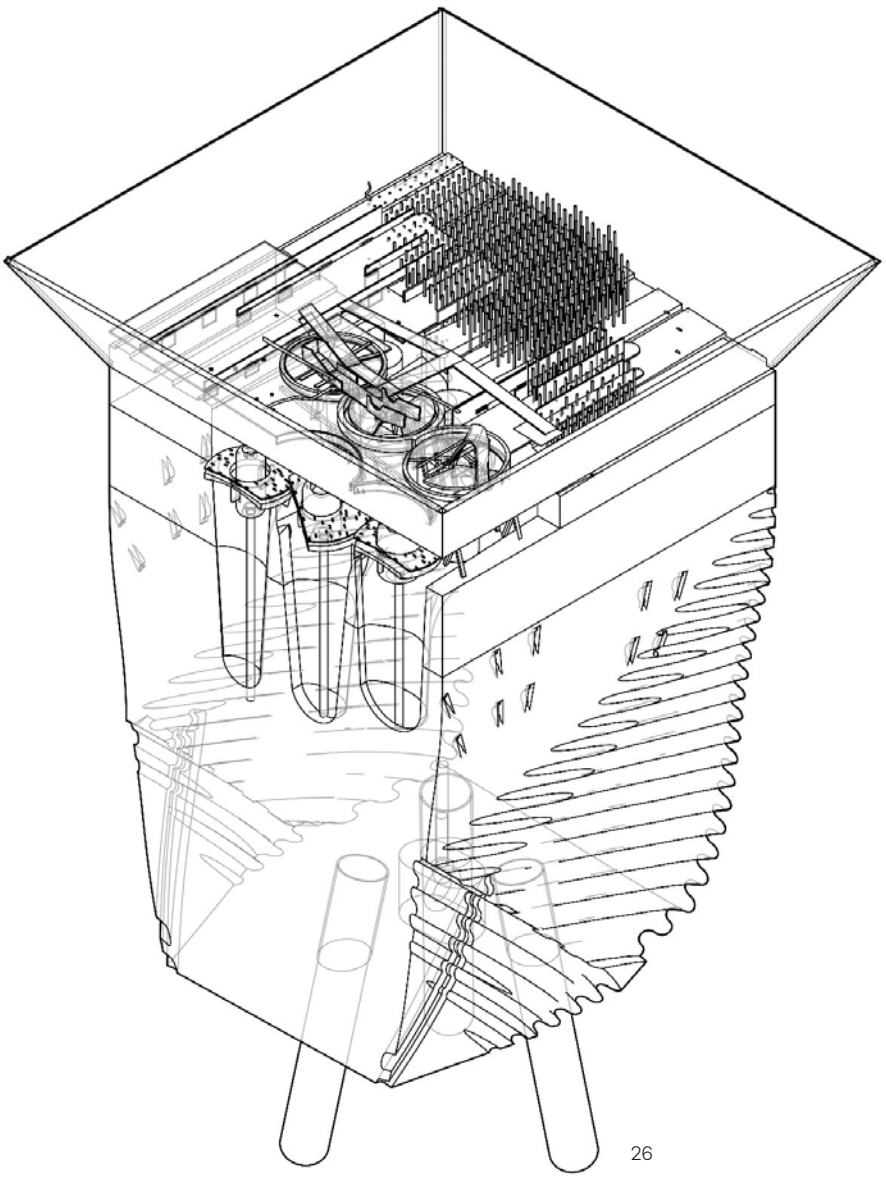


25

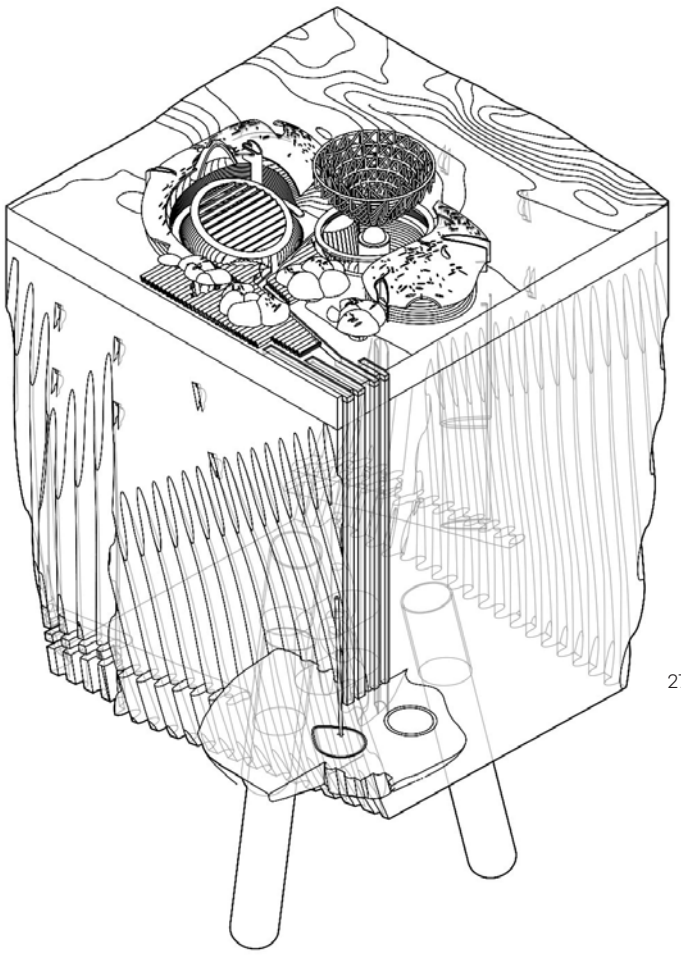
25 Earth Observatory section drawing.

Fault Power

The endless jostling of the city, whether due to tectonic activity or its relentless cycle of demolition and construction, can be tapped as a new source of renewable energy. Vast flywheels convert seismic disturbance into future power, spinning beneath generation facilities built throughout the city's sprawl. A 'garden' of beacons registers the fluxing power generation and reserve **(26, 35)**.



26 Line drawing of Fault Power model.



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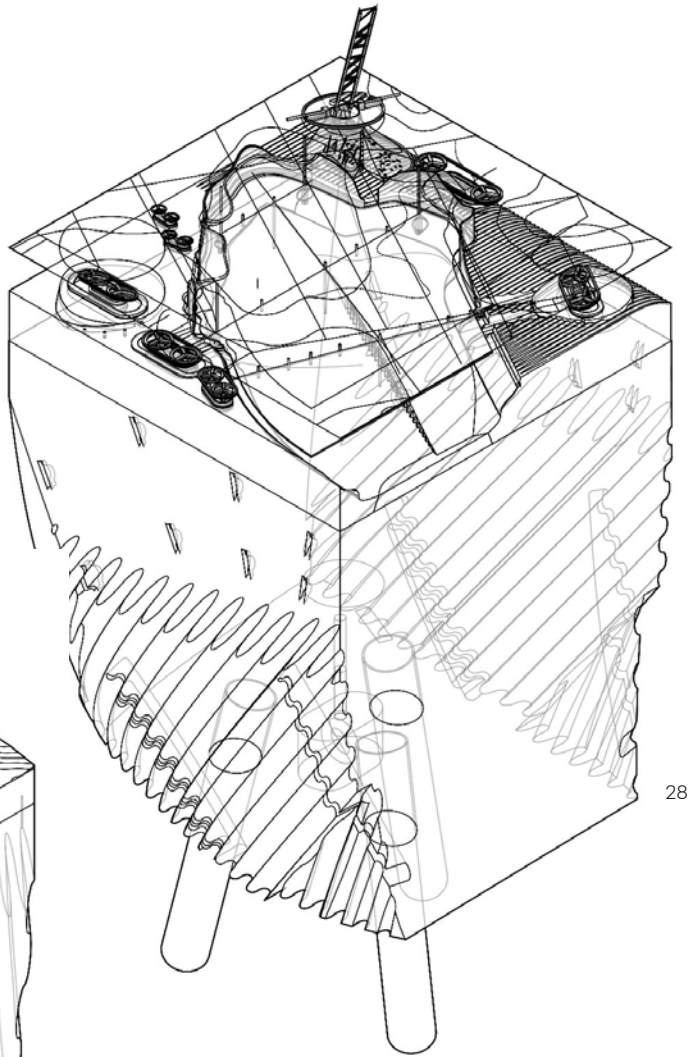

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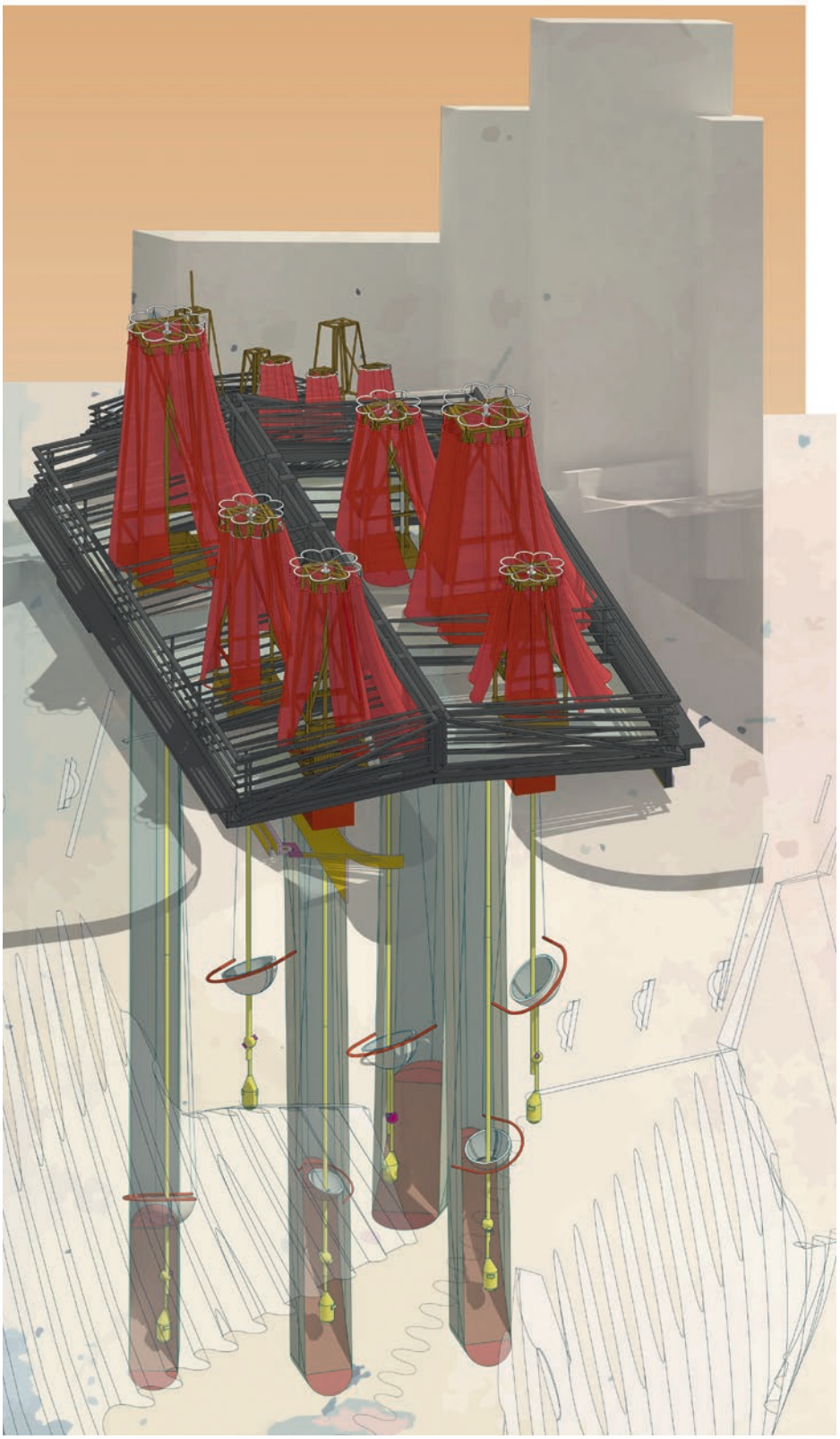
27 Line drawing of Slow Fountain model.

