santorini

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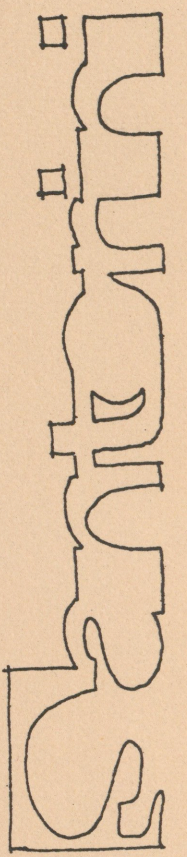
forward

This book has been researched and written by the 1978-1979 third year architectual design class at Montana State University. The book was written as a reference guide for the design of a tourist facility on the Greek Island of Santorini.

The direction of this study is to better understand the island and people of Santorini, Greece.



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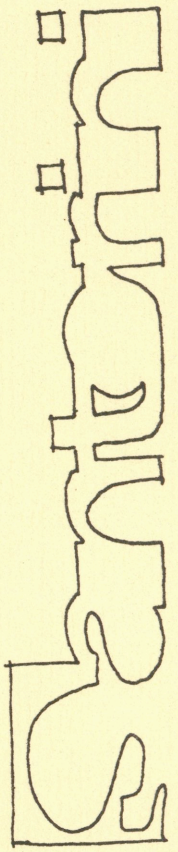
philosophy of tourism



the tourist
Cocaine
AMAICA

In order to establish a new aesthetic for a given situation, it is recognized that traditional philosophies must be critically re-examined for their contextural appropriateness. Such is the case with the philosophy of tourism where it can be observed that complete satisfaction is not met through the presently accepted standards.

What is the tourist and tourism? Is a tourist different from a traveller? Centers of tourism see the outsider (tourist) as a market, the tourist brings in revenue and keeps the economy alive. Even though the tourist is (or may be) the main economy, he is still considered an outsider, not a part of the culture. The tourist is only tolerated because of the revenue he brings in. Are there not visitors that are not really tourists or revenue builders? It seems as though another classification should be considered. The other type of visitor might be referred to as a traveler, a special breed of tourist that mingles with the culture, a person who compliments the environment. The traveler searches for a new experience that intensifies the quality of life.

The tourist strives for personal gratification, he is searching for an intensity of life's experience although he is continually disappointed because he is not searching in the right direction. So in essence we discern two types of tourist: the tourist of leisure travel, and the traveler who becomes a vistor, who experiences a culture.

The refreshment (or enlightenment) of mind and body is the most important human desire, and that refreshment is not to be found in uninvolvement (a presently accepted idea of relaxation being the total remission of all the responsibities of being alive). Ideally just the opposite type of relaxation should be found, an intense involvement in a new experience. This involvement means awareness and respect for all cultural and natural environments in which the refreshment being sought occurs. The awareness comes about only through commitment, a commitment to bring about a good feeling between native and tourist. The relationships between the tourists themselves and the relationships between the designed and built tourist environment is whatmakes a community desirable to visit.

The existing environment must not be destroyed, it must be maintained according to its culture, and be respected and maintained by the tourist who visits the culture.

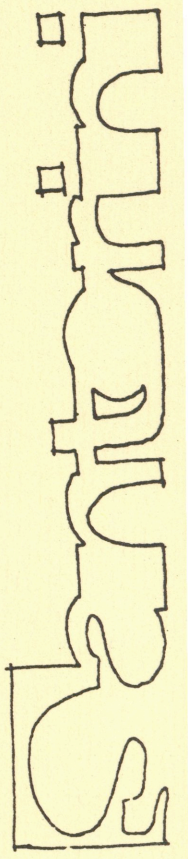
The "visitor" or "foreigner" is only a participant for a relatively short time in an environment that has been built upon for possibly thousands of years. The tourist is part of the environment, and hopefully a respect for this foreign environment can be maintained. The experience being offered for those of commitment, provides a timeless sense of place where one can get in touch with oneself. This timelessness of the island of Santorini, Greece was created by the harmonious co existence between the native built environment, the existing environment and the natives.

In conclusion, ideally a visitor is not treated as an outsider, but rather becomes a part of the native culture, physical environment and organic environment.

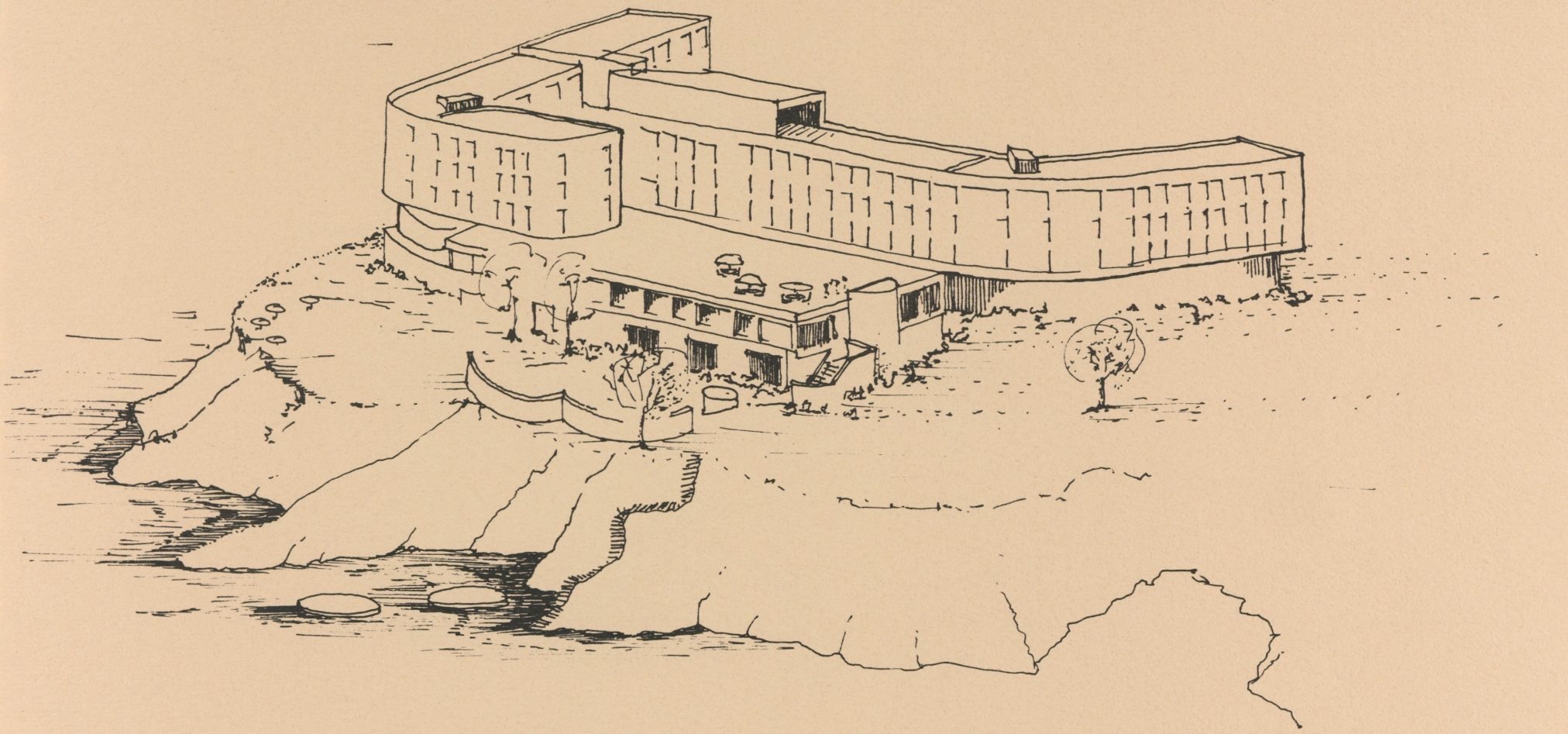
The isles of Greece,
The isles of Greece!
Where burning Sapho loved and sung
Where grew the arts of war and peace
Where Delos rose, and Phoebus sprung!
Eternal summer glids them yet
But all except there sun is set.

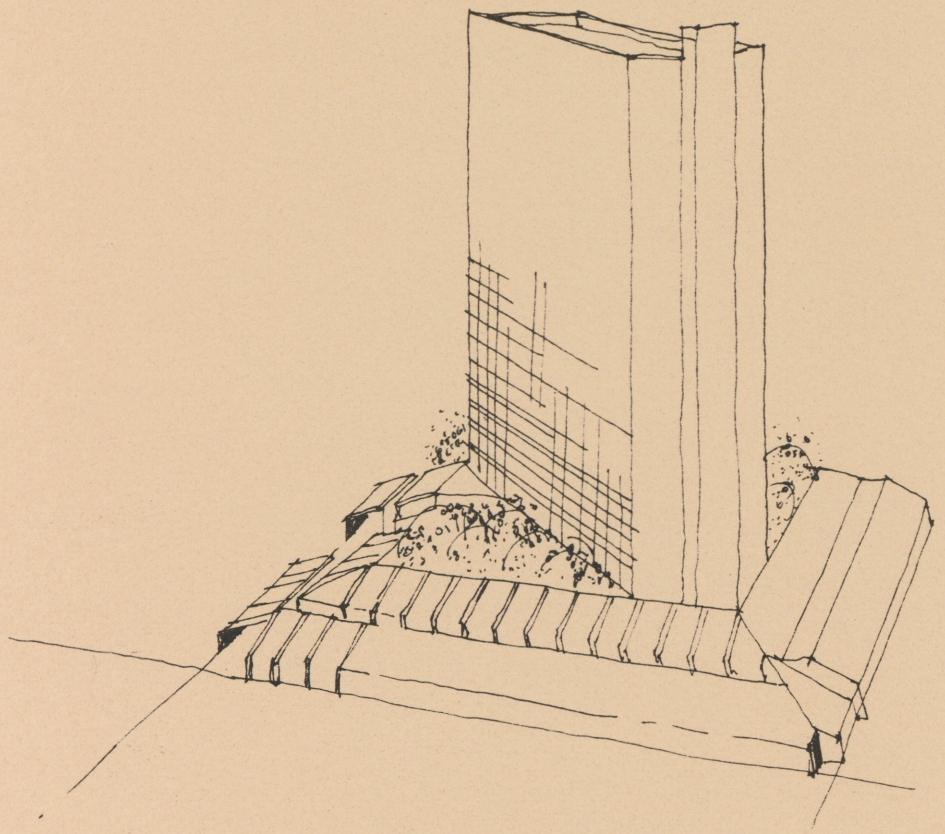
—Lord Byron

philosophy of "resort hotels"



international 'low impact



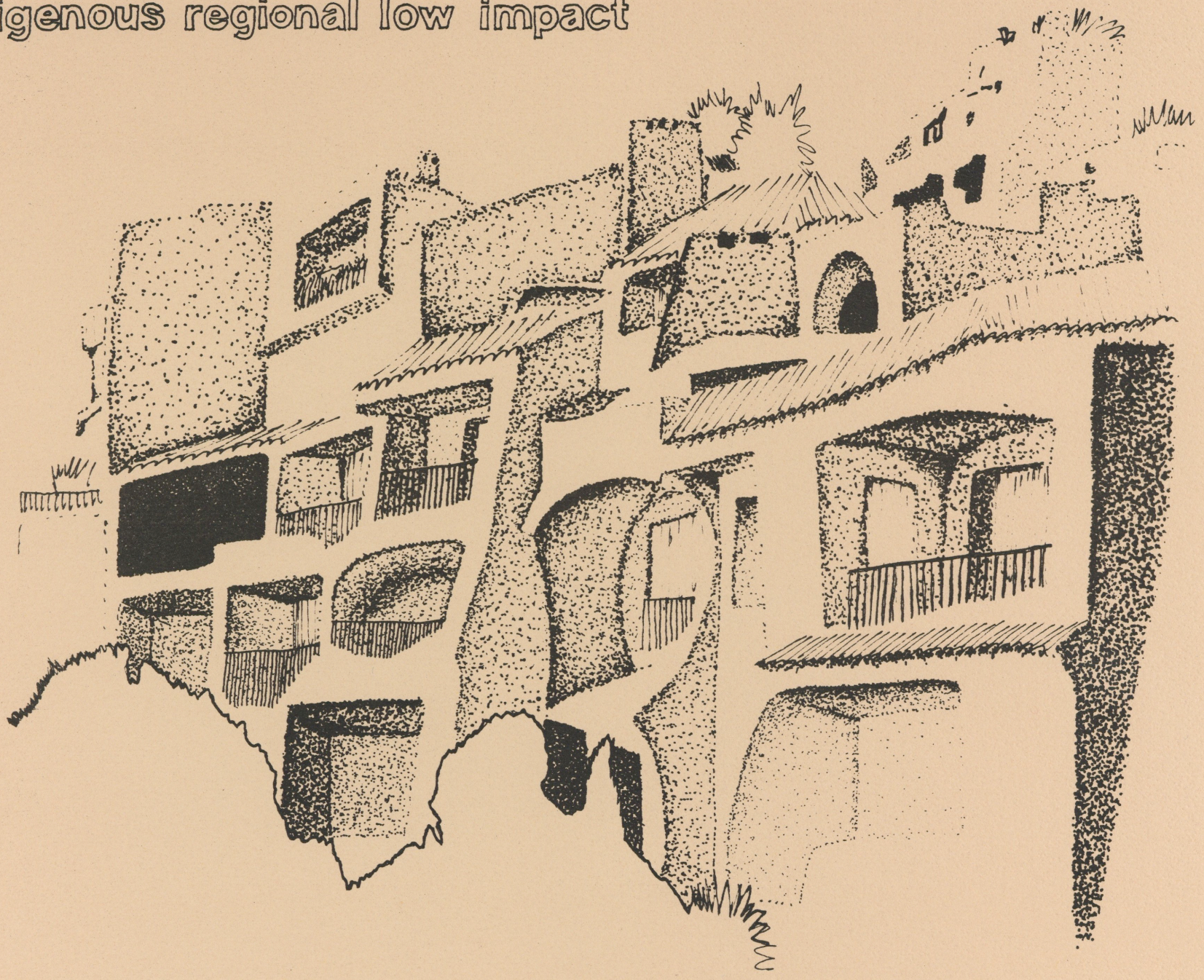


The following sketches represent some of the basic relationships between three basic design considerations which will play an important role in the architects final conceptual solution.

The three basic relationships are: the site (its use or misuse), the scale (dominants, passive etc.), and the character of the facility.

note: these factors have been used to give insight of the different impacts created, not to suggest different design solutions.

indigenous regional low impact



hotel categories

general identification

identification of "resort hotel" with respect to the three general hotel categories

motel and motor inn

generally services a transient clientele with a tendency to function as inns & recreational centers in the suburban environment.

luxury hotels (ie. hilton etc.)

generally services large public gatherings such as conventions etc. with functional emphasis placed on large public rooms & small private guest apartments.

resort hotels

serves to offer a new experience or environment in a less artificial atmosphere. architecture is usually more simplified & placed in a natural setting.

note:

in addition to establishing current architectural trends, it is important to relate other resort philosophies besides the most commonly thought "social resort." these may include the following:

next page

- spiritual development
- physical development
- intellectual development
- psychological development

it is therefore our intent to recommend a philosophy for this facility of:

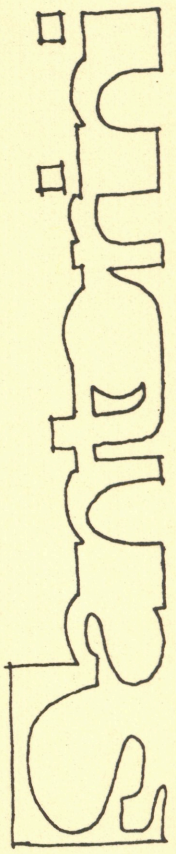
- establishing a facility or environment that reflects the style and attitudes of the tourism reflected.
- to create a facility or environment that develops a sensitive transformation of character more directly identified with the personalities and services to the participants.
- a facility that recognizes a respect for the nature of the site and establishes a composition of interwoven architectural, natural and cultural elements.
- in relation to the present built environment, the facility should compliment and not copy the existing architecture and be sensitive to current building influences (ie. energy etc.) to establish a sense of its place in time.

A place where the earth, sea, fire and wind can meet

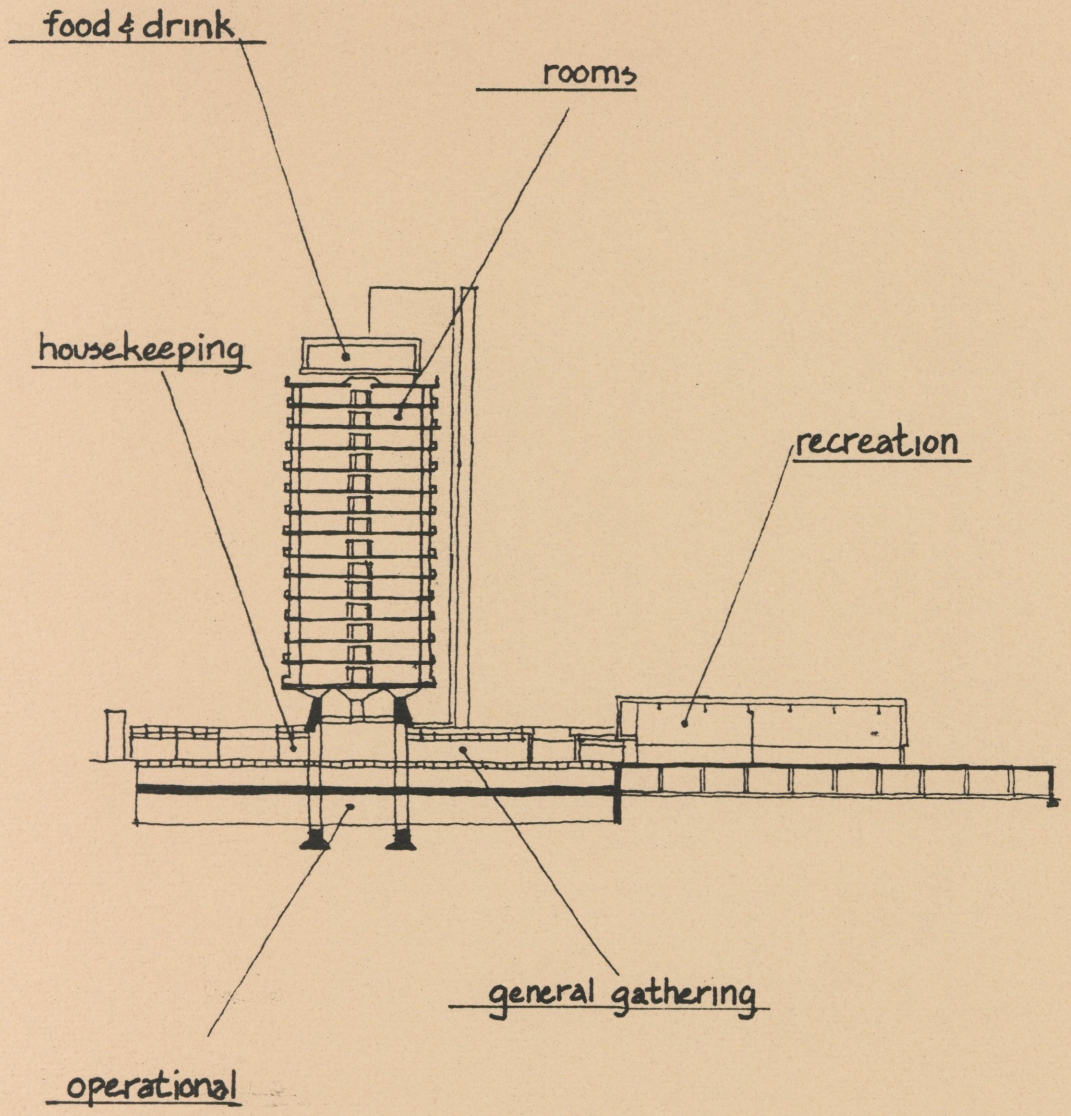
"So associated with these islands are the horrors connected with the wind, with the idea of demons that the devil is often called 'the wind'"

Bent

basic functional spaces of hotels



functional spaces of a typical large scale corporation-type hotel



rooms
- components
  - terrace
  - beds
  - bathrooms (app. 4.0 m²)
  - dressing
- storage
  - luggage
  - cloth hanging
  - drawer
- types
  - cluster (several units become as one)
  - studio (app. 21 m² incl. bath)
  - multi bedroom
  - multi-room
  - autonomous (units contain kithen etc.)
  - interior/exterior
- employer quarters
  - manager
  - housekeeper
  - staff

basic functional spaces

operations
- administration
  - registration area
    - lobby
    - desk
    - information
    - financial transaction
    - communications
  - offices
    - secretary (approx. 8.5 m²/sec.)
    - manager (approx. 10.5 m²)
    - accountant (8.5 m²)
    - banks / vault / files
- housekeeping (daily)
  - maids area
  - storage
    - linen
    - supplies
  - laundry
  - roomcleaning (1 maid / 10-15 rooms)
  - administration (housekeeper)
  - maintenance (annually)
    - storage
    - repair
    - upkeep
    - mechanical

public
- recreation
  - pool / beach
  - tennis court (11 m x 24 m)
  - 9 hole golf course (20.5 hectares)
  - skeet trap range
  - dancing
  - fishing
  - television
  - billiards
  - bowling
  - theatre
  - gymnasium
  - boating
  - recreation indigenous to area
- food and drink
  - types
    - food
      - restaurant
      - banquet room
      - snack bar
      - grill room
      - coffee shop
    - drink
      - bar / lounge
      - night club / disco
- more food & drink components
  - kitchen (1.0 m²/seat, 60% of dining)
  - eating area (1.3 m²/seat)
  - server's station
  - preparation
  - deliveries
  - storage
  - administration / contrd
  - employee dining
- general gathering
  - convention (.6 m²/person)
  - meeting
  - ballroom
  - ceremony hall
  - entry / reception
  - shops / stores
  - music room
  - theatres
  - library

Α'. ΣΑΝΤΟΡΙΝΗ

Σκύψε ἂν μπορεῖς στὴ θάλασσα τὴ σκοτεινὴ ξεχνώντας
τὸν ἦχο μιᾶς φλογέρας πάνω σὲ πόδια γυμνὰ
ποὺ πάτησαν τὸν ὕπνο σου στὴν ἄλλη ζωὴ τὴ βυθισμένη.

Γράψε ἂν μπορεῖς στὸ τελευταῖο σου ὄστρακο
τὴ μέρα τ' ὄνομα τὸν τόπο
καὶ ρίξε το στὴ θάλασσα γιὰ νὰ βουλιάξει.

Βρεθήκαμε γυμνοὶ πάνω στὴν ἀλαφρόπετρα
κοιτάζοντας τ' ἀναδυόμενα νησιὰ
κοιτάζοντας τὰ κόκκινα νησιὰ νὰ βυθίζουν
στὸν ὕπνο τους, στὸν ὕπνο μας.
Ἐδῶ βρεθήκαμε γυμνοὶ κρατώντας
τὴ ζυγαριὰ ποὺ βάραινε κατὰ τὸ μέρος
τῆς ἀδικίας.

Φτέρνα τῆς δύναμης θέληση ἀνίσκιωτη λογαριασμένη
ἀγάπη
στὸν ἥλιο τοῦ μεσημεριοῦ σχέδια ποὺ ὡριμάζουν,
δρόμος τῆς μοίρας μὲ τὸ χτύπημα τῆς νέας παλάμης
στὴν ὠμοπλάτη·
στὸν τόπο ποὺ σκορπίστηκε ποὺ δὲν ἀντέχει
στὸν τόπο ποὺ εἶταν κάποτε δικός μας
βουλιάζουν τὰ νησιὰ σκουριὰ καὶ στάχτη.

Bend if you can to the dark sea forgetting
the flute's sound on naked feet
that trod your sleep in the other,
the sunken life.

Write if you can on your last shell
the day the name the place
and fling it into the sea so that it sinks.

We found ourselves naked on the pumice stone
watching the rising islands
watching the red islands sink
into their sleep, into our sleep.
Here we found ourselves naked, holding
the scales that tipped towards
injustice.

Instep of power, unshadowed will,
considered love,
projects that ripen in the midday sun,
course of fate with a young hand
slapping the shoulder;
in the land that was scattered,
that can't resist,
in the land that was once our land
the island-rust and ash-are sinking

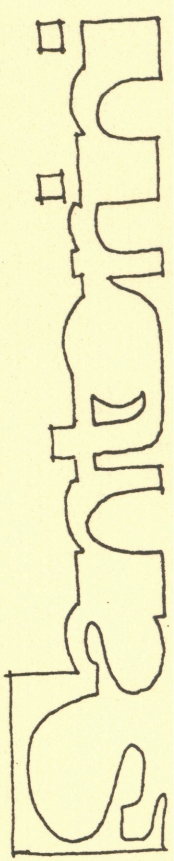
Βωμοί γκρεμισμένοι
κι' οἱ φίλοι ξεχασμένοι
φύλλα τῆς φοινικιᾶς στὴ λάσπη.

Ἄφησε τὰ χέρια σου ἂν μπορεῖς, νὰ ταξιδέψουν
ἐδῶ στὴν κόχη τοῦ καιροῦ μὲ τὸ καράβι
ποὺ ἄγγιξε τὸν ὁρίζοντα.
Ὅταν ὁ κύβος χτύπησε τὴν πλάκα
ὅταν ἡ λόγχη χτύπησε τὸ θώρακα
ὅταν τὸ μάτι γνώρισε τὸν ξένο
καὶ στέγνωσε ἡ ἀγάπη
μέσα σὲ τρύπιες ψυχές·
ὅταν κοιτάζεις γύρω σου καὶ βρίσκεις
κύκλο τὰ πόδια θερισμένα
κύκλο τὰ χέρια πεθαμένα
κύκλο τὰ μάτια σκοτεινά·
ὅταν δὲ μένει πιὰ οὔτε νὰ διαλέξεις
τὸ θάνατο ποὺ γύρευες δικό σου,
ἀκούγοντας μιὰ κραυγὴ
ἀκόμη καὶ τοῦ λύκου τὴν κραυγή,
τὸ δίκιο σου·
ἄφησε τὰ χέρια σου ἂν μπορεῖς νὰ ταξιδέψουν
ξεκόλλησε ἀπ' τὸν ἄπιστο καιρὸ
καὶ βούλιαξε,
βουλιάζει ὅποιος σηκώνει τὶς μεγάλες πέτρες.

Altars destroyed
and friends forgotten
leaves of the palm tree in mud.

Let your hands go traveling if you can
here on time's curve with the ship
that touched the horizon.
When the dice struck the flagstone
when the lance stuck the breat-plate
when the eye recognized the stranger
and love went dry
in punctured souls;
when looking round you see
feet harvested everywhere
dead hands everywhere
eyes darkened everywