

高海岸： 走向雪的海拔经济

The High Coast:
Toward an Altitudinal Economy of Snow

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摘要 ……

作为地质圈和气象圈之间最直接的交接面，高海拔山区的“高海岸”拥有巨大、分散的，但却并未得到广泛认知的淡水“海洋”——积雪。在美国西部地区，80%以上的水源来自落基山脉、内华达山脉及其他山脉的融雪。因此，雪在很大程度上影响了区域性城市化过程中“地质技术”系统的形态。该系统中的基础设施性组成部分，包括从雪篱到森林格局的方方面面，反映出了特定的海拔和地形范围内当地经济和生态的情况。对这些组成部分的多样化整合需要一种跨越多个时空尺度的、既分散又系统化的积雪区域管理。在帕特里克·格迪斯、刘易斯·芒福德、本顿·迈克凯耶的研究的基础上，本研究通过重新审视“雪”并将其视为理论和物质的“地质技术”实践平台，进而为加利福尼亚州、内华达州和犹他州的一系列场地展开了一幅热动力环境的推测性图景，就高海岸“积雪急剧消融”的可能性与应用进行了探索。

关键词 ……

雪；岩土工程学；热力学；总体经济；远端城市化

Abstract ...

As avant-garde interface between geologic and meteorologic media, high-altitude montane and alpine zones constitute a "High Coast" delimiting a massive, diffuse, yet largely unrecognized freshwater "ocean": the snowpack. In the western United States, up to 80% of water resources draw from the snowpack of the Rockies, Sierra Nevadas, and other ranges; accordingly, snow has critically shaped geotechnical systems of regional urbanization, both up- and down-slope. The infrastructural components of such systems express the vernacular geographies of economy and ecology unique to each altitudinal and orographic (mountain) range, from snow-fences to forestry patterns. The highly varied coupling of components evidences decentralized yet systematic territorial management of snow across multiple spatio-temporal scales. Reimagining snow as theoretical and material ground for geotechnical praxis (following Patrick Geddes, Lewis Mumford, and Benton MacKaye), this project proposes a speculative thermodynamic narrative for a set of sites in California, Nevada, and Utah, exploring the potentials and implications of a "Big Melt" for the High Coast.

Key words ...

Snow; Geotechnics; Thermodynamics; General Economy; Remote Urbanization

山川之间最短的距离是从一个山峰到另一个山峰，但是你需要拥有一双长腿。

——弗里德里希·尼采，《查拉图斯特拉如是说》（1885）

……因为山脊线是新的边界…

——本顿·迈克凯耶，《新探索》（1928）

冬雪掩埋了一切人的踪迹。

——肯尼思·力士乐，《露营于西部山区》（公共事业振兴署未发表手稿，1939）

山，作为地质圈和气象圈之间脆弱的交接面，是决定山脚城市体系的海拔临界“前线”。虽然沿海和滨河景观是人类设计结果中的空间对象，对其设计结果的分析（包括不好的设计或者缺乏设计的情况所带来的后果）已经受到越来越多的关注，但我们在很大程度上仍然缺乏对总体地理范围和气候周期的认识。而山的水文气象活动以及地质活动密切地影响着总体地理范围和气候周期：小到地区范围内的雨影区，大到复杂的雨水径流模式，都与山的海拔以及走势息息相关。这些水文气象活动和地质活动反过来也影响了区域范

围内的资源开采、管理以及运输的地形^①基础设施，同时也决定了人类居住的空间格局和时间周期（由山峰到海岸、河流三角洲或河岸）。由于人们既没有对高海拔景观拥有足够的认知，又因为它们不属于通常的人类居住范围，所以高海拔景观很少走进人们的视野，在设计行业内也鲜少对其进行讨论——尽管近来出现了一股“地质”回潮。

在城市规划师的词典里，山，以及山上的水的主要存在形态（冰和雪）出现的贯通性或问题迫切性都远不如低地的水文景观系统，造成这一落差的原因并不是

简单的因为各派实践家和学者都对山、冰和雪兴趣索然。相反，高海拔冰冻圈——一种冰雪笼罩的世界——被亨利·列斐伏尔称作“盲域”^①。盲域本身就是一种临界空间，“存在于各种（知识）领域之间，充满了力量和冲突……盲域不单是黑暗的、带有不确定性的、尚未被充分探索的区域，盲域的‘盲’指的是视网膜上的盲点。”我们如果看到一些事——人口密集的沿海地区、热带风暴、潮水上涨——就会看不到另一些事：在人们眼中，雪既可能是一种城市中的障碍，也可能成为一种娱乐设施，但却很少被看作是水；山可以是一幅优美的风景，拥有或缓或险的地形，同时蕴藏矿物，但很少被理解为一个气候影响机制。当我们把都市主义和工业布局放在一起谈论，或是把城市的范围单纯地定义为城市及其腹地地区时，我们忽视了那些远离城市的、极端的、转瞬即逝

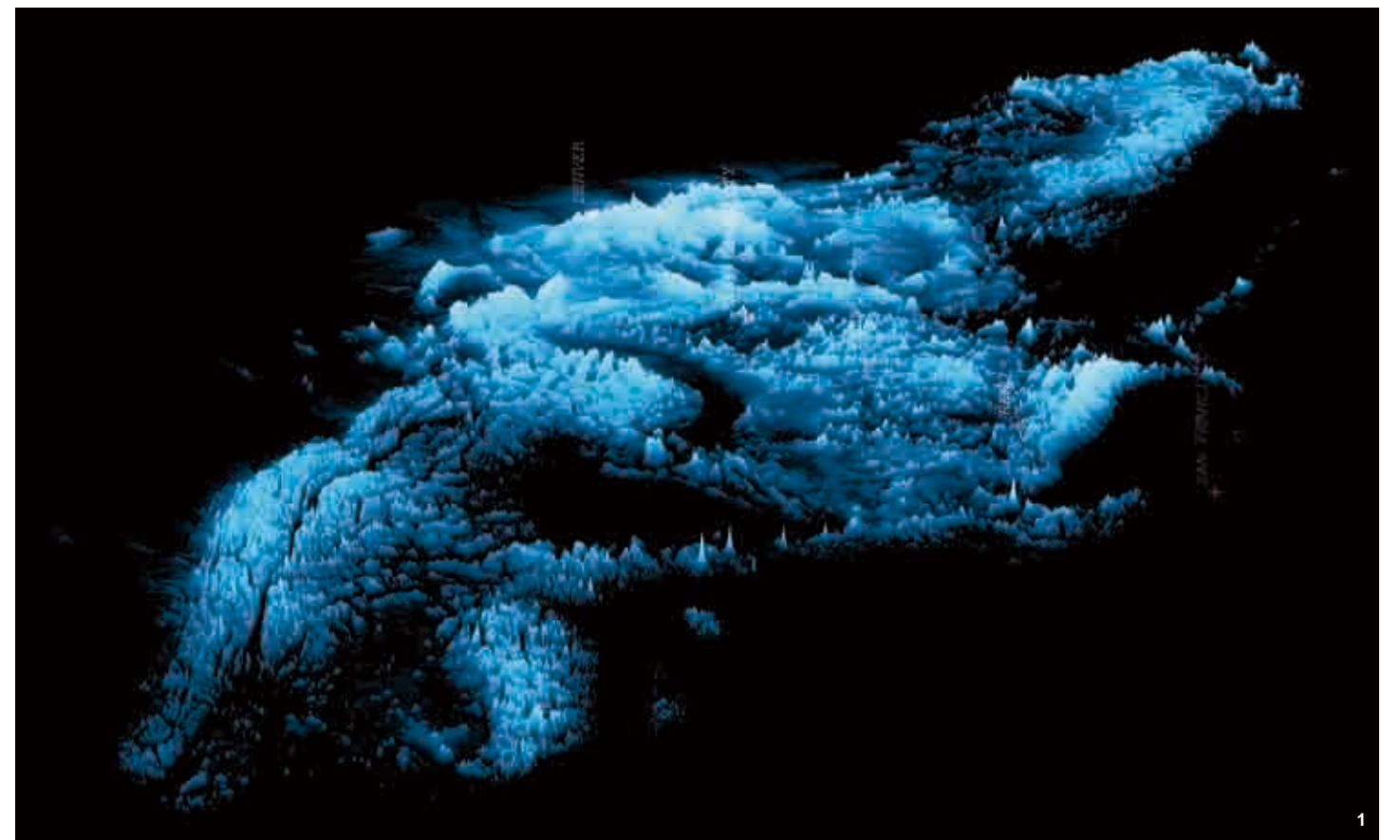
的，甚至是视觉不可见的景观也会受到城市系统的重大影响。正是这些地区将山和大都市这看似分离，实则处于同一系统中的二者联系起来。正如昂利·列斐伏尔提出的问题：“是不是因为我们的视野已经在早期景观的影响下定形（变形）了，所以我们看不到新的空间？”^①

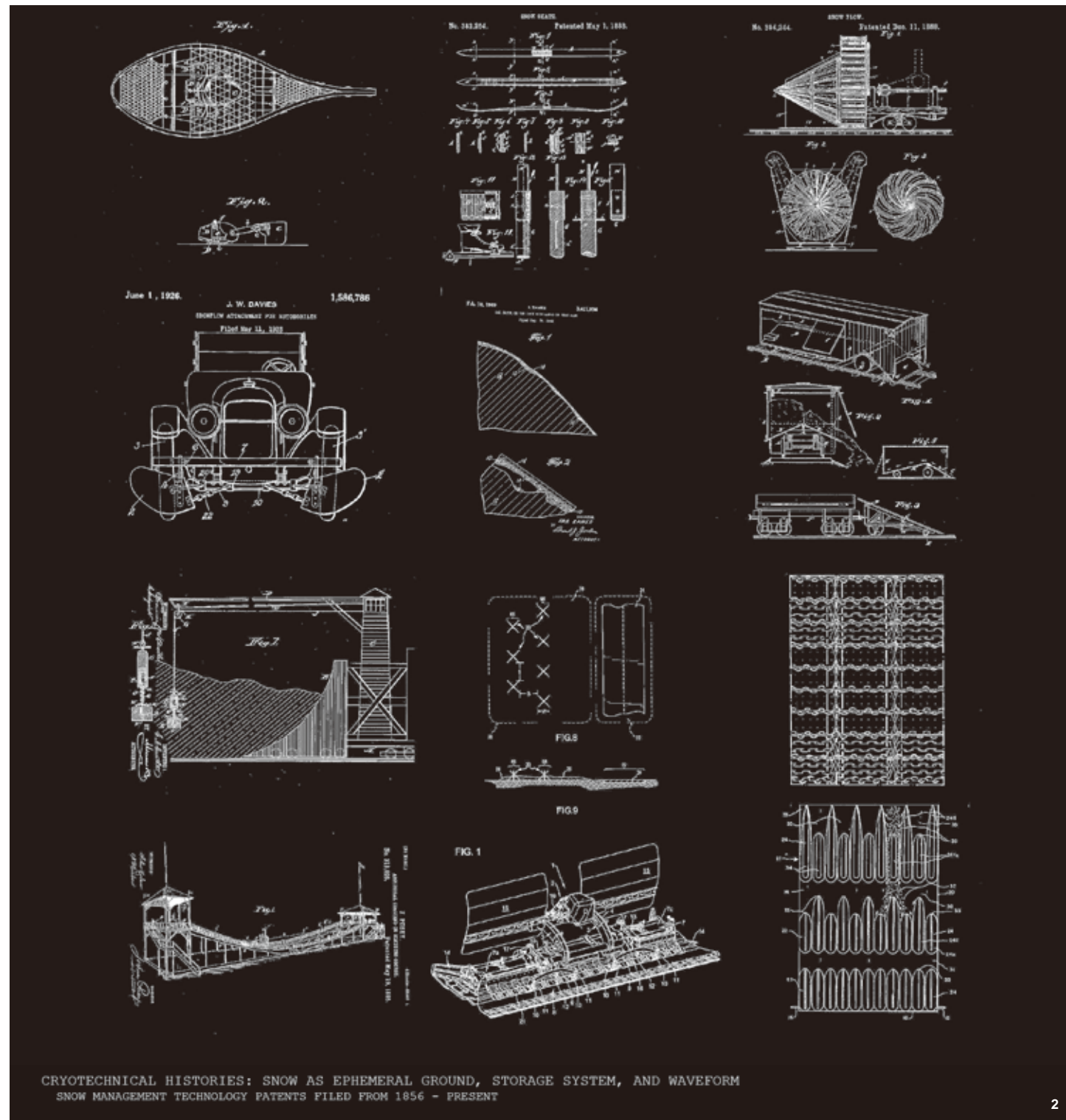
传统的概念把谷底、三角洲、海岸线，以及其他低地景观作为城市聚居的场所，而我认为，与气象息息相关的山可以为城市系统的发展提供一个截然不同的、分散式的发展方案——正如尼采在《查拉图斯特拉如是说》里所讲的，“以山峰为舞台”来看待城市系统的发展。^②从这个海拔上的制高点来看，山地和高山地带共同形成了另一种形式的“海岸”，这里稀薄的空气和浓厚的雾气造就了天气的反复多变，也从通常不被人认识的海拔和纬度层面，并最终在热力学层面上对冰冻圈和

其他气候类型地区之间的临界区域进行了界定。雪线，虽然很难被描画或设计出来，但其与树线以及海岸线一样重要，一直处于动态的变化当中，在生态上也具有指标性意义。这个“高海岸”划分出了一个巨大的、分散的、且几乎不被人发觉的“水库”，一个漂浮在海拔1 000m之上的淡水海洋：积雪。举例来说，美国西部和加拿大有多达80%的地区，其水源都来自于落基山脉、内华达山脉，以及其他一些山区的融化雪水。实际上，根据美国海洋及大气管理署的估算，这些积雪价值数十亿美元，而管理积雪所带来的经济效益也同样巨大。

雪管理既有“保存”的特征又能够促进“变化”：通过控制雪在不同的空间和时间尺度上融化为水，我们得以根据长远的目的，策略性地调节并且系统性地管理雪的各个状态。无论是一微秒、一个月、

1. 高海岸：北美西部地区的雪的海拔经济（冬季积雪时海拔达1 000m以上地区）。
1. The High Coast: altitudinal economies of snow in Western North America (average winter snowpack above 1,000 meters).





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一个季度或是一个世纪的时间维度，雪管理实践中的复杂的规律、循环和周期与城市系统中的气候条件、内在材料以及空间需求之间的动态关系相互交织，并为其进行索引。雪管理因此很自然地成为了一种调节方式，它可以跨越不同的地形和海

拔对领域阶段变化进行调节，并为区域规划、环境工程，以及设计理念和实践提供热力学层面、空间层面以及时间层面上的整体性策略。

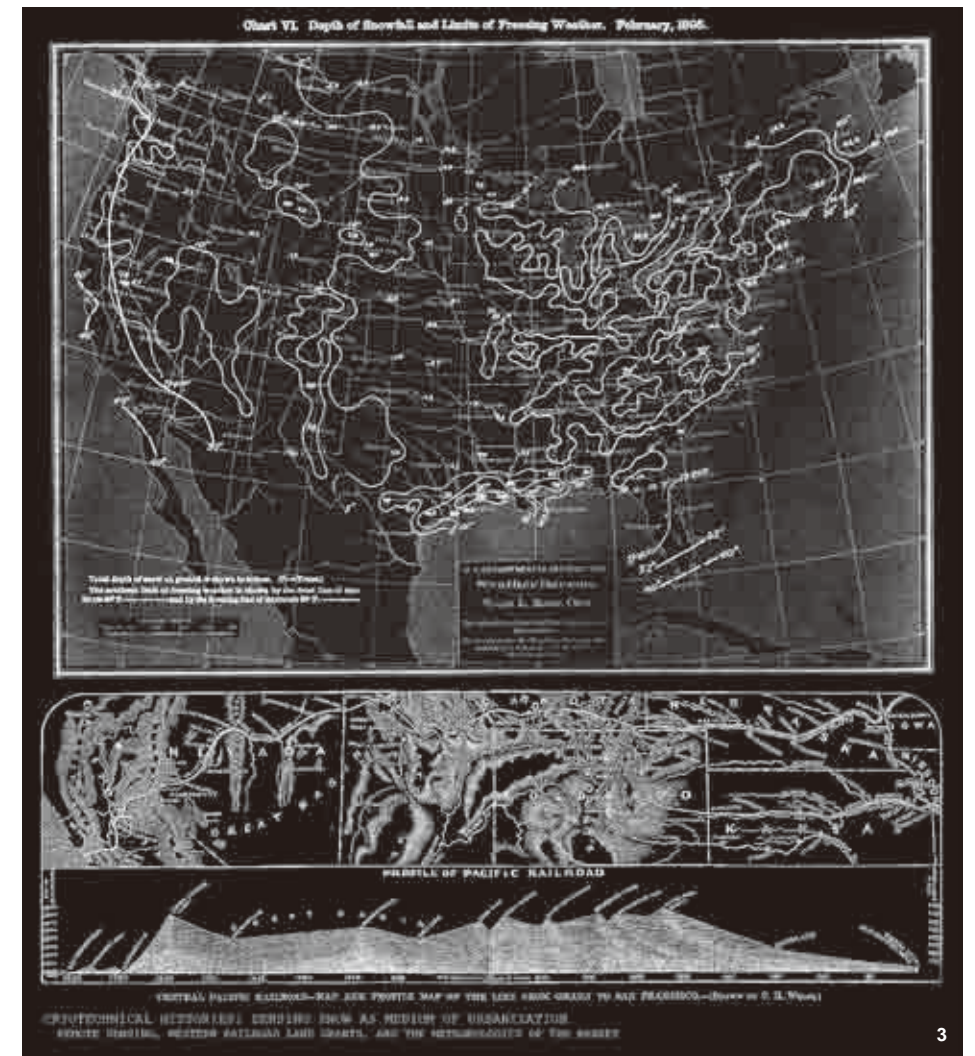
乔治·巴塔耶大概会用能量交换的“总体经济”来形容这种热力景观。在这

种能量交换中，结构性流动度——使得雪的不同晶体形态和不同聚集性质之间可以互相转换——以及约束性活力（举例来说，融雪是由湿度、温度和成比例的生物地理化学物质的梯度所决定的）塑造了状态变化过程中的实际空间和演化中的实际

向量。^[2]以雪来说，它的总体经济需要被进一步地理解为空间上的操作和阶段性的操作，即在不同海拔层面上进行操作。让我们回顾并重新理解帕特里克·格迪斯著名的山谷剖面，图中通过记录雪在海拔高度上和热力上的临界点，可以看出每一特定的人类活动都有其相应的操作环境以及活动范围。将这些范围和区域进行分层，就不难看出，在一个充满活力的景观中，不同海拔区域的各自特有的经济模式一同为这个景观注入了活力。高海岸既不是腹地也不是僻壤，它有着极端的地理条件和分散化的运作模式，富有活力地统筹各个标量性活动，通过简单的空间延伸和基础设施连接，成为“远端城市化”中的一种关键空间。

在落基山脉西侧，当地的雪的密度、覆雪范围，以及极具变化的热力学和形态特征从根本上决定了当地城市化的“地质技术”系统。^[3]这里所说的“地质技术”萌芽于彼得·克鲁泡特金、爱丽丝·雷克勒斯，以及特别是帕特里克·格迪斯的的作品，这一概念在本顿·迈克凯耶的作品中更是得到了充分说明。地质技术一词虽然首先由格迪斯定义为“让世界更宜居的应用科学”，^[4]但迈克凯耶对地质技术的定义却更具综合性与针对性：（该学科）交织于“地理学、林学和保育学、工程学、殖民行为（这里的“殖民”指的是广义上的人类殖民，而非帝国殖民）、区域规划学及经济学。”^[4]在寒冷、多雪的高海岸地区，“可居住性”这一关键概念除了对于山区定居地而言是直接相关的，在其他大部分情况下，这一概念的唤起间接地源于区域城市系统的物质和能源需求，以及多样化地质技术基础设施的应用——其目的是为了实现在远程资源管理及吞并，并造成区域热动力循环景观的转变。

除了这个基本情况以外，远端城市化系统的基础设施组成部分反映出了特定的海拔、地形范围内高度本土化的当地生态和经济情况。与看起来魅力超凡、规模巨大的低地水道和沿海固防等传统工程设计不同，这些组成部分往往是分散的、破碎



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的和平凡无奇的：雪梨，雪桥，雪棚，高速公路路堑，挡土墙，整地过后的坡面，起爆雷管，绕山路和撒盐化雪，伐林空地和植栽雪篱，雪崩防御性“堤坝”和高海拔水库，滑雪缆车，雪地车，以及在地表/地下/地上进行造雪、融雪、探雪和塑雪工作的机器。

通过将这些组成部分粗放地整合在一起，雪的季节性管理实际在空间和时间上将布满积雪的高海拔山峰和加利福尼亚州的农业景观、内华达州的牧场，以及犹他州和科罗拉多州的爆炸性矿产开采及水压天然气开采产业连接起来。尤其是在大盆地地区——由（加利福尼亚州）内华达山脉和（犹他州）瓦萨奇山脉所围合的山间地区——根据季节的不同，这些属于国家

林业局、土地管理局、私人产业、滑雪胜地，或是聚居地的地区可能被用作工业林地，也可能被用作农业用地或娱乐滑雪用地。这些用地都是正在不断强化但仍较为分散的城市化的主要载体。雪还可以根据生物地质化学、水文和地理情况的变化进一步地标记远端的城市活动，例如检测原

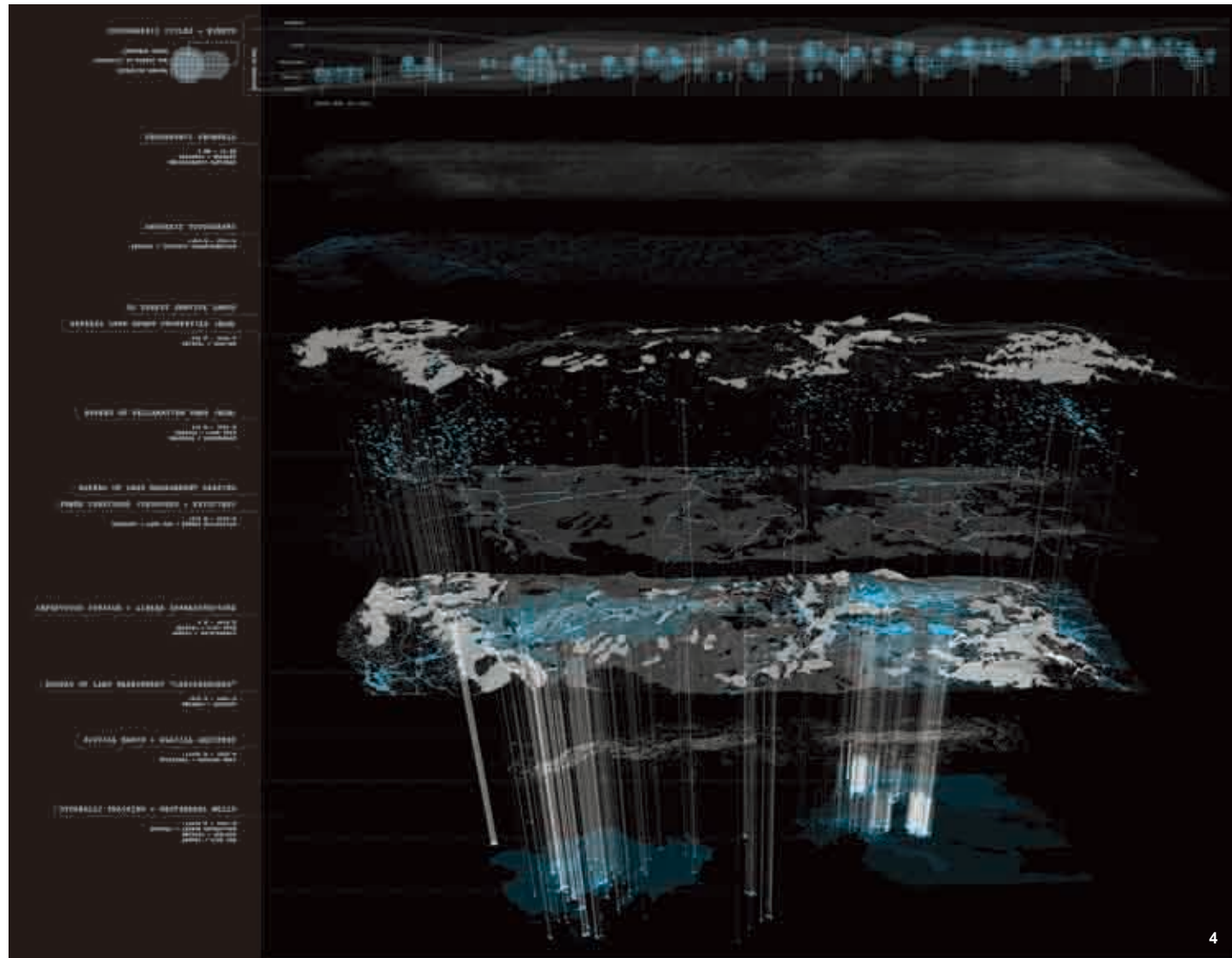
2. 冰雪技术历史：雪作为转瞬即逝的界面和（淡水）储存系统，并具有波形性（1856年至今的雪管理技术专利领域发展历史）。
3. 冰雪技术历史：对雪进行远程控制是一种城市化的媒介（具体手段包括遥感、西部铁路建设赠地，以及市场变化的气候性）。
2. Cryotechnical histories: snow as ephemeral ground, storage system, and waveform (snow management technology patents filed from 1856 - present).
3. Cryotechnical histories: sensing snow as a medium of urbanization (remote sensing, western railroad land grants, and the meteorologies of the market).

始高山草甸区空气中的工业污染物含量，或是检测由流速变快、流量加大的集中性的春季融雪引起的大坝溃水和沉积物超载。这些变化会产生诸如打造低海拔滑雪胜地的大规模造雪系统等新的地质技术，并淘汰过时的旧技术（例如不堪重负或错置的雪崩防御设施）。每个地区当地的雪的变化状况与地质技术基础设施之间相互影响，这种不断变化着的互动成为与高海岸适居性相关的远端和即时策略的工具革新、再利用以及重新注资的非常重要且备受争议的场所。

季节性积雪管理的最终区域体制存在内在杂合性并常常相互冲突，二者通过

跨越海拔上的临界点和区域管辖边界的各种“冰雪技术”的基础设施来进行调控。通过将组织性的框架结构和空间尺度进行叠加，雪证实了其本身并不只是简单的水文、生态和气候的媒介，同时也是政治媒介。马克·吐温称，在干旱的美国西部，“水是战争之源”。他的这一说法被广为引用，显然，这场水的战斗也包括雪，从发展滑雪胜地的奢侈经济，到以放牧牲畜及水压开采等为形式的“雪资源开采”。迈克凯耶曾经反对“地质技术”一词，认为应该用“地质政治”一词代替，因为他认为地质技术只不过是“地质统治的一个客套说法”。^[3]而我提出的则是一个更趋

4. 权力的海拔分级——西部山区的能源及过量经济（从顶层到底层依次是）：山区降雪；山区地形；美国森林用地；联邦政府赠地；美国垦务局管辖的堤坝；美国管理局管辖的放牧地区；（项目设想的及现有的）电能廊道；非渗透性地表与线性基础设施；美国土地管理局管辖的地下租赁权格局分布；洪积盆地及冰川含水层，以及水压致裂采气井与地热井。
5. 冰岩政治学与各影响机构的海拔分布（沃萨奇山脉/盐湖城地区中联邦政府、州政府及地方性雪管理机构）。
4. Altitudes of power — intermontane west economies of energy + excess (from top layer to bottom): orographic snowfall; orogenic topography; US forest service lands; federal land grant properties; Bureau of Reclamation Dams; Bureau of Land Management Grazing; power corridors (proposed and existing); impervious surface + linear infrastructure; Bureau of Land Management subsurface leasing rights "Checkerboard"; pluvial basin + glacial aquifers; hydraulic fracking and geothermal wells.
5. Political cryologies + altitudinal agencies (federal, state, and local agencies of snow management, Wasatch Range / Salt Lake City Region).

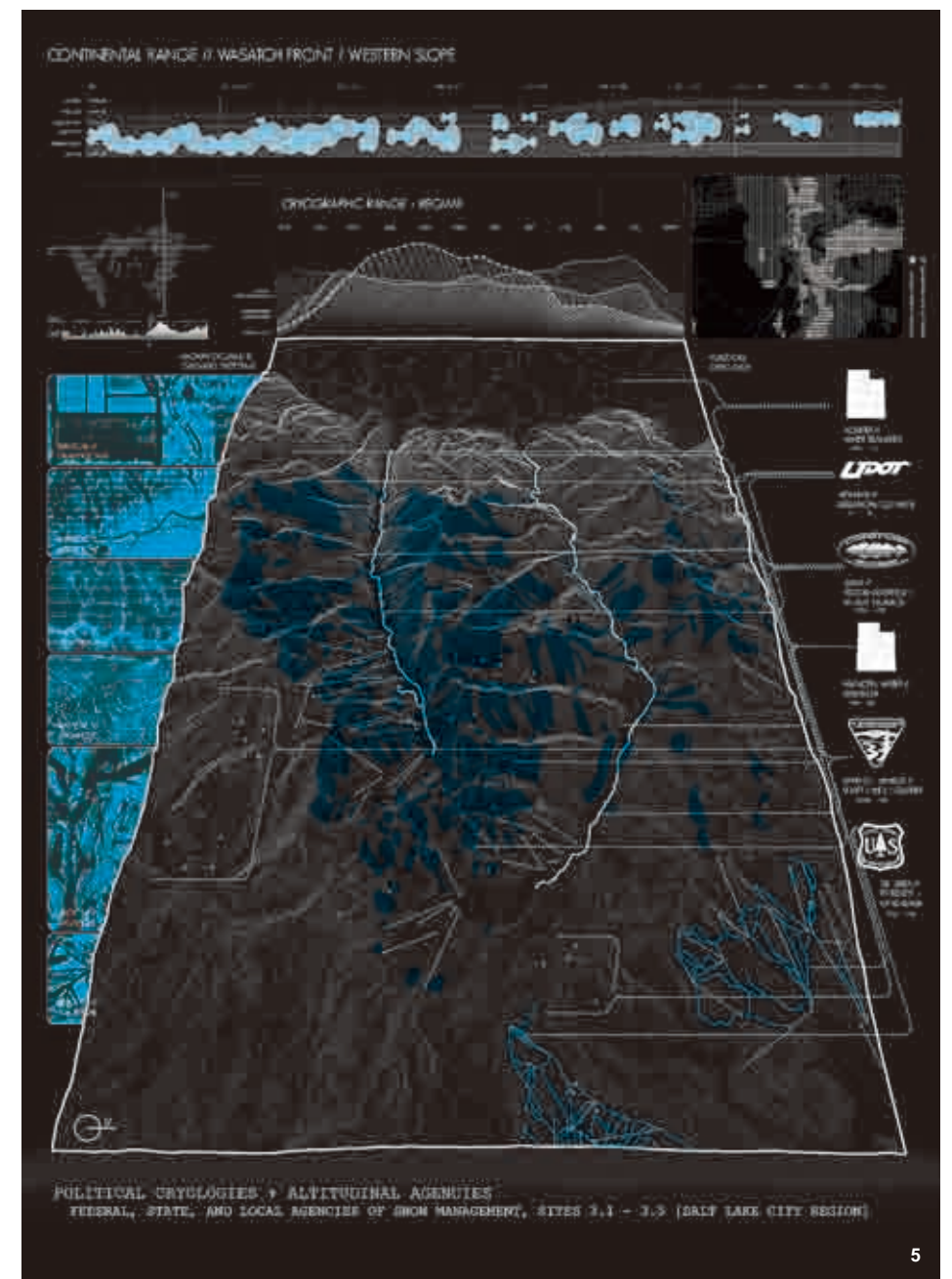


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于政治不可知论的概念：地质技术（及其“冰雪技术”子集）是使“权利景观”得以构成、运作以及重生的一系列场所、范围和策略。

高海岸项目通过对假设性的设计及理论的探讨，旨在学习迈克凯耶和政治生态学的一些当代作品，取其精华，帮助大家跨越各种尺度，从政治冰雪水文的层面来看待雪。通过从“晶体、地形、地质、制图表达”这四种各自独立的雪的状态入手，高海岸项目为雪参与远端的城市进程提供了空间上、技术上和概念上的语境，策略性地活用雪的热力状态，把雪看作季节性水库、生物气候调节器、临时性地貌，以及政治催化剂。高海岸计划不是选择一个单一的试验点，而是通过对雪的各个阶段的状态进行研究，以创建一系列包括表现水平、长期潜力和空间技术在内的“冰雪技术性”指标，用以组织高度政治化的、高海拔地区的土地利用、管理以及使用系统。小到真菌的雪中播种，大到对雪崩后的雪进行储存收集，都属于这里所说的指标范畴。从以“之”字型空间分布为基础发展起来的住宅分区，到林业和放牧用地格局之间的蒸散量的反馈循环，该指标用以修补、改善、开创、操纵冰雪技术系统，使其朝着基础设施离散化、政治影响力突出的方向发展。

高海岸项目认识到雪和产生这些状态的气候地形力量是不可分割的。该项目针对一系列位于北纬40度的美国“大盆地地区”内，在海拔、物质构成、尺度方面具有代表性的不同地点，对它们的这些指数进行测试和调整。该项目展开了一幅跨越100年时间维度的美国大盆地地区热动力环境的推测性图景，基于一个在这一期间发生的高海岸地区“积雪急剧消融”的假想性前提，来探讨前文所述的一系列从属于“地质技术性”之下的指标对于政治及冰雪技术方面所形成的影响。高海岸项目积极应对未来的复杂图景，而非一味追求不切实际的地质工程最优化目标。针对牧场、度假村、滑雪区和居住区展开实验性推测，该项目将城市化的逻辑和尺度从



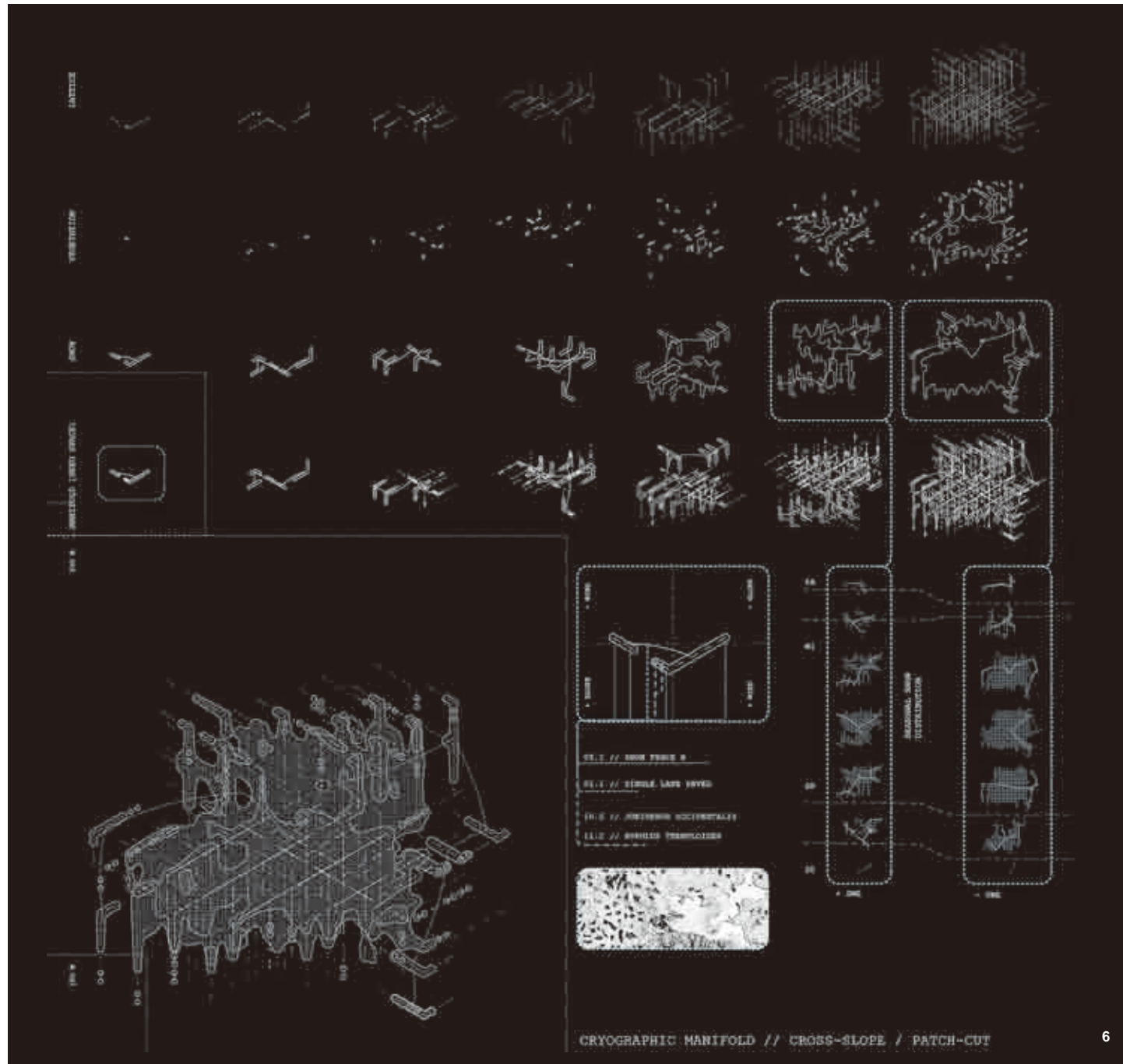
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“体积制”转向“能量制”概念，从散布的“区域”转向集中的“范围”概念，从静止的“地方”转向具有时间性的“阶段性空间”概念，从平面化的“财产和土地”转向基于大气和海拔属性的“雪的经济”概念。肯尼思·力士乐指出，“冬雪掩埋了一切人的踪迹”；同样，认识到环境的四季更替和气候的变化无常，高海岸项目试图透过我们的“雪盲”来展望景观设计、环境设计范畴内热动力学空间及其

影响，展望一个全新的积极应对季节和气候变化的“地质技术”项目。LAF

注释

- ① 这里是指由山脉引起的，或始于山脉的。
- ② 此种对于资本主义城市化中远端基础设施性和运作性景观的理解很大程度上基于哈佛大学皮埃尔·比朗格尔教授、尼尔·布伦纳教授以及城市理论实验室的相关研究成果。
- ③ 两个突出的案例可以对此段历史进行阐释：美国西北部铁路的修建，以及一些关于遥感——特别是气象学——的新兴学科和基础设施的出现。这些历史展示了通过地质技术操作，尤其是在19世纪和20世纪初，特定的景观能够在通过西部地区水文地质资源中获得投机价值的资本累积模式下得以产生。



In the mountains the shortest way is from peak to peak: but for that one must have long legs.

— Friedrich Nietzsche, *Thus Spake Zarathustra* (1885)

... For the crestline is the new frontier...

— Benton MacKaye, *The New Exploration* (1928)

Winter is (the) great obliator of the signs of man.

— Kenneth Rexroth, *Camping in the Western Mountains* (unpublished WPA manuscript, 1939)

As fragile interface between the geologic and meteorologic, the mountain is the avant-garde altitudinal threshold shaping downslope urban

systems. While our attention is increasingly beaded on coastal and riverine landscapes as spaces of design consequence (and the consequences of bad — or absent — design), we have largely ignored the full geographic scope and climatic cycles for which the mountain performs irreducible hydro-meteorologic and -topographic operations, ranging in scale and function from regional

rainshadows to the complex choreographies of runoff. These operations in turn shape regionally-scaled, orogenic^① infrastructures of resource capture, management, and conveyance, while shaping spatial patterns and temporal cycles of occupation, from peak to coast, delta, or riverbank. Yet due to the apparent remoteness of high altitude landscapes on the peripheries of both imagination and inhabited elevations, these threshold spaces remain distant from view and far from design discourse, despite a recent “geologic” turn.

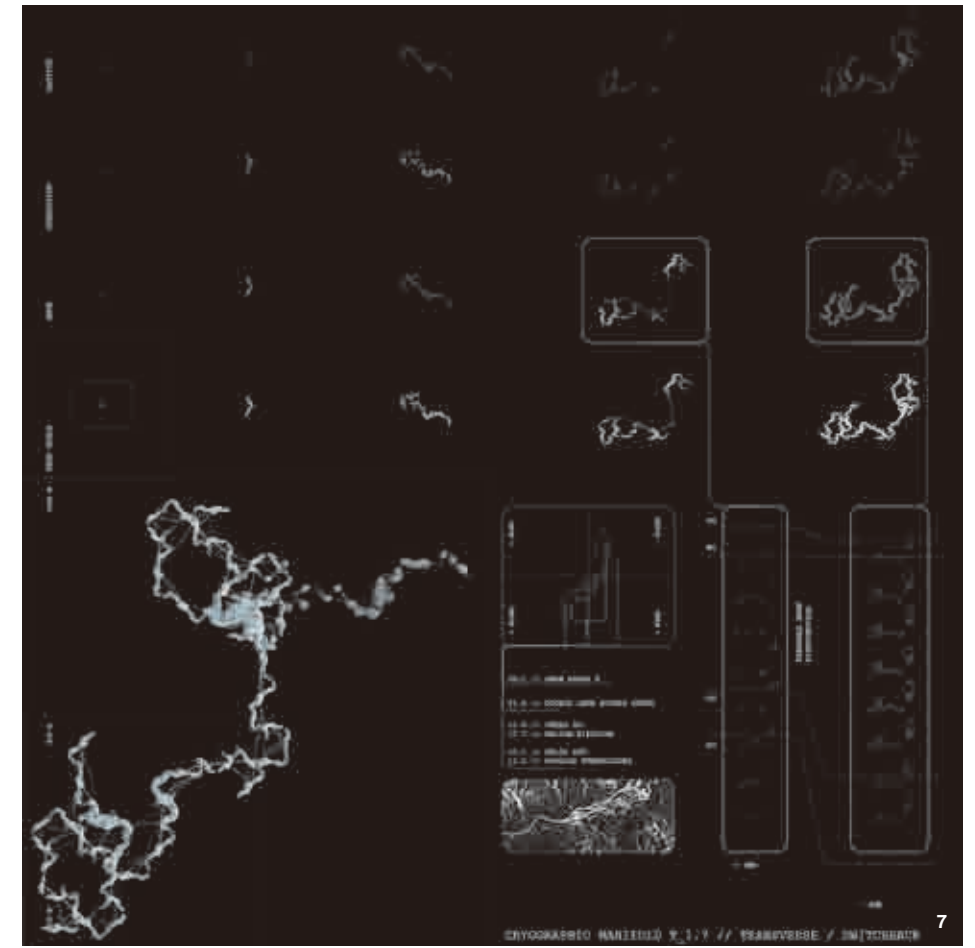
That neither the mountain nor its predominant forms of water — ice and snow — enjoy the same fluency or urgency in urbanist discourse as low-lying hydrologic and landscape systems is not simply the result of lack of interest by diverse practitioners and thinkers. Rather, the high-altitude cryosphere — spaces of frozen water — is what Henri Lefebvre has referred to as a “blind field”^[1]. A blind field is itself a threshold space, “between fields (of knowledge), which are regions of force and conflict.... These are not merely dark and uncertain, poorly explored, but blind in the sense that there is a blind spot on the retina”. In seeing one thing — the densely populated coast, tropical storms, rising tides — we become blind to another: snow can be an urban obstacle or recreational device, but rarely is seen as water; the mountain can make a view, offer a gentle or dangerous slope, or cache minerals, but rarely is understood as a meteorologic machine. Where we conflate urbanism and industrial settlement, or we take the city and its hinterland to constitute an urban territory, we miss critical spaces of the effects and operations of urban systems on remote, extreme, ephemeral, or even invisible landscapes through which mountain and megacity share the same systemic and discursive ground. As Henri Lefebvre asks: “Is it simply that our eye has been shaped

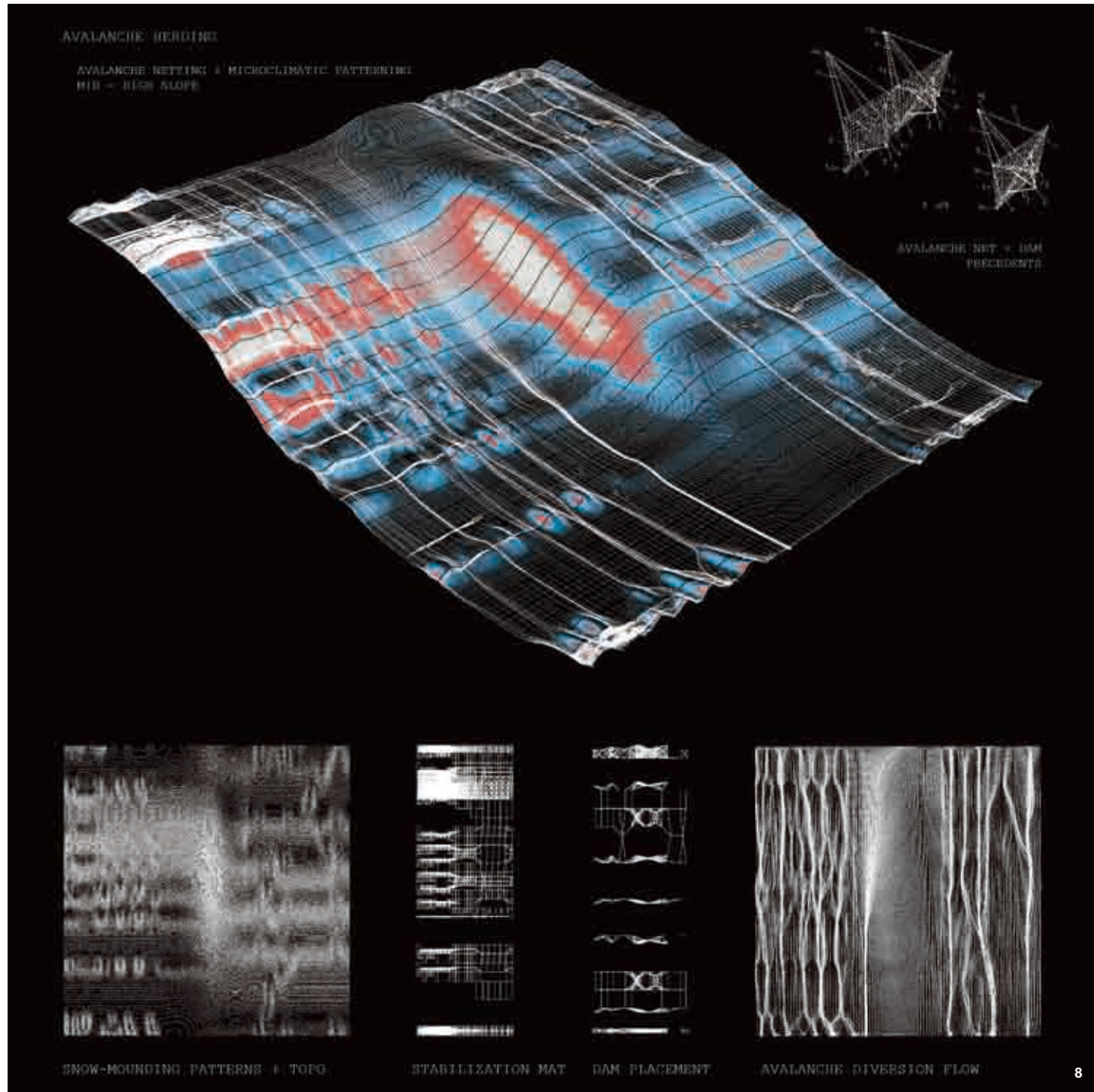
(misshaped) by the earlier landscape so it can no longer see a new space?”^[1]

Against fixation on valley floors, deltas, shorelines, and other lowland landscapes as sites of urban agglomeration, I propose that the meteorological mountain offers a distinct and decentralized view of urban systems — a view “staged from the peaks”, as Nietzsche’s *Thus Spake Zarathustra* suggests.^② From this high-altitude vantage point, montane and alpine zones mark a different kind of “shore” altogether, spaces of thinning air and thickened weather both mercurial and manifold, delimiting an often unrecognized altitudinal, latitudinal, and ultimately thermodynamic threshold between the cryosphere and other climatic geographies. As materially dynamic and ecologically indexical as treeline or coastline, the snowline is harder

to draw or engineer, but of equally critical importance. This “High Coast” demarcates a massive, diffuse, yet largely unseen reservoir, a freshwater ocean floating a thousand meters above sea-level: the snowpack. Up to 80% of the western United States and Canada, for instance, depends on the snowpack of the Rockies, Sierra Nevadas, and other ranges

6. 冰雪技术策略：依据春季融雪绿洲的动态扩展进行区域性组织（短面横坡/森林片区清除/无性系植被分布/500m x 500m网格尺度）。
7. 冰雪技术策略：利用环绕山路的聚落方式进行区域性组织 [长面横坡/坡面加固（无性化植被和菌根菌网络分布）/阶段性边坡塌毁以形成台地式的雪库/1 000m x 1 000m网格尺度]。
6. Cryographic strategies: territorial organization using spring snow oases (cross-slope / patch cut / clonal forestry / 500 m x 500 m).
7. Cryographic strategies: territorial organization using switchback-based settlement [transverse-slope / slope stabilization (clonal vegetation and mycorrhizal networks) / phased slope collapse for terraced snow reservoirs / 1,000 m x 1,000 m].





for water; indeed, according to NOAA, the snowpack is speculatively valued at billions of dollars, and the economy of management it generates is similarly megalithic.

Snow management is both conservative and transformative. Snow distills several spatial and temporal scales through which

we tactically modulate and systematically manage its many metamorphic states for long-term strategic purposes. Whether engaged over the course of a microsecond or month, season or century, the complex rhythms, cycles, and periods of snow management practices interweave and index the dynamic

relations between climatic conditions and the immanent material and spatial demands of urban systems. Snow management thus becomes an unwitting way of modulating a kind of territorial phase change across orographic and altitudinal ranges, setting thermodynamic strategies alongside spatial

and temporal ones for regional planning, environmental engineering, and design thought and practice in general.

George Bataille might describe this thermodynamic landscape in terms of a “general economy” of energetic exchange for which structured fluidity — between, say, different snow crystal types and emergent properties of aggregation — and constrained dynamism — snowmelt defined, for example, by gradients of humidity, temperature, and proportional biogeochemical content — shape virtual spaces of transformation and actualized vectors of evolution.^[2] In the case of snow, this general economy must further be understood to operate spatially and sectionally, which is to say, altitudinally. Recalling and recalibrating Patrick Geddes’ famous valley section of urbanism, tracking snow across both altitudinal and thermodynamic thresholds shows the relation of distinct urban processes to ranges of operative intensive conditions and extensive zones of operation. Stratified into these ranges and zones, an energetic landscape comes into view, animated by the altitudinal economy of its operation. Geographically extreme and operationally decentralized, the High Coast is neither hinterland nor wasteland, but a key space of “remote urbanization” that works as much through energetic systematization across scalar events as through simple spatial extension and infrastructural connectivity.

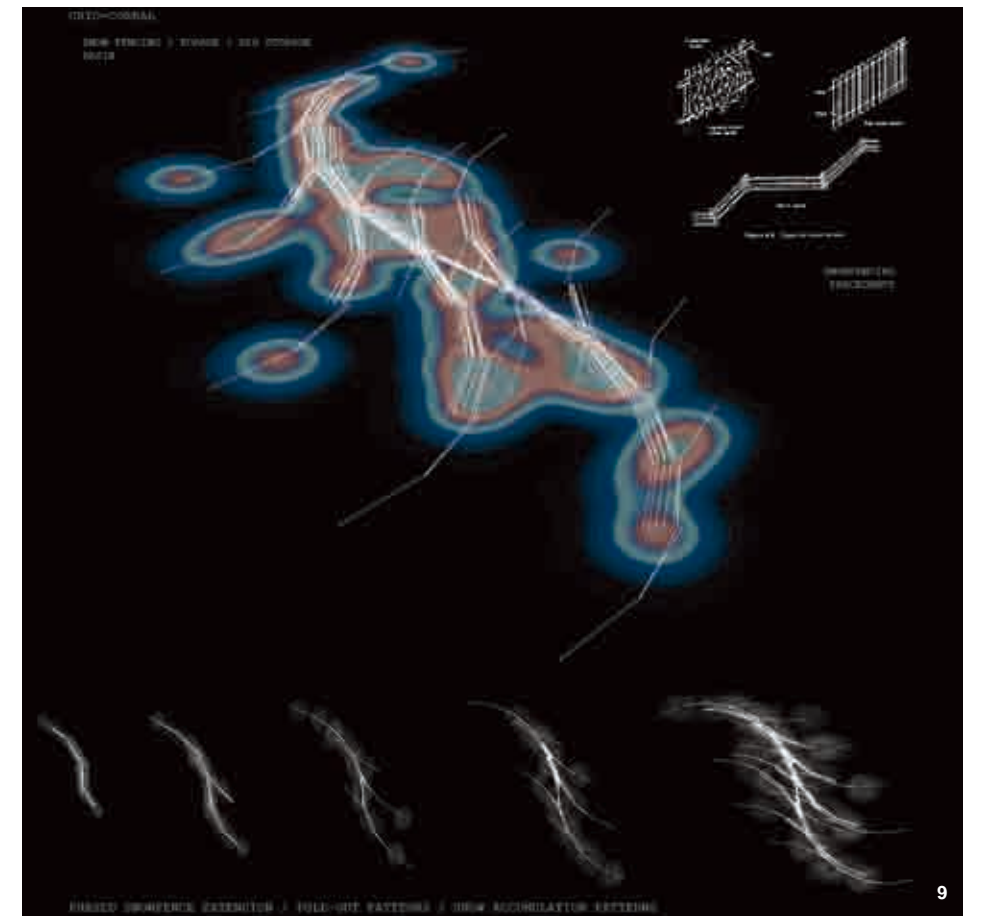
West of the Rockies, the local densities, extents, and highly variable thermodynamic and morphologic properties of snow foundationally shape the “geotechnical” systems of regional urbanization.^③ “Geotechnics” must here be understood in the sense initially germinated in the work of Peter Kropotkin, Elisee Reclus, and especially Patrick Geddes, and fully articulated in the work of Benton MacKaye. While first formulated by Geddes as the “applied science

of making the world more habitable”,^[3] Mackaye offered a more synthetic and particular concept, interweaving “geography, forestry and conservation, engineering, colonization” — in the broadly human, rather than imperial mode — “regional planning, and economics.”^[4] In the context of the cold, snowy High Coast, this key question of “habitability” — while directly relevant in the case of mountain settlements — is primarily invoked indirectly by the material and energetic demands of regional urban systems, remotely controlling and annexing the snowpack through diverse geotechnical infrastructures that serve to both sense and accordingly transform the thermodynamic landscape.

Despite this general condition of remote urbanization, the infrastructural components of such systems express the highly localized,

vernacular geographies of ecology and economy unique to each altitudinal and orographic range. Distinguished from the charismatic megaforma typical of engineered lowland waterways and coastal armoring, these components are most often dispersed, fragmented, and banal: snow-plows, snow-bridges, snow-sheds, highway roadcuts, retaining walls, graded slopes, blasting caps,

8. 冰雪技术策略：利用方向引导性的雪崩和植被加固垫层建立雪“库”[中高度坡面/可种植的地质纤维加固垫层/雪崩防御“堤坝”(右坡)/雪丘作为分散化地形(左坡)]。
9. 冰雪技术策略：利用雪篱建立雪“库”(盆地/折叠及铰链结构的木质及编织纤维形成的围篱/用于夏季牧场和水资源的围雪操作)。
8. Cryotechnical tactics: snow “banking” using avalanche herding and vegetated stabilization mats [mid-high slope / seeded geofiber stabilization mat / avalanche fence “dams” (right slope) / snow mounding as diversionary topography (left slope)].
9. Cryotechnical tactics: snow “banking” using corral fencing (basin / folded + hinged timber + woven-fiber fencing / snow accumulation for summer pasture forage and water resource).



switchbacking and salting, patch-cut forests and living snow fences, avalanche protection “dams” and high-altitude reservoirs, ski lifts and snow-mobiles, and snow-making, snow-melting, snow-sensing, and snow-shaping machines operating on, under, and above ground.

Through the cacophonous coupling of infrastructural components, the seasonal management of snow spatially and temporally links the peaks to California’s agricultural landscapes, Nevada’s ranching ranges, and Utah’s and Colorado’s explosive mineral and fracking claims. Particularly in the Great Basin region — the intermontane area bound by the Sierra Nevada (California) and Wasatch (Utah) ranges — seasonally-shifting matrices of industrial forestry, agriculture, and leisure migrate across National Forest Service, Bureau of Land Management, and private properties, ski resorts, and agglomerated settlements, becoming the predominant vector for intensifying yet diffuse urbanization. Snow further indexes these remote urban processes through biogeochemical, hydrographic, and geographic transformation, whether through

traces of airborne industrial pollutants in apparently pristine alpine meadows, or accelerated, concentrated, and intensified Spring snowmelt leading to dam overtopping and sediment overloading. These changes both generate new geotechnical artifacts — for instance, extensive snowmaking systems at low elevation ski resorts — while making others obsolete — overwhelmed or misplaced avalanche barriers, for example. The locally emergent interactions between changing snow conditions and geotechnical infrastructures become important and contested sites for retooling, repurposing, and recapitalizing both remote and immediate strategies of High Coast habitability.

The resultant territorial regimes of seasonal snow management are inherently heterogeneous and often internally contradictory, mediated through diverse “cryotechnical” infrastructures across altitudinal thresholds and jurisdictional borders. Operating through overlaid organizational frameworks and spatial scales, snow proves not simply a hydrologic, ecologic, and climatic medium, but a political

one as well. Mark Twain is often quoted for his observation that in the arid western United States, “water is for fighting”; evidently, this fight saturates snow as well, from the luxury economies of ski resort development to snow “prospecting” by water-thirsty cattle ranching and fracking operations alike. MacKaye once opposed geotechnics to geopolitics, which he rightly called no more than “a polite term for geo-domination”;^[3] while I propose a more politically agnostic concept, geotechnics (and, accordingly, the subset of “cryotechnics”) designate a set of sites, scales, and strategies through which landscapes of power are constituted, operated, and reproduced.

Explored through both speculative design and theory, The High Coast project aims to diagram a political cryology of snow across multiple scales, taking cues from both MacKaye and contemporary work in political ecology. Isolating four scalar events — the crystallographic, topographic, orographic, and mesographic — The High Coast develops a spatial, technical, and conceptual vocabulary for the agency of snow in remote urban processes, strategically inflecting its

thermodynamic states to work as seasonal reservoir, bioclimatic modulator, ephemeral landform, and political catalyst. Rather than select a single site of experimentation, The High Coast samples the diverse phase states of snow to propose a cryotechnical index of performative profiles, long-term potentials, and spatial techniques for organizing highly politicized, high-altitude land use, management, and occupational systems. Ranging in scale and scope from fungal snow-seeding to avalanche herding, and from switchback-based residential subdivisions to evapotranspiration feedback loops between forestry and grazing patterns, this index tinkers, tools, hacks, and hijacks extant cryotechnical systems toward infrastructurally decentralized and politically radicalized ends.

Recognizing snow to be inseparable from the morphoclimatic forces that generate these profiles, The High Coast tests and tunes the index across a series of representative altitudes, material conditions, scales and sites spanning the 40th parallel in the Great Basin. Taking the form of a 100-year speculative thermodynamic narrative for

the Great Basin, The High Coast probes the political and cryotechnical outcomes of the index by envisioning a Big Melt for the High Coast, embracing the complexity of future scenarios over the false positivism of geo-engineered optimization. Played out over rangelands, resorts, ski areas and settlements, The High Coast shifts the logics and scales of urbanization from the volumetric to the energetic, from extensive zone to intensive range, from place to phase space, and from the planar imaginaries of property and land to an atmospheric and altitudinal economy of snow. As Kenneth Rexroth noted, “winter is the great obliterator of the signs of man”; this project makes an attempt to see through our “snow-blindness” to new thermodynamic spaces and consequences for landscape architecture, environmental design, and a renewed geotechnical project for our world of shifting seasons and changing weather. **LAF**

NOTES

- ① That is, caused by or originating in mountains.
- ② This understanding of the remote infrastructural and operational landscapes of capitalist urbanization has been critically shaped by the work of Pierre Bélanger, Neil Brenner

- and the Urban Theory Lab at the Harvard Graduate School of Design.
- ③ Two particular cases studies of snow elucidate this history: the ingression of the railroad into Western North America and the emerging disciplines and infrastructures of remote sensing, specifically meteorology. Both of these histories index the geotechnical operations by which specific landscapes could be brought under the rubric of capital accumulation through the extraction of speculative value from the hydrogeologic resources of the Western territories, especially during the 19th and early 20th centuries.

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10. 美国“大盆地地区”中的热动力领地主义（促进西部山区“冰雪技术”都市主义的沿海海拔分布的场地、系统和基础设施）。
10. *Thermodynamic Territorialism in the Great Basin* (altitudinal sites, systems, and infrastructures for “cryotechnical” urbanism in the intermontane west).