28 Line drawing of Earth Observatory model.



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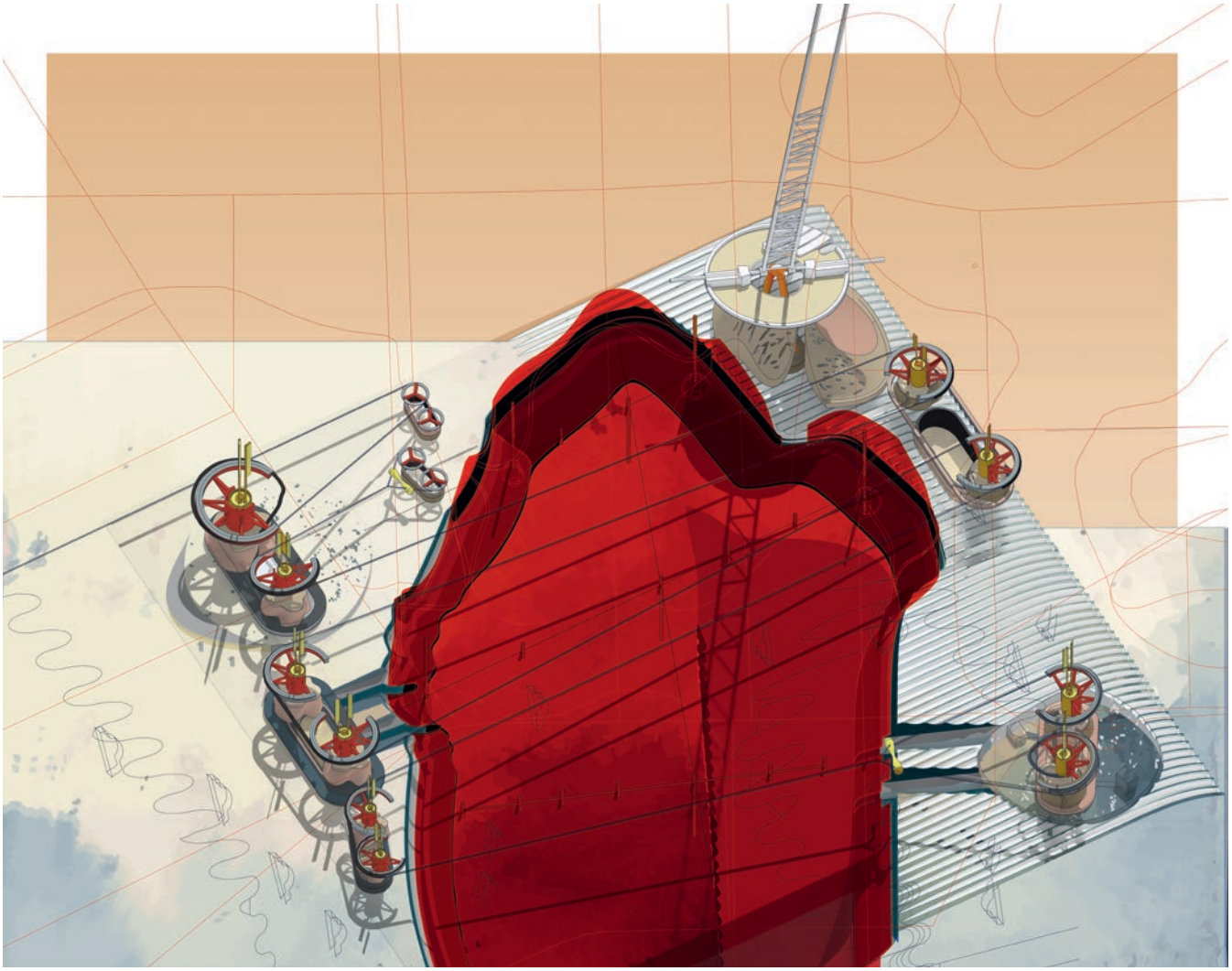
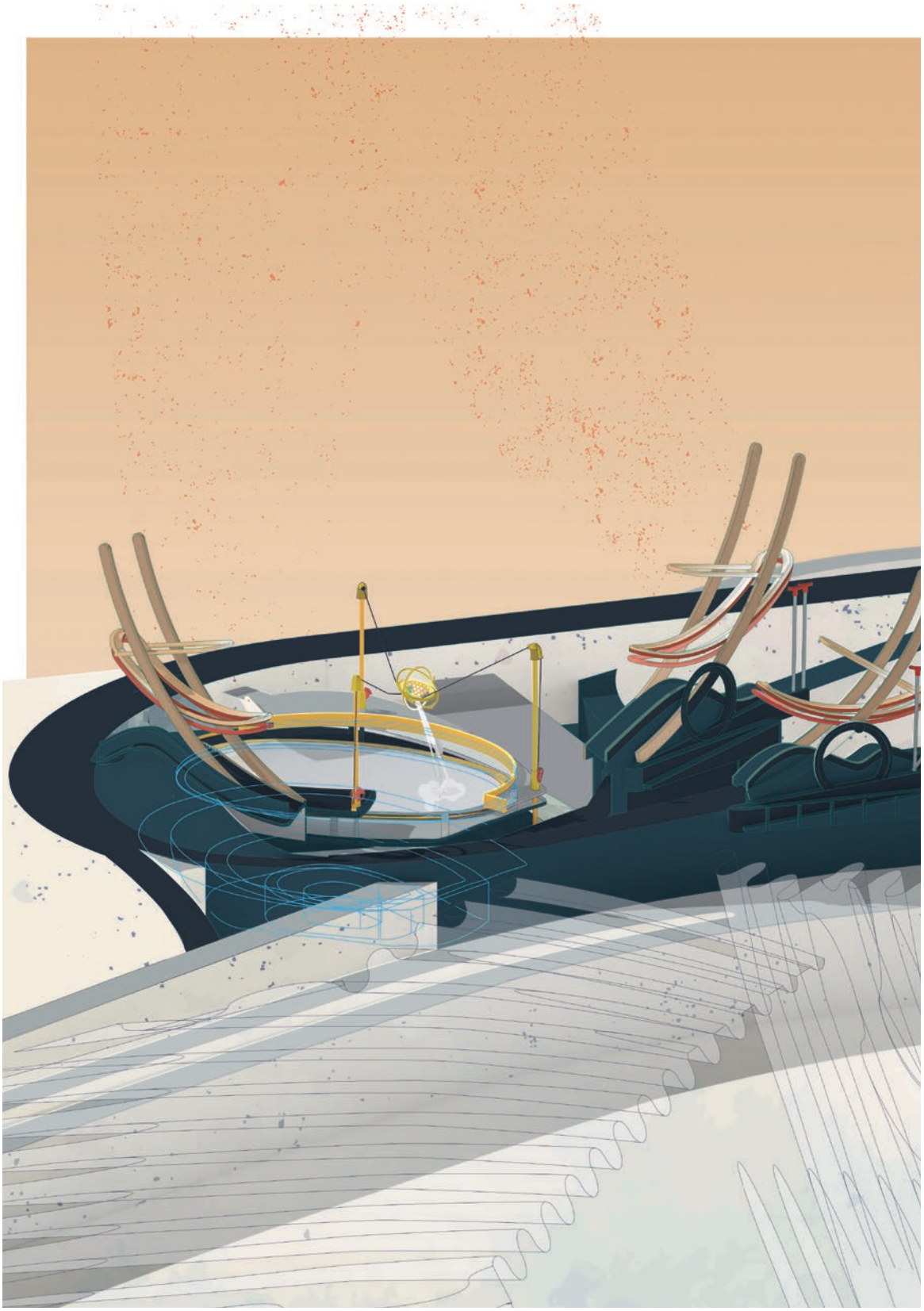


30

29 Drift City drawing, depicting a newly installed field of underground pendulums that protect the city's infrastructure from collapse.

30 Earth Observatory drawing depicting a vast instrument, constructed from ropes and cables, buried beneath the city. The instrument reacts to and measures movement by tectonic plates, and is observed by a team of scientists stationed there.



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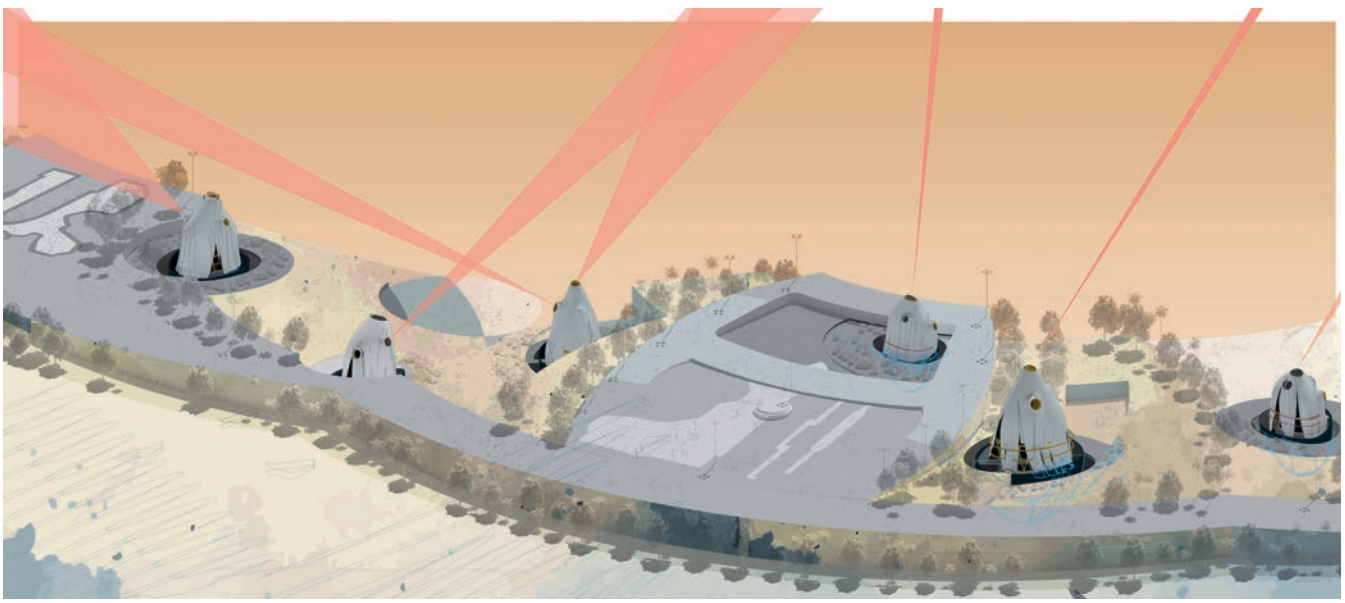
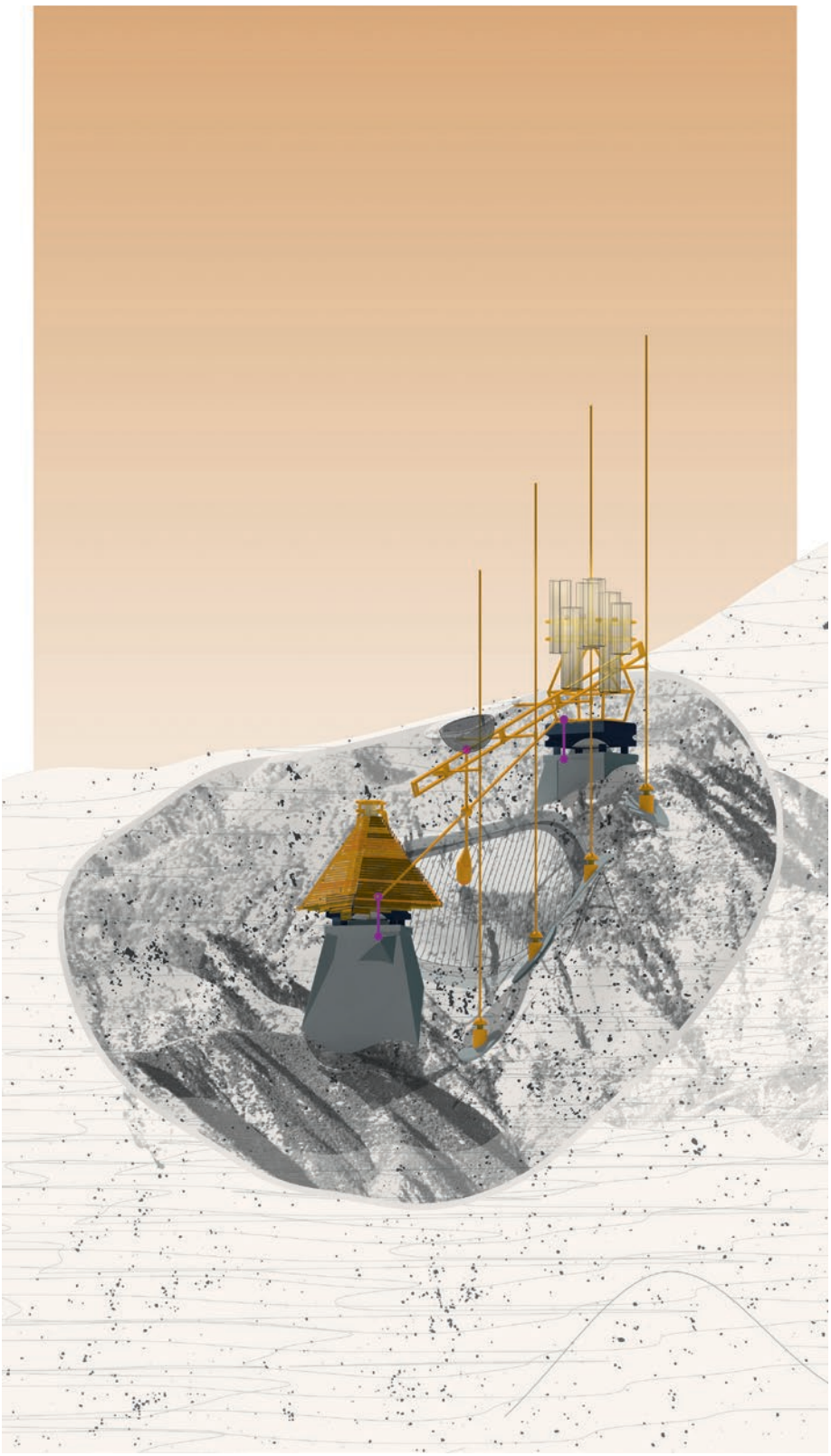


32

31 Freeway Astrolabe drawing. The city's widely maligned landscape of freeways and parking lots has been narratively reinvigorated with the installation of gates, frames and other architectural horizon lines, aligning the grain of the city with the solstices, stars and future constellations.

32 Tower of Stars and Memory drawing depicting planetariums that connect the city with no-longer visible stars. It also gives simulated views into the Earth's interior.



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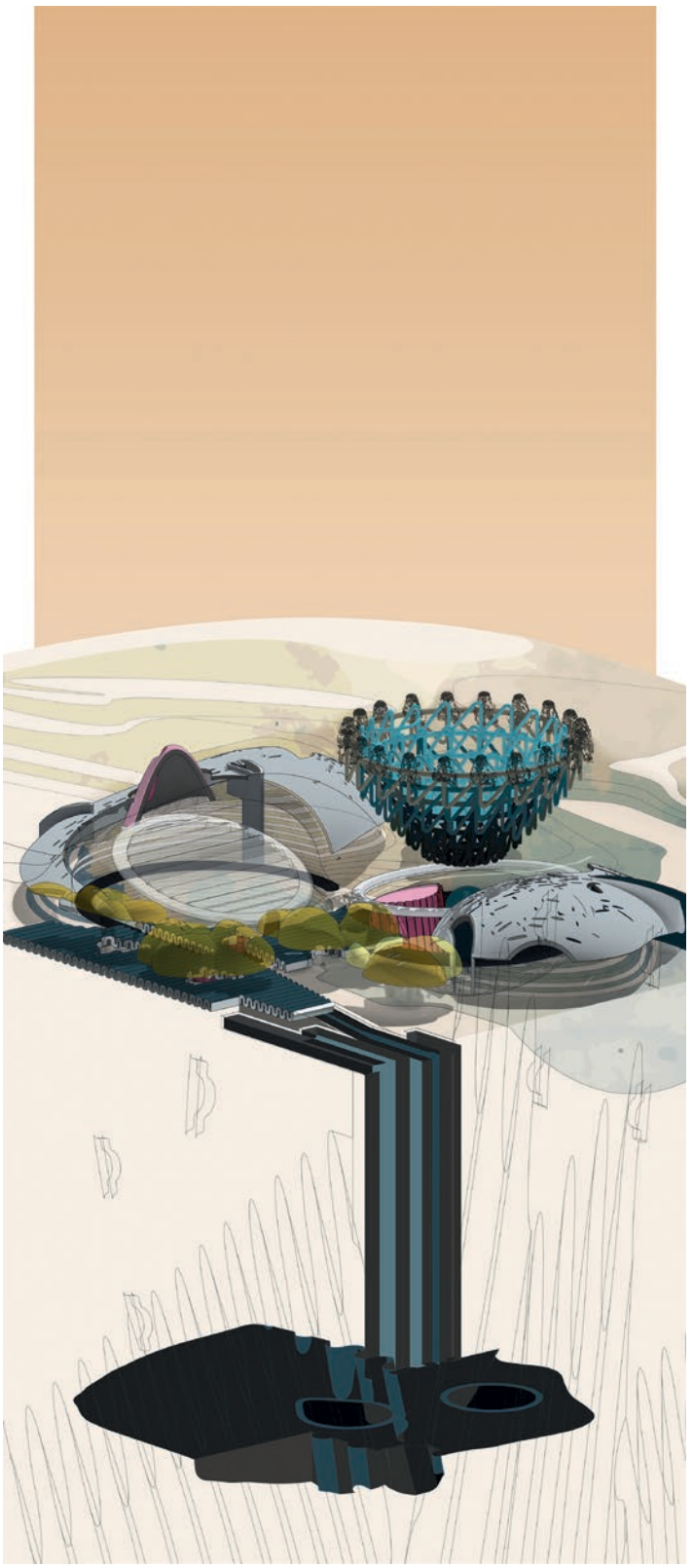
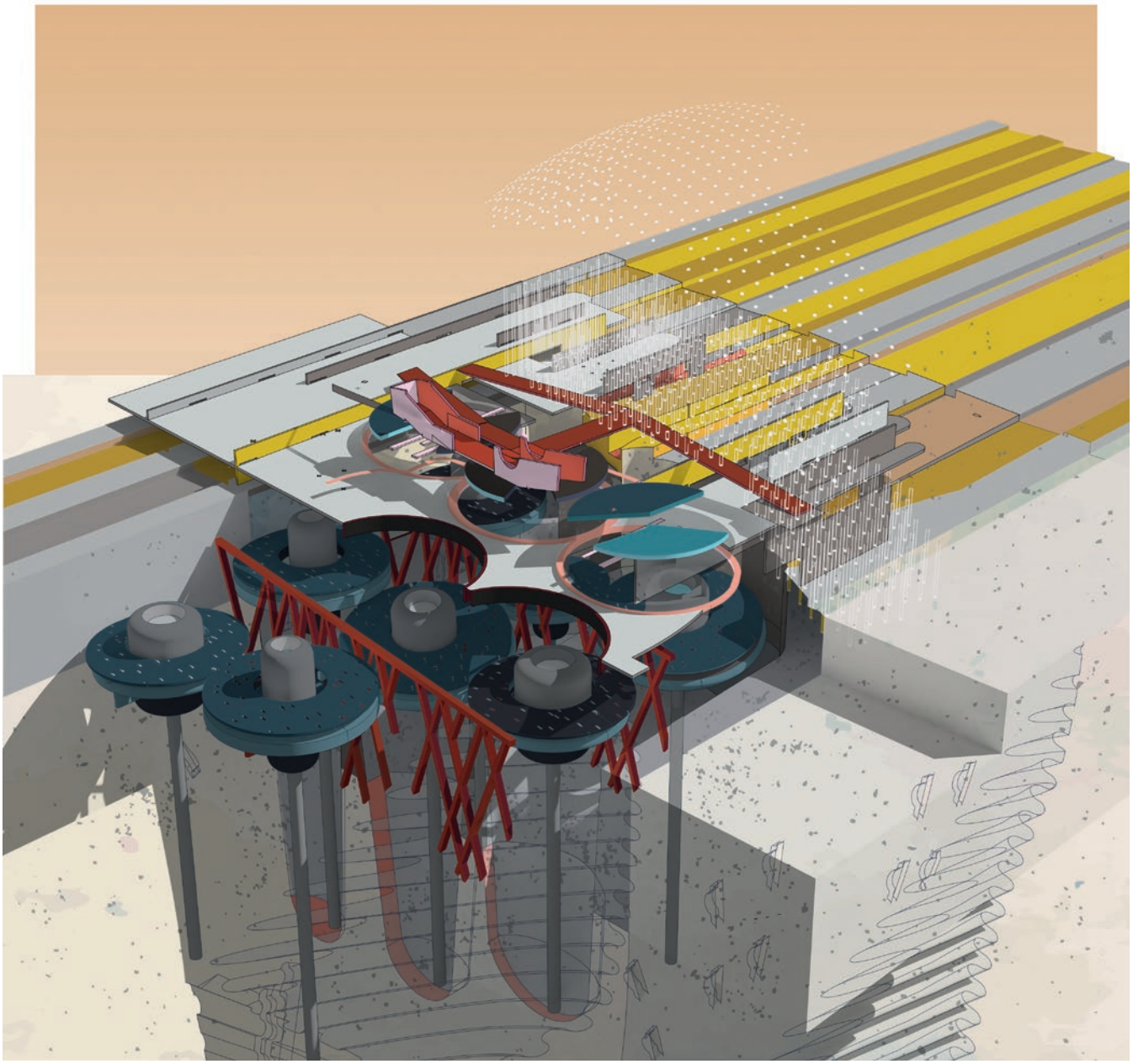


33 Crown of Mirrors.

34 Slow Fountain.



35

35 Fault Power.

Aims and Objectives

This research aims to explore how specific geological and historical events have and continue to influence LA's urban landscape. It sets out to examine:

1. Historical archival and cartographic materials to generate and share greater knowledge and understanding of geologically active landscapes and their impact on urban environments;

2. The design of technological and instrumental landscapes, responding to narrative concepts that investigate futures for the city's urban oil landscape;

3. The symbiotic relationship between the built and natural environment in the making of architectural scenarios.

Questions

1. How have LA's subterranean oil fields influenced its urban development from the late 1900s until today, and how have they informed new urban design approaches?

2. In what ways can architectural design and modelling integrate information and techniques from geomorphology, geology, seismography and astronomy? How can they best interpret and visualise complex subterranean conditions, such as fault paths and oil seeps, that can be useful for landscape and urban design disciplines?

3. In what ways can new infrastructures monitor the city's subterranean conditions? Can alternative infrastructural systems, such as battery powered alternatives to fossil fuels, constructively influence future urban development?

4. How can experimental architecture generate greater knowledge and contribute to current architectural practice? Imagining alternative and, in this case, more symbiotic ways of living or inhabiting the landscape.

Context

LA Futures researches LA's geological potential and its relationship with the urban landscape. It draws from work by the Centre for Land Use Interpretation (CLUI), a nonprofit organisation based in LA. CLUI have recorded how the landscape of LA is interwoven with the infrastructure of petrochemical extraction, exploiting the reserves of some of the most productive wells in history. Flows of methane and helium and sticky pavement stains contribute to the ad hoc petroleum landscape of spills, vents, gas detectors and methane alarms, which reveal the volatility of the earth below. Matthew Coolidge, CLUI's Director, leads tours of this dispersed network and writes 'the petroleum industry operates in the cracks, corners and edges, hidden behind fences, and camouflaged into architecture, literally pulling oil out from under the feet of the city's inhabitants' (Coolidge 2006) **(36–7)**.

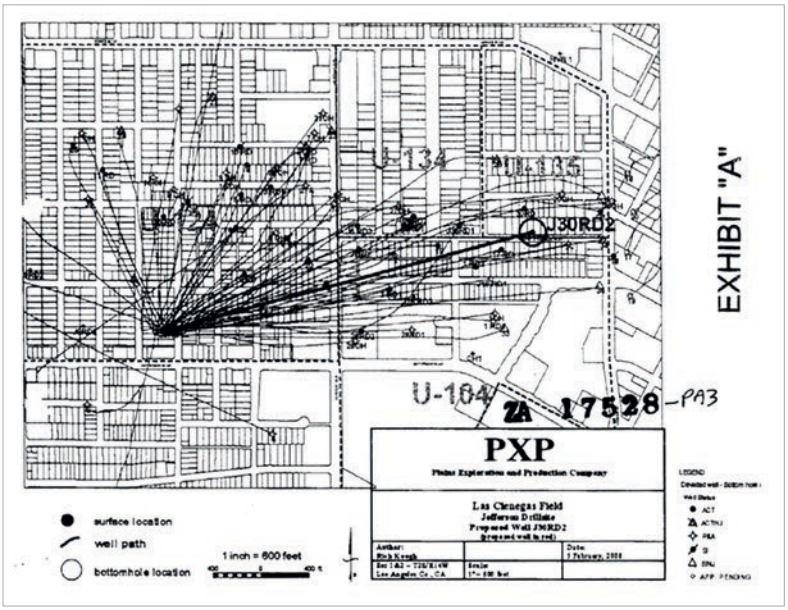
In exploring LA as a site of astronomical observation and scientific experimentation, this project responds to the work of physicist Albert A. Michelson who conducted a series of experiments in the 1920s to accurately measure the velocity of light in the mountains beyond the city. Sending pulses of light from Mount Wilson to Mount San Antonio, 22 miles east, Michelson measured the speed of the returning light reflected off an intricate apparatus of multifaceted revolving mirrors **(38)**. Crown of Mirrors attempts to materialise the instruments of scientific study at a building and urban scale.

LA Futures revisits two projects by architect Lebbeus Woods. Both projects present architecture as responsive to dynamic geomechanical forces and were instrumental in the design proposals, where architecture is similarly presented as dynamic and reactive to Earth's elemental forces. Firstly, Underground Berlin (1988) imagines a subterranean 'living laboratory' in which architecture is devised as an instrumental device:

> Tools for extending perceptivity to all scales of nature are built spontaneously, playfully, experimentally, continuously modified in home laboratories, in laboratories that are homes […] each object – chair, table, cloth, examining apparatus, structure – is an instrument; each material thing connects the inhabitants with events in the world around him and within himself (Woods 1992).

Inhabiting the Quake (1995), meanwhile, envisions a series of organic and responsive projects for San Francisco: Quake City, Slip House and Fault Houses explore the possibilities for an architecture that:

> In its conception, construction and inhabitation comes in to new and potentially creative relationships not only with the effects of earthquakes, but more critically with the wide nature of which they are a part (Woods 1997).



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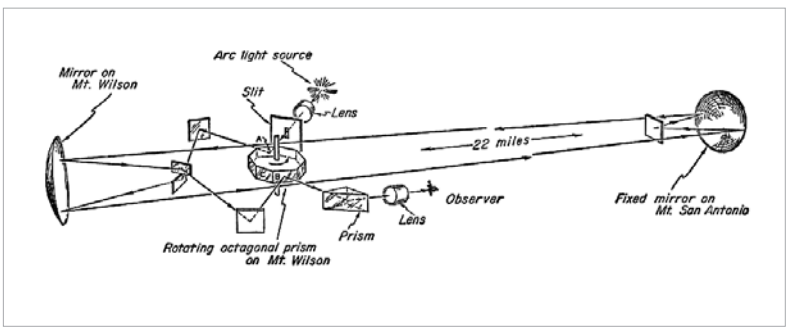

37

36 Map of the Las Cienagas Jefferson drill site, showing a web of at least 30 diagonal wells radiating out and under the local residential area, 2017.

37 Schematic by Albert A. Michelson of the Mount Wilson apparatus set-up, c.1920.

38 The Packard Well site disguised as an office building, however, aerial photos reveal oil derricks operating 51 wells that extend from a void behind its façade.


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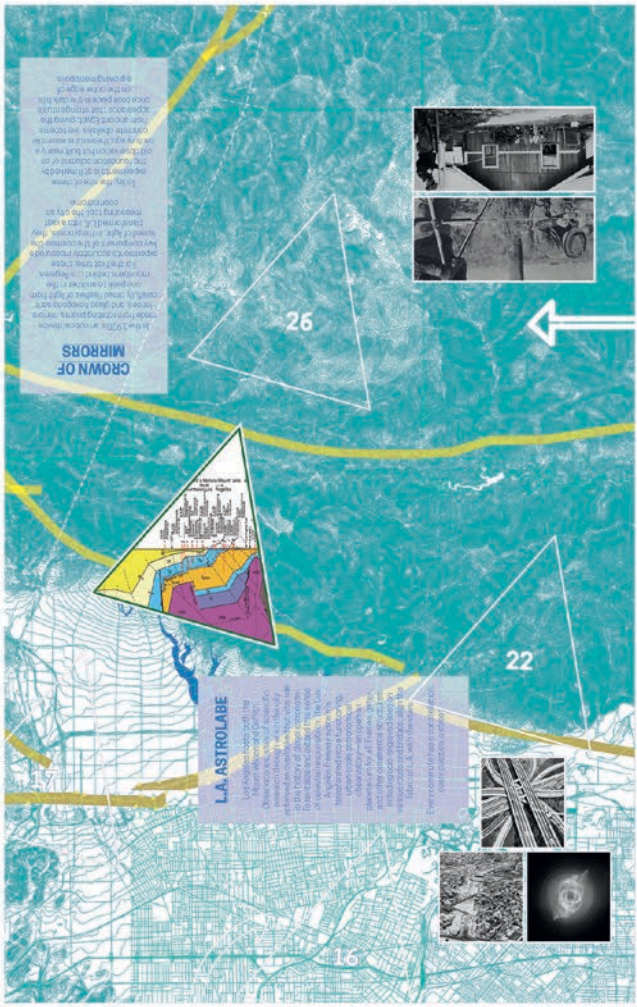
EARTH OBSERVATORY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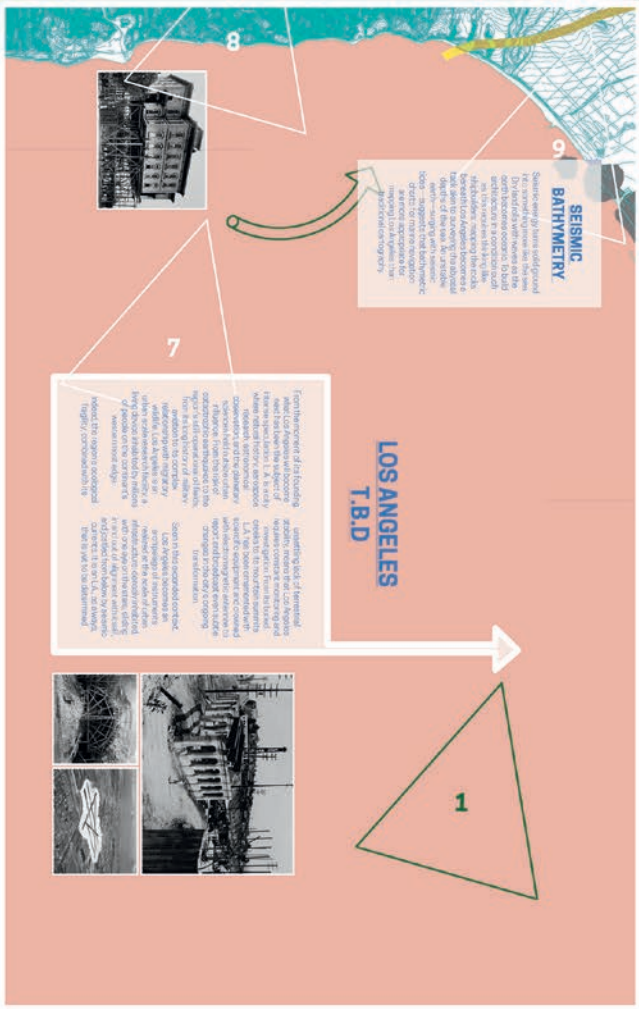
CROWN OF MIRRORS
L.A. ASTROLABE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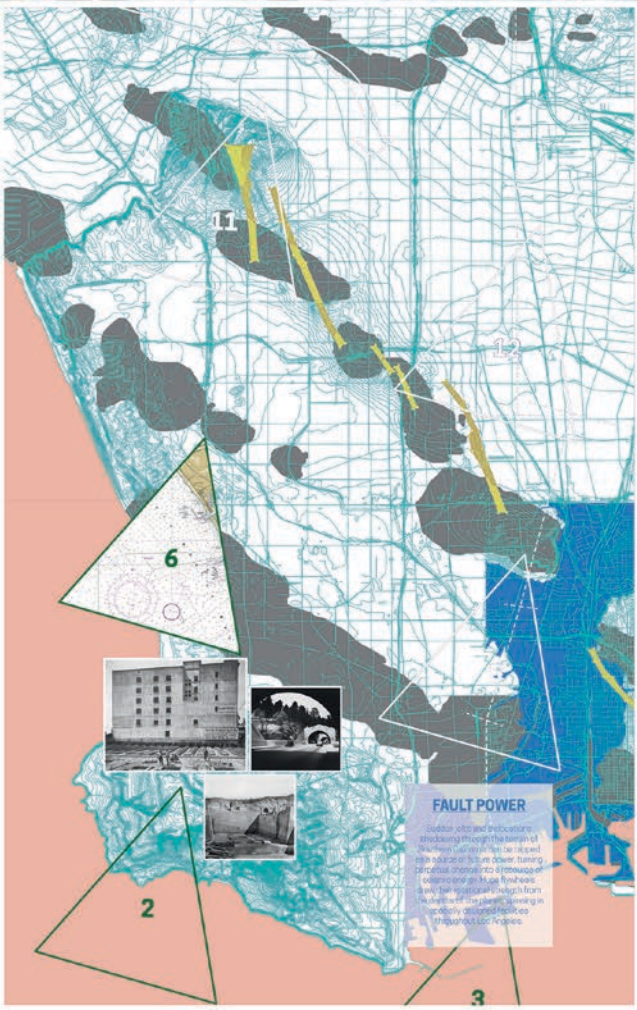
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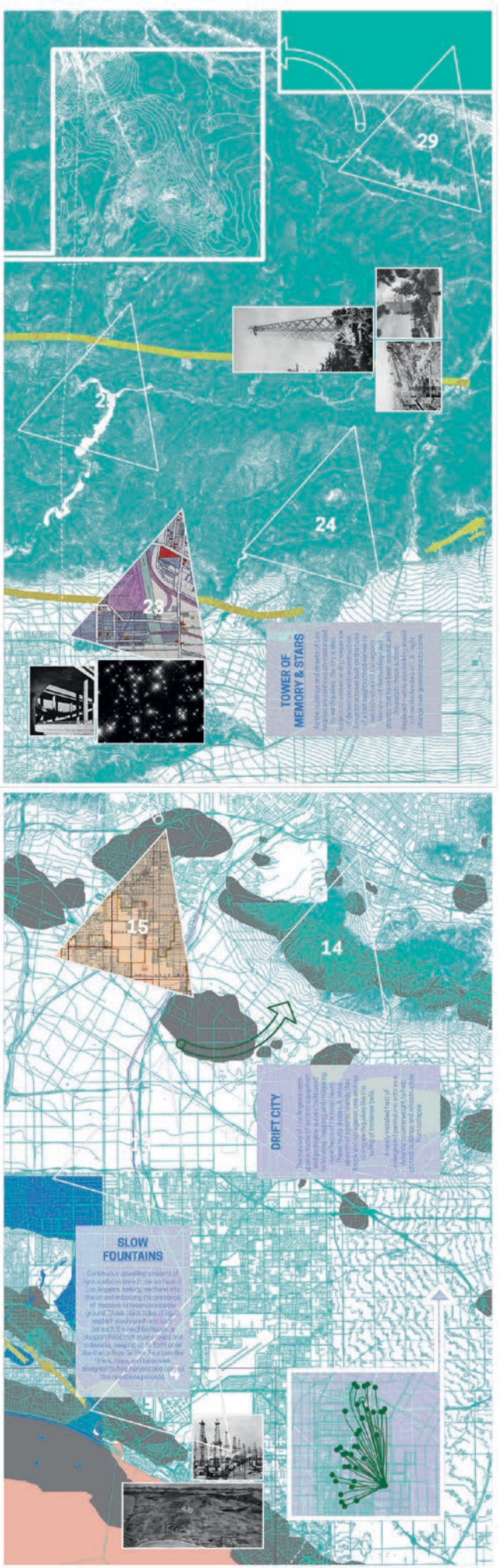
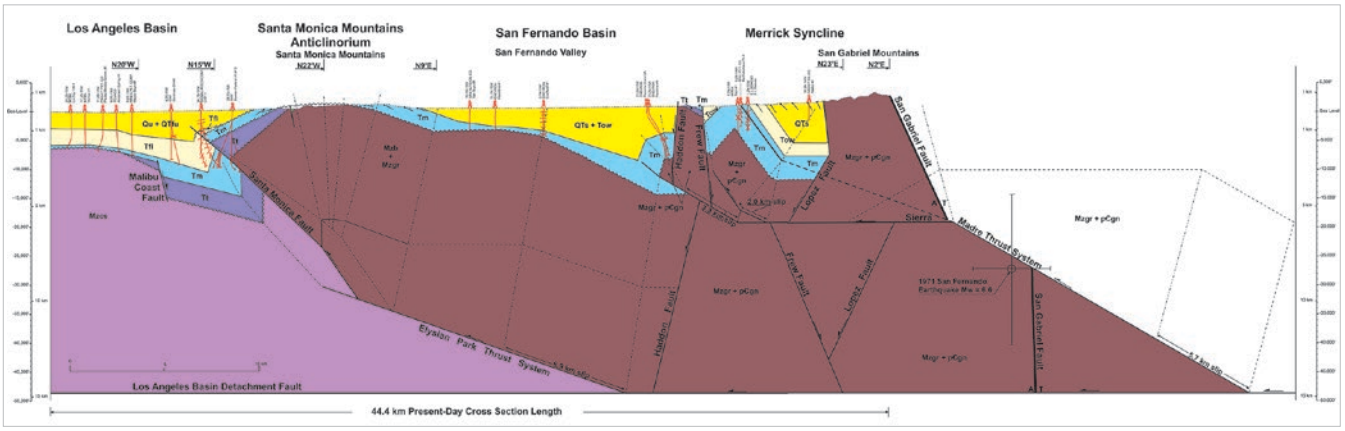
FAULT POWER



39 *#LATBD* map showing use of a gameboard graphic, featuring images from the USC Archive.



40

41

40 USGS Geological section no. 11, LA Basin to San Gabriel Mountains.

41 Earthquake Faults of California, 1980.

Methodology

Research began with scrutiny of photographic archival material, maps and geological data, as well as interviews conducted by Geoff Manaugh. The interviewees included: Lucy Jones, USGS Seismologist; Jeff Watson, USC Assistant Professor of Interactive Media and Games; Edwin C. Krupp, Director of the Griffith Observatory; Erik Davis, writer; Nathan Masters, historian; and John Carpenter, filmmaker. The interviews revealed concepts and opinions that were critical in imagining LA as a discontiguous ground or a liquid landscape, and were instrumental in our decision to conceive the projects as geographically independent architectures, anchored only to the influence of their geological or astronomical environment. Extracts from the interviews were incorporated into the material exhibited at USC. All material was critically interpreted to form the basis for an iterative design process that led to a set of architectural, urban and landscape proposals **(39)**.

1. Researching cartographic material

In order to understand the geography of LA, map analysis was undertaken, including the use of 1:24,000 quadrangle topographic maps, geological sections, Google Earth imagery, fault maps, oilfield and wellhead maps, bathymetric maps and the USGS interactive earthquake map. The data revealed the complex physical geography of LA and the forces of human inhabitation that leave marks and contend for space within the city's dense fabric **(40)**.

2. Researching material from the USC Libraries photographic archive

The USC Digital Library holds extensive historical archives of maps, land-use surveys, Works Progress Administration projects, photos, posters, audio and video recordings. A set of photographs, maps and postcards were selected that depict LA's infrastructural transformation. This included buildings that were moved or demolished in preparation for civic projects, the construction of the Dodger Stadium, the denaturing of the LA River with concrete embankments, tangled networks of freeways and the incision of tunnels. The selected material illustrates the accomplishments of the Mount Wilson Observatory and records the encroachment and subsequent retreat of the city's oil fields.

The process of terraforming – the regrading of contours and flattening of hills – is depicted in the selected imagery. Terraforming opens up the city to suburban sprawl and car culture, providing accessible land for housing speculations and faster road networks. It also eradicates above-ground indications of the natural topography and significant geological circumstances of the LA landscape **(41–8)**.

42

43

42 Aerial view of LAX, facing northeast, 1951. The picture has been edited to highlight the runway system. In the foreground are houses and fields; in the distance the city extends and tapers off towards a mountainous border.

43 Santa Monica Freeway under construction, looking east from Hoover Street, 1961.

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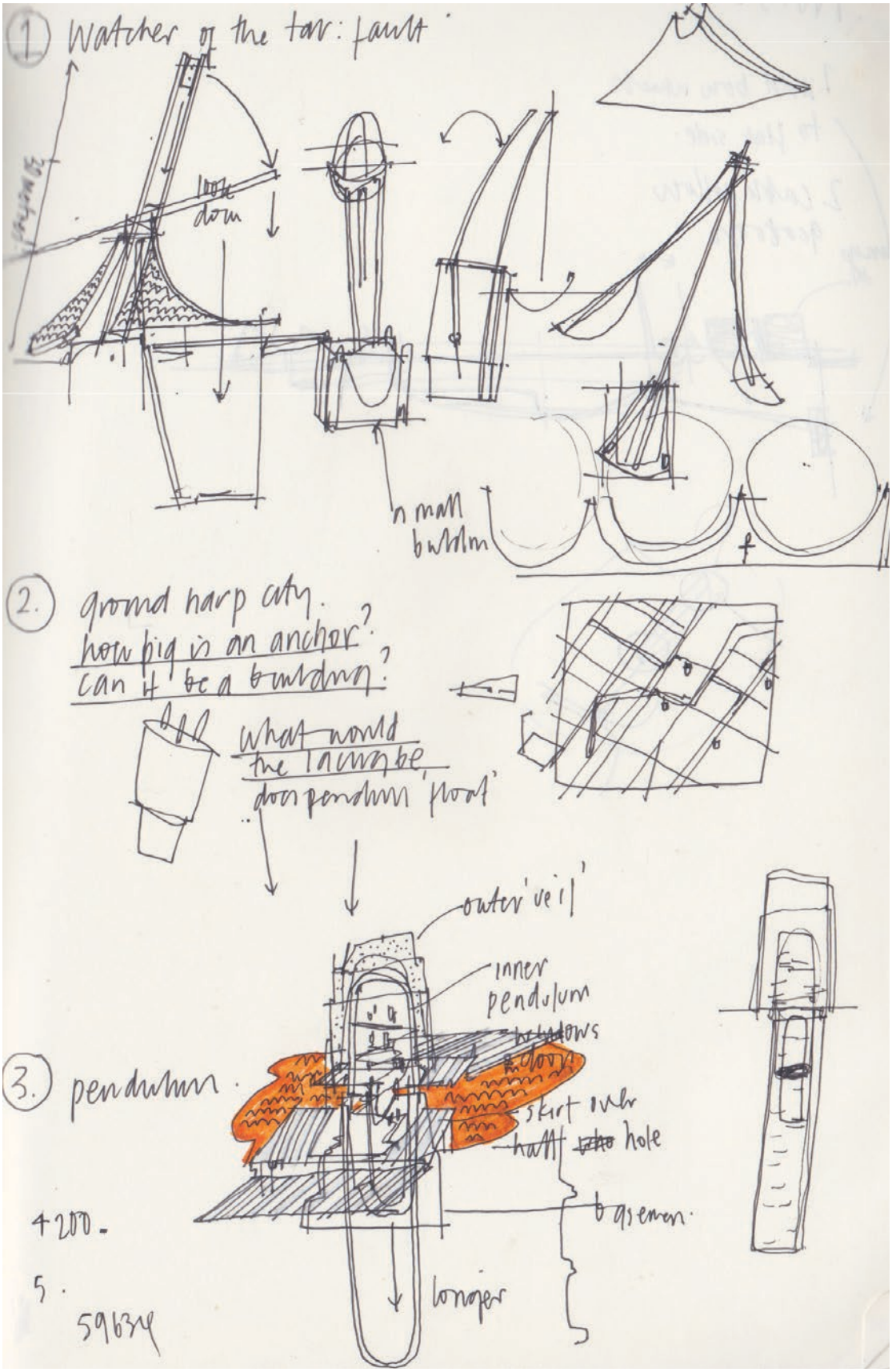
44 Construction of an unidentified bridge.

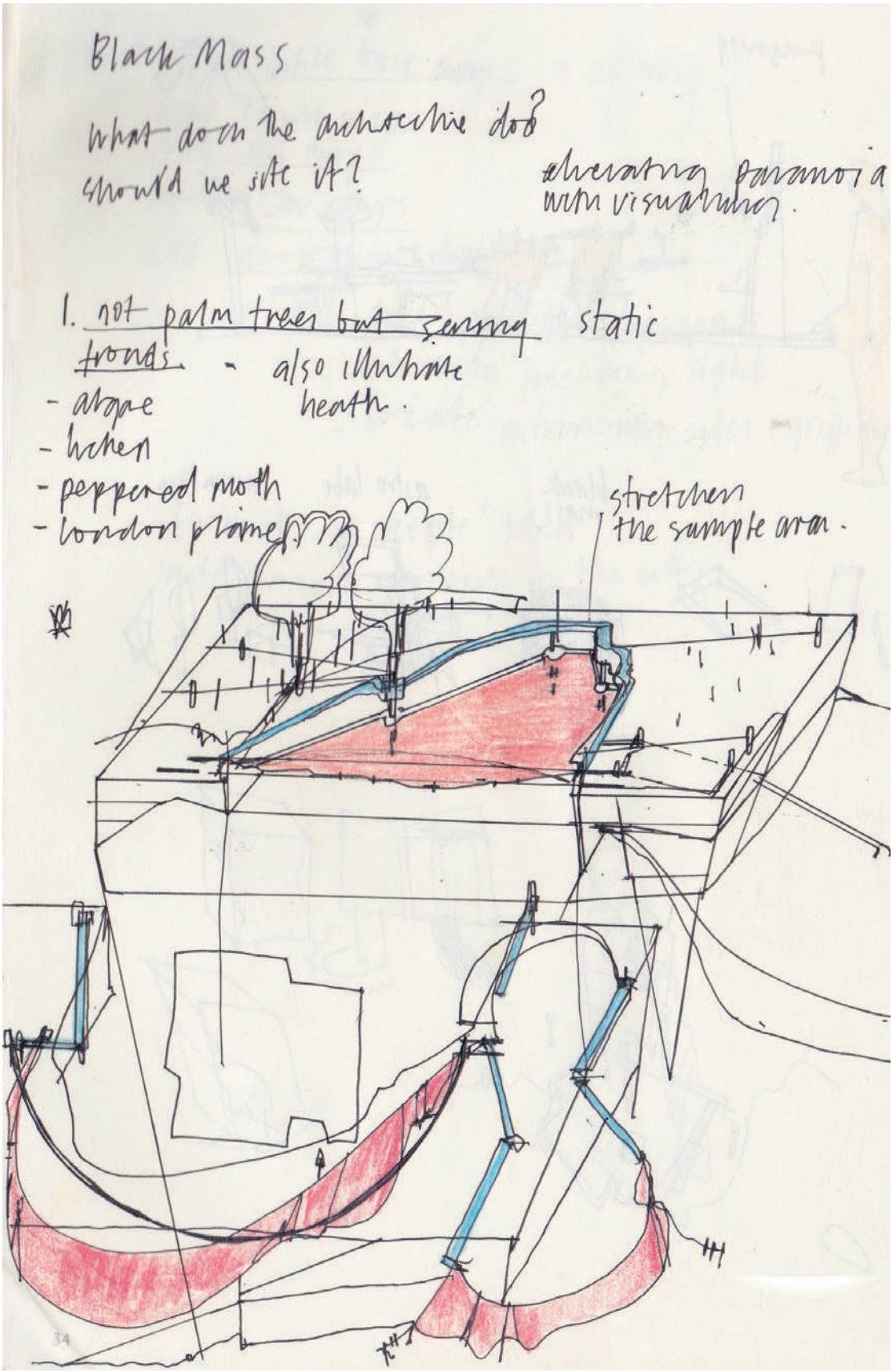
45 Exterior view of Mount Wilson Observatory in snow, c.1930s.

46 Fort Moore Hill High School being moved across Temple Street and Broadway, 1886.

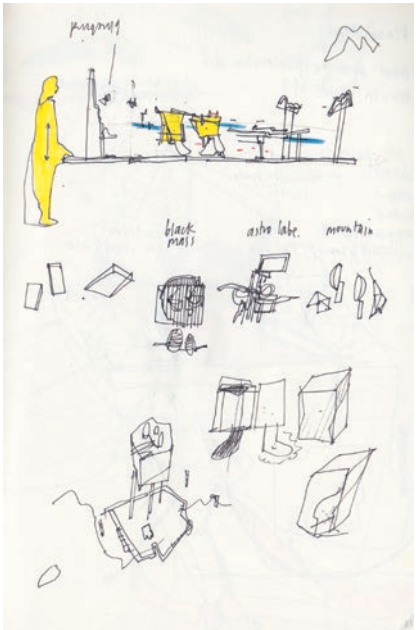
47 Chavez Ravine evictions, 1959.

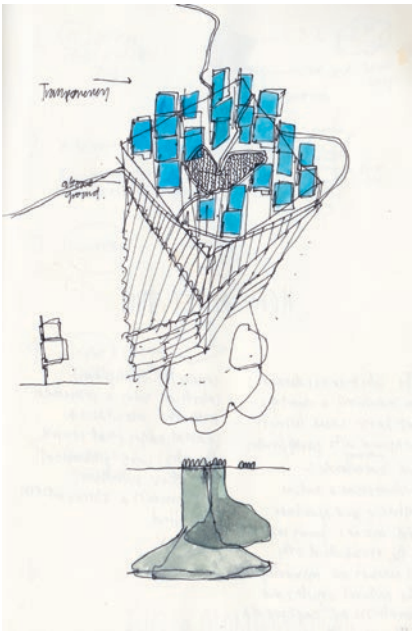
48 Griffith Observatory under construction, 1933.

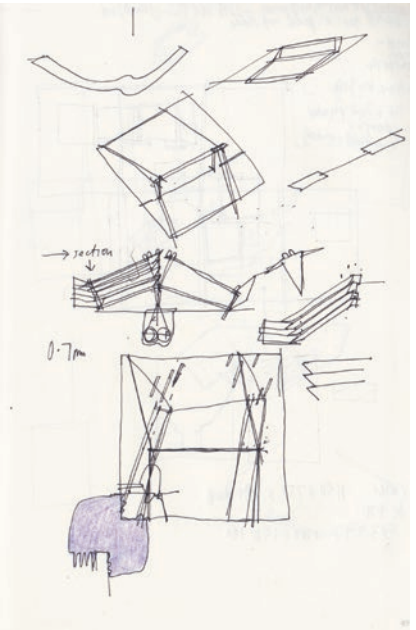

1. Watcher of the tar: fault
small building
2. ground harp city.
how big is an anchor?
can it be a building?
what would the tower be, drop pendulum 'roof'
3. pendulum
outer 'veil'
inner pendulum
skirt over
hole
basement
longer
+200-
5.
59634

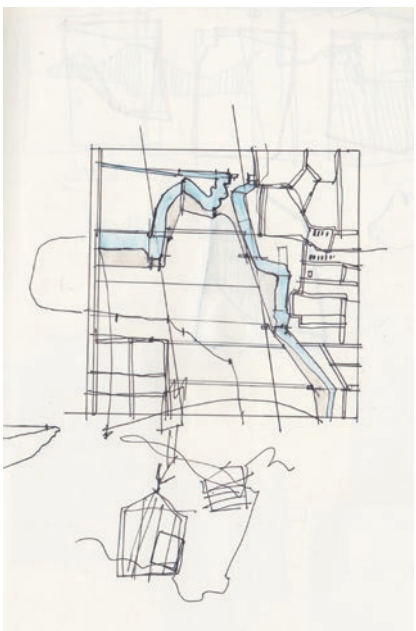

Black Mass
What does the architecture do?
should we site it?
alienating paranoia
with visualisation.
1. not palm trees but swaying fronds - also illustrate
static
heath.
- algae
- lichen
- peppered moth
- london plane
stretchers
the sample area.
34

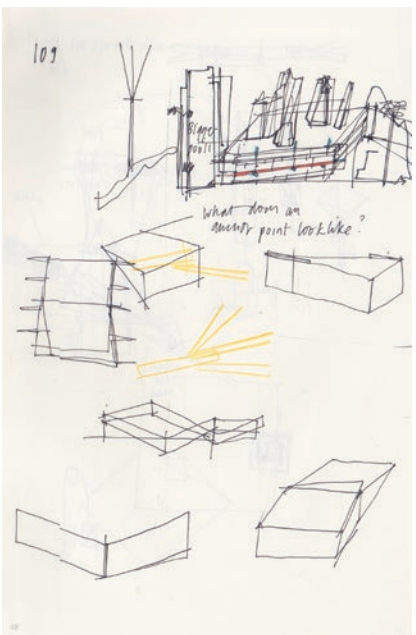
50

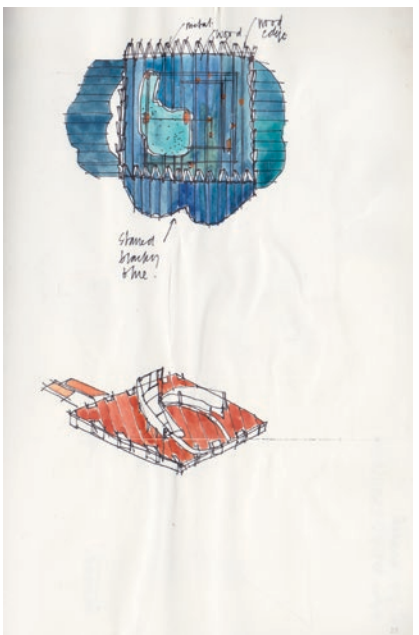












51

49–51 Development sketches.

3. Model design as a tool of research interpretation, proposition and communication

A series of models were devised to examine and communicate architectural, urban and landscape concepts for LA. The models are presented as independent dioramas, each atop an extracted geological core, which is represented by a deep wooden base. A range of analogue and digital processes were used, including sketching and developing, sketch modelling, digital modelling, CADCAM manufacturing and 3D printing **(59–61)**.

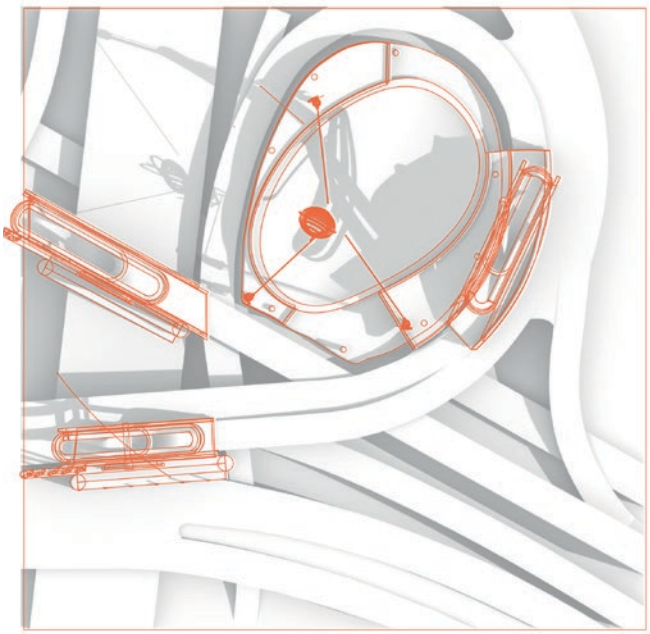
The models in this context take on numerous roles: they are a vital step in the creative process and in 3D thinking, enabling speculation on practical alternative designs; they are artefacts of the research and design process; and they make thinking visible. Via prototypes and maquettes – so-called 'study models' of yet-to-be-realised ideas – pragmatic concepts such as programmatic requirements, spatial relationships, proportion and material qualities are iterated. More significantly, however, the model allows for freedom of interpretation. As a reflective device for both the designer and viewer, the model is more than simply an interlocutor between the design and realisation of architecture, and most importantly for this research project, is 'a proposal for, and an abstraction of, the world' (Barikin 2013).

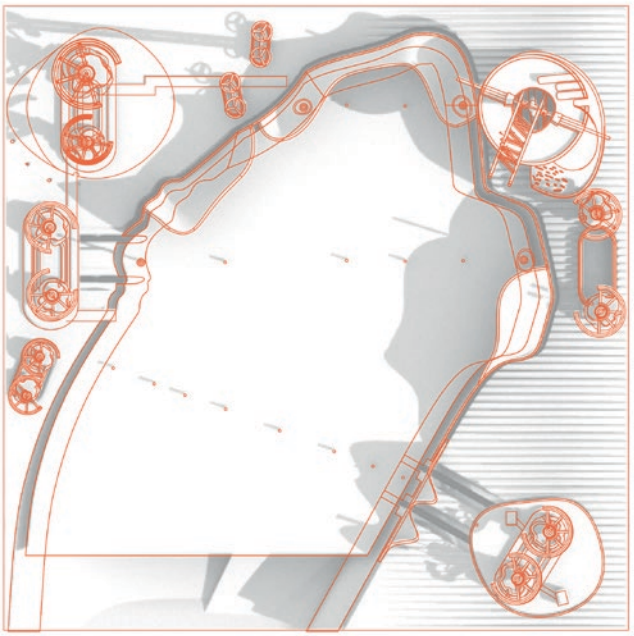
The making process

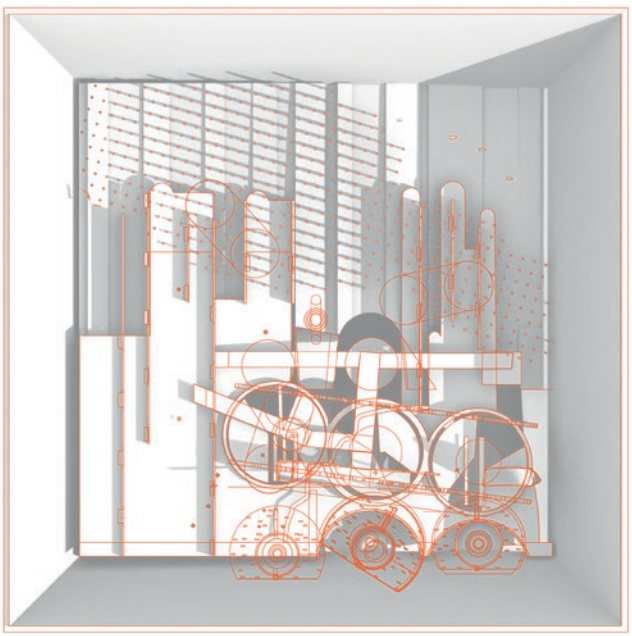
Design begins with sketches that establish links with site and context. As well as examining the communication of technical and cultural concepts, such as site, terrain, geological features, time and scale, these drawings provide the first stage in a design progression to measured drawings for digital-manufacturing processes.

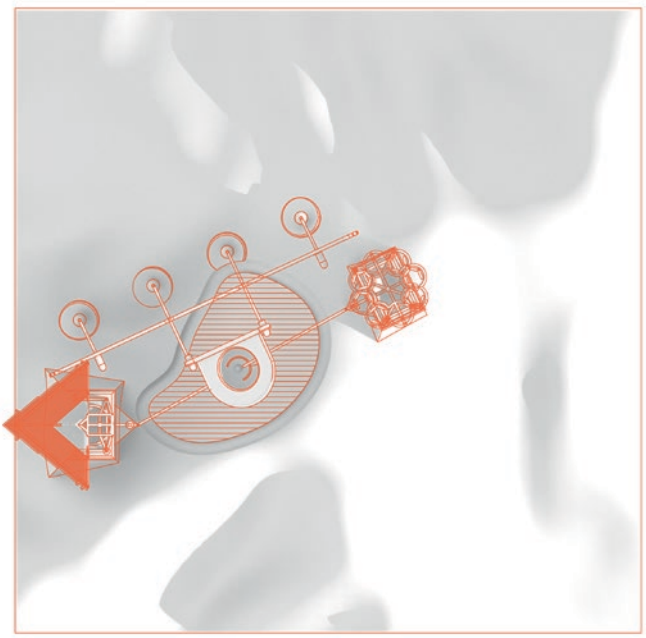
Hand drawings of seismic devices and civic installations are translated into digital 2D-drawing files, which in turn become 3D-data files **(51)**. Sectional drawings of geological strata indicating the relationship between geophysical features, such as faults, rock types and oil deposits, are extrapolated for eight significant cross-sections across the LA basin. The chosen sites and their interpreted geological strata are translated into a milling pattern for the five sides of each timber model base **(53–4)**. The timber for the models was chosen as it has a soft, fine and even grain, and has been used for intricate carving for thousands of years.

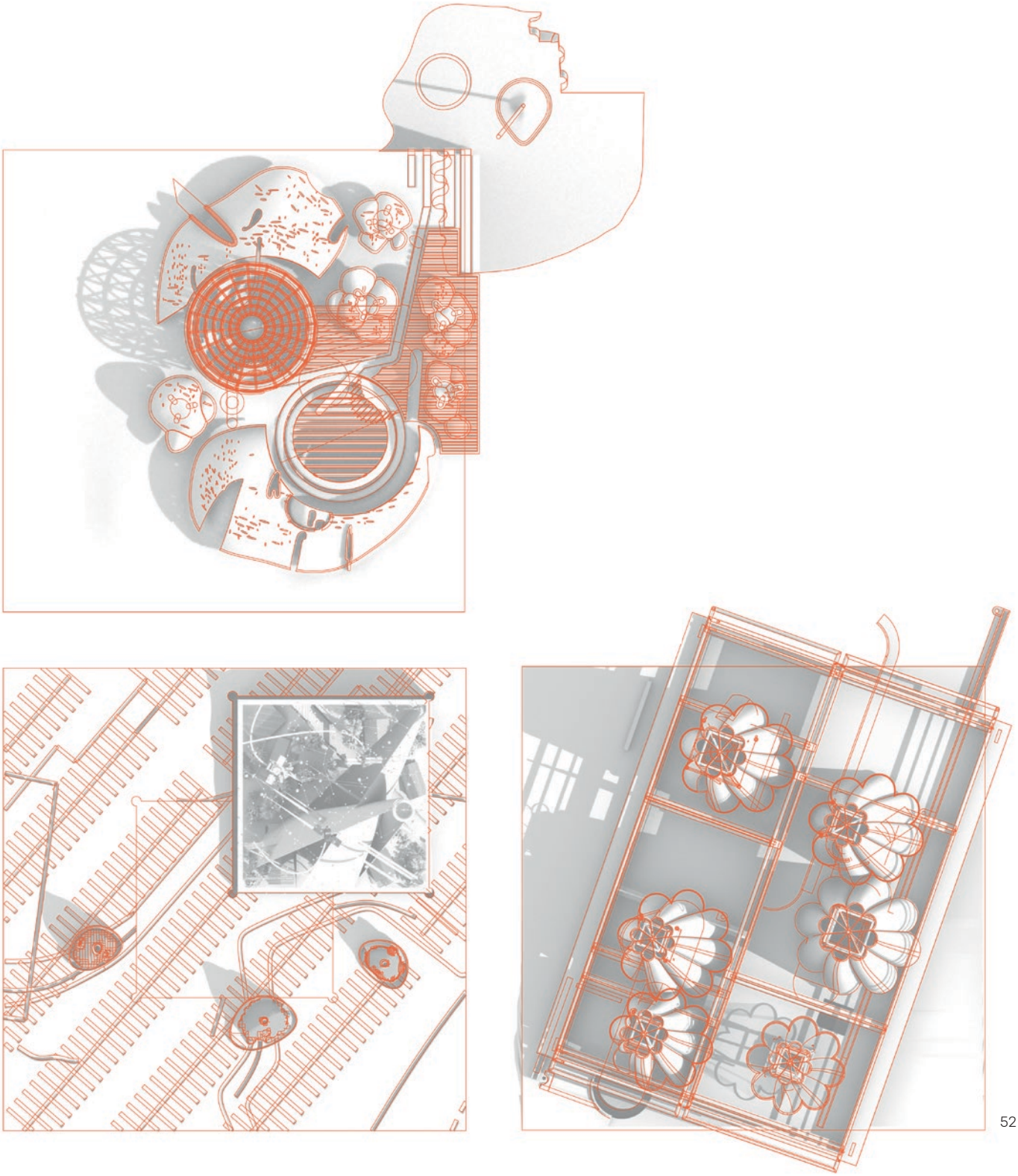
Each model base, measuring 400 × 280 × 280 mm, is topped with blue high-density polyurethane model 'foundry' board, which is finely milled by a six-axis robot into complex forms. This represents the local site context and immediate footprint of each proposal **(55–8)**. The remaining elements are modelled from a mix of 3D printing and traditional analogue-modelling techniques.





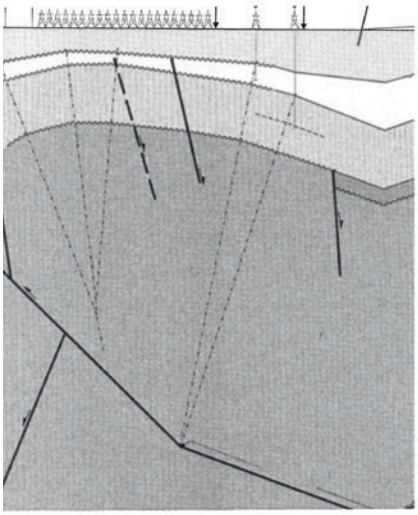


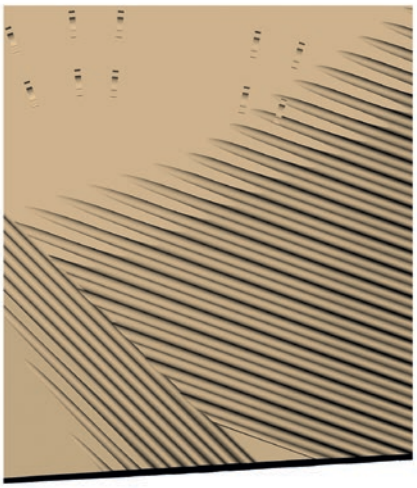




52

52 *#LATBD* model plans.





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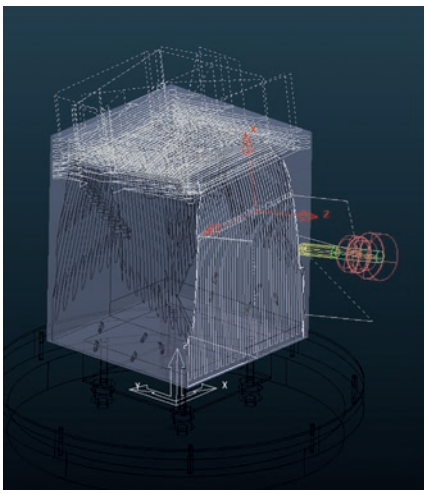

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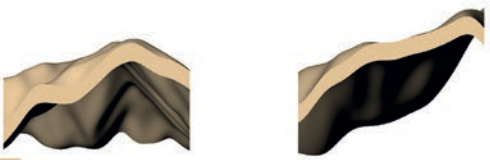
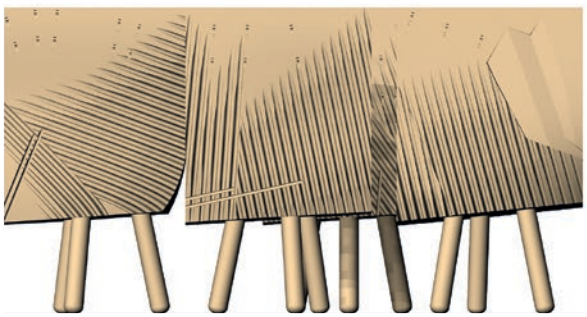
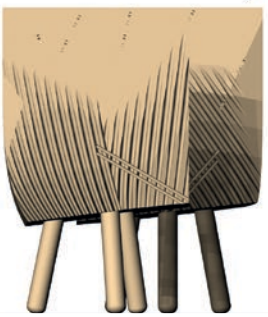




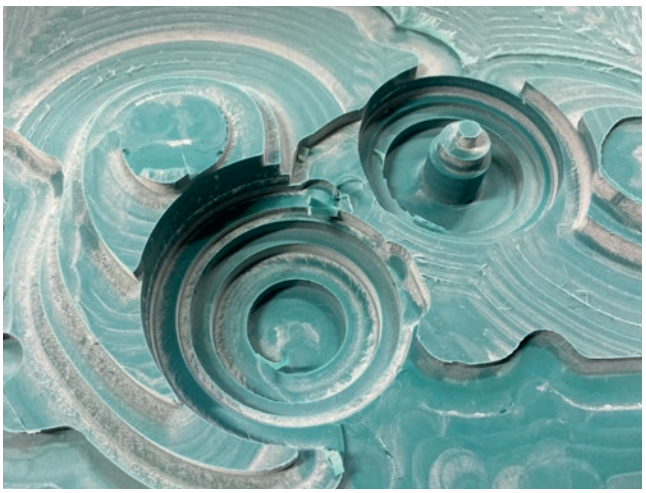


55

53 Extracted geological section (left) translated into a milling pattern (right).

54 Milling tool paths are arranged to be sympathetic to the timber grain so that they contribute to the demonstration of geological terrain.

55 Digital image of model bases in elevation, showing the sequence of combined milled patterns and demonstrating the geological terrain.



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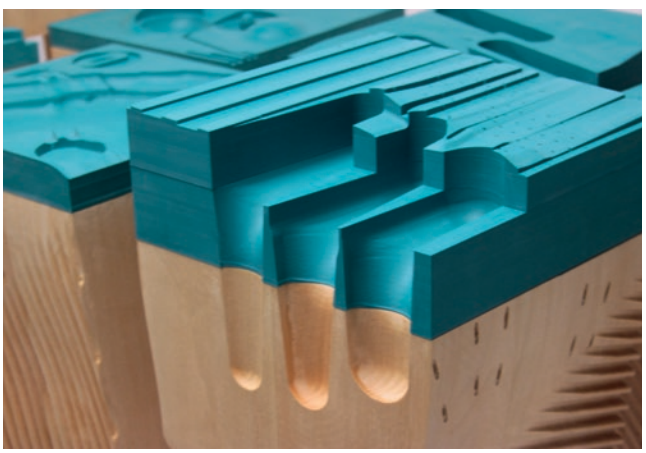


57

59

56 Polyurethane model board during the milling process.

57 Layering of modelling materials: blue model board on robot-milled lime base.

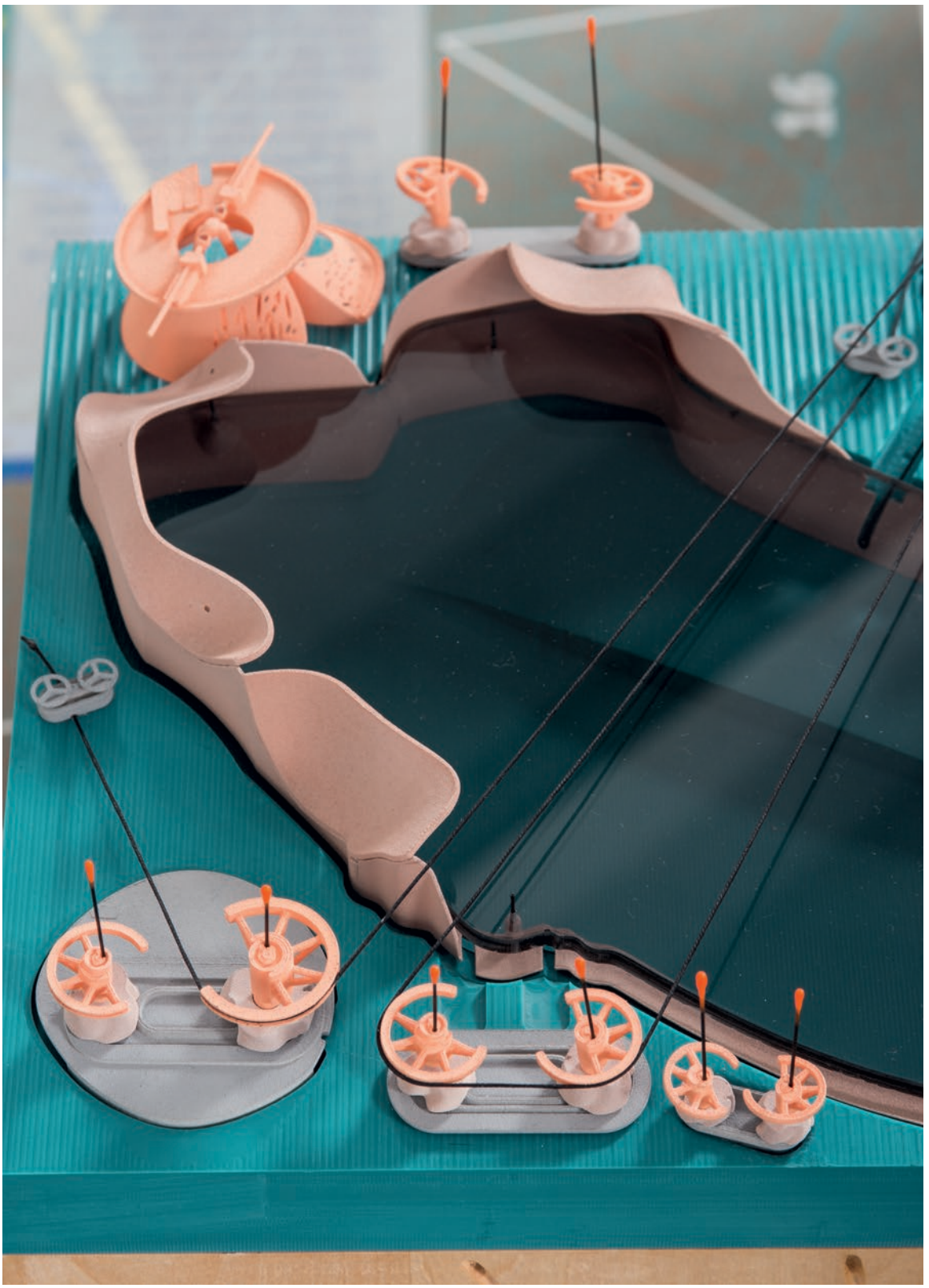
58 Each base was hand finished and oiled. The natural grain of the wood contributes to the machine marks and demonstrates the geology of the model landscape.

59 Each design is digitally modelled to enable the production of 3D-printed elements. These are composed in a process similar to kit modelling, and are dyed and augmented with hand-modelled brass and plastic components.

60

60 Drift City (foreground) and Slow Fountain (background), depicting layering of materials, including lime-wood blocks, milled model board and 3D-printed architectural models.

61 Earth Observatory final model proposal. 3D-printed components are set into a base of Perspex and milled model board.



61

Dissemination

LA Futures has been shown at a number of exhibitions in the UK and internationally, in full or partial form:

- *LA Recalculated* (extract, drawing), Roca London Gallery (2019–20)
- *LA Recalculated* (extract, drawing), Taubman College, University of Michigan, Ann Arbor (2018–9)
- *Summer Exhibition 2016*, Royal Academy of Arts, London (2016)
- *#LATBD,* Treasure Room, USC Libraries, Los Angeles (2015–6)
- *LA Recalculated,* The Chicago Architecture Biennial (2015–6)

The project was published in one article by the authors in the journal *Hidden* (2015). It has been extensively written about by Geoff Manaugh on his aclaimed blog *BLDGBLOG.*

It has been the subject of five invited talks in the US and UK:

- AIA Baltimore and Baltimore Architecture Foundation Spring Lecture Series (2016)
- Norwich School of Architecture (2016)
- Greenwich School of Architecture, London (2015)
- UC Berkeley, College of Environmental Design (2015)
- USC Libraries and the USC Sidney Harman Academy for Polymathic Study, Los Angeles (2015)

Project Highlights

LA Futures has been exhibited at important international venues with a wide intellectual reach, including The USC Doheny Memorial Library in LA **(62–3, 65–6)** and the Royal Academy of Arts in London. Smout Allen were chosen to participate in the inaugural Chicago Architecture Biennial in 2015, alongside over 100 practices from 30 countries. The Biennial is a major international architectural event and in its first year attracted more than 500,000 visitors **(64, 67)**.

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65

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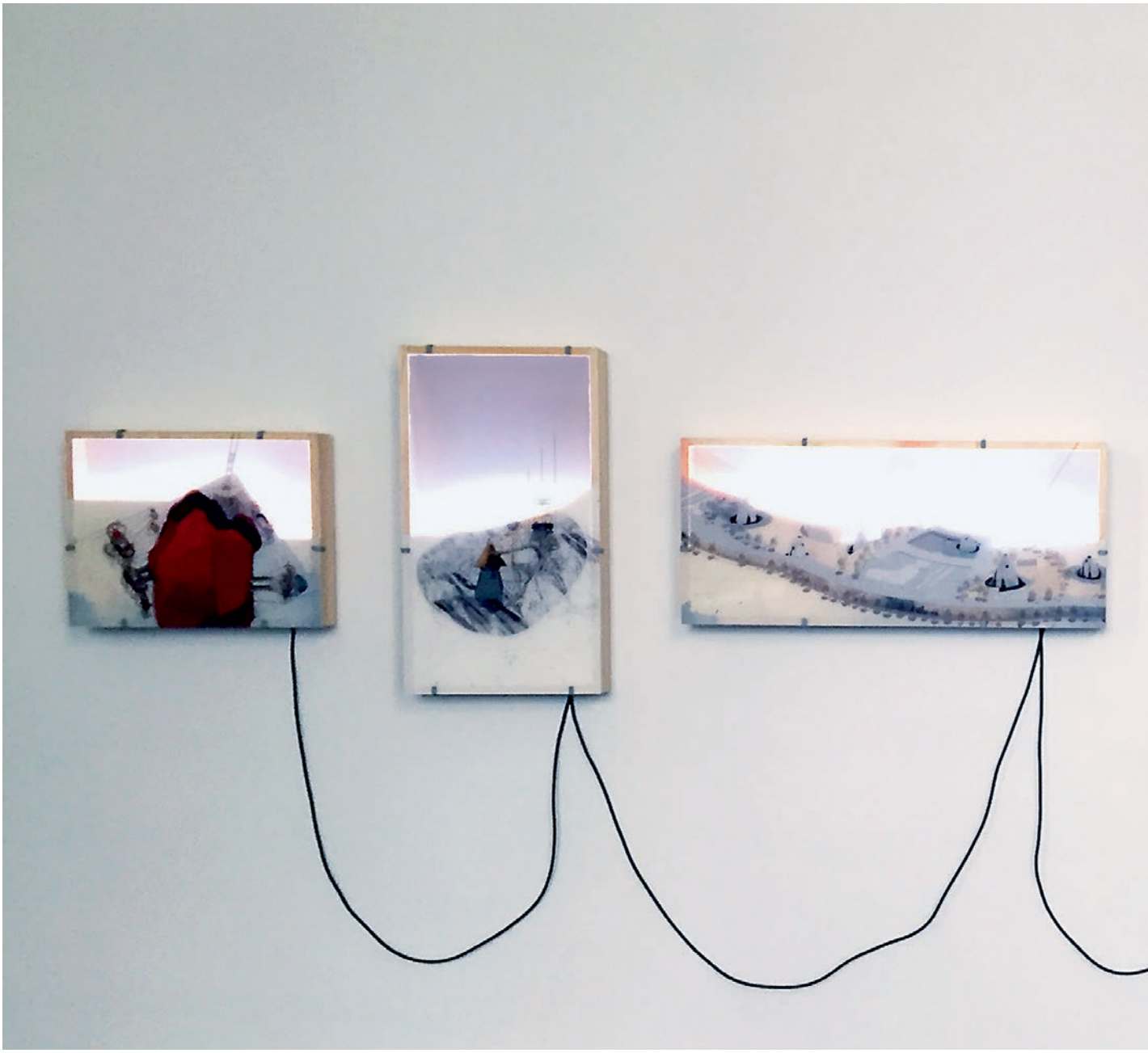
64

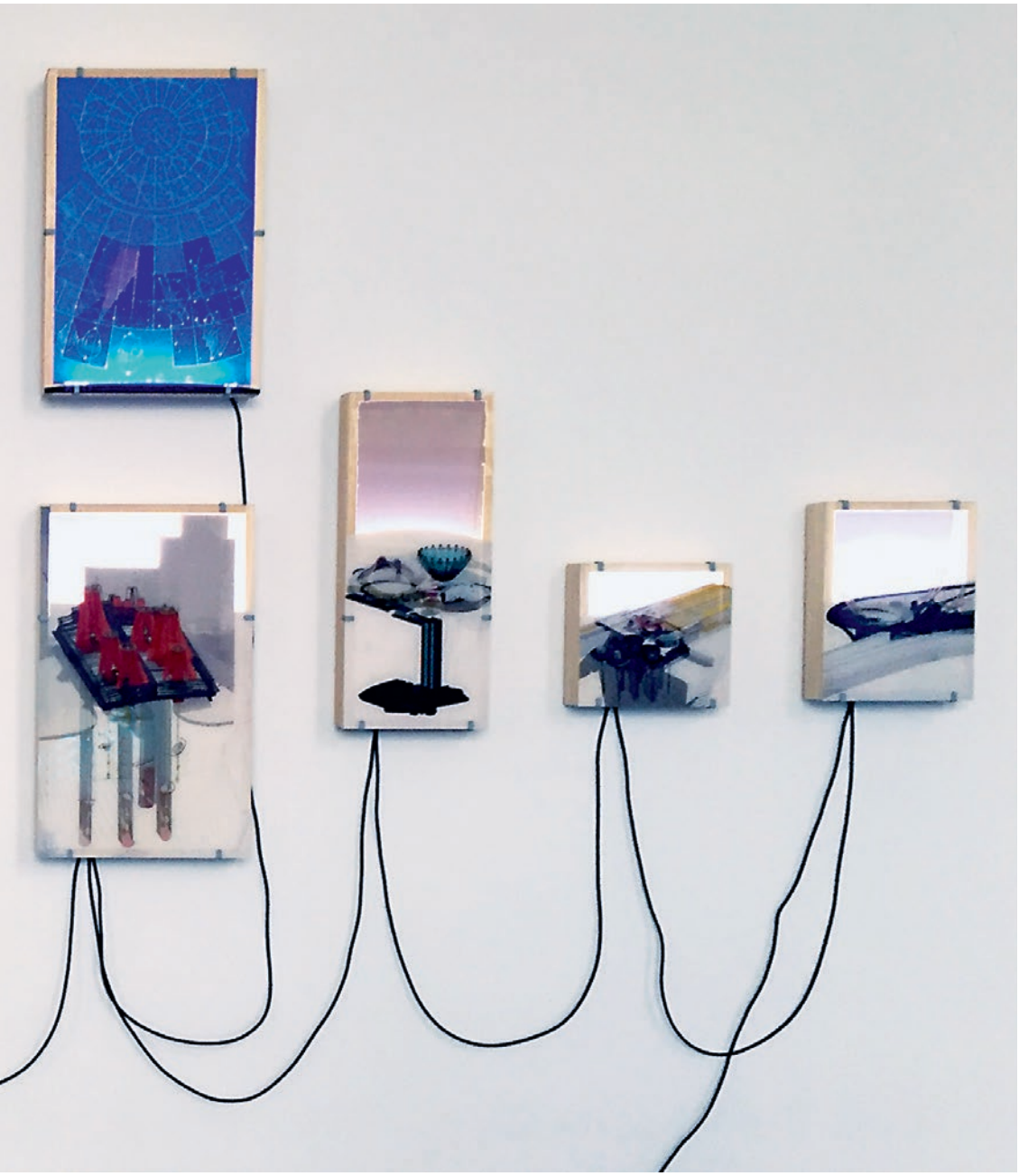
62–3 *#LATBD* exhibition.

64 Lightbox fabrication for *LA Recalculated*.

65 Visualisation of the *#LATBD* exhibit in the Doheny Library Treasure Room, USC.

66 *#LATBD* exhibition board game.





67

67 *LA Recalculated,* Chicago Architecture Biennial.

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Open Cinema
Colin Fournier, Marysia Lewandowska

The ActiveHouse
Stephen Gage

Déjà vu
Penelope Haralambidou

Urban Collage
Christine Hawley

Hakka Cultural Park
Christine Hawley, Abigail Ashton, Andrew Porter, Moyang Yang

House Refurbishment in Carmena
Izaskun Chinchilla Architects

Refurbishment of Garcimuñoz Castle
Izaskun Chinchilla Architects

Gorchakov's Wish
Kreider + O'Leary

Video Shakkei
Kreider + O'Leary

Megaframe
Dirk Krolikowski (Rogers Stirk Harbour + Partners)

Seasons Through the Looking Glass
CJ Lim

Agropolis
mam

Alga(e)zebo
mam

Chong Qing Nan Lu Towers
mam

ProtoRobotic FOAMing
mam, Grymsdyke Farm, REX|LAB

Banyoles Old Town Refurbishment
Miàs Architects

Torre Baró Apartment Building
Miàs Architects

Alzheimer's Respite Centre
Níall McLaughlin Architects

Bishop Edward King Chapel
Níall McLaughlin Architects

Block N15 Façade, Olympic Village
Níall McLaughlin Architects

Regeneration of Birzeit Historic Centre
Palestine Regeneration Team

PerFORM
Protoarchitecture Lab

55/02
sixteen*(makers)

Envirographic and Techno Natures
Smout Allen

Hydrological Infrastructures
Smout Allen

Lunar Wood
Smout Allen

Universal Tea Machine
Smout Allen

British Exploratory Land Archive
Smout Allen, Geoff Manaugh

101 Spinning Wardrobe
Storp Weber Architects

Blind Spot House
Storp Weber Architects

Green Belt Movement Teaching and Learning Pavilion
Patrick Weber

Modulating Light and Views
Patrick Weber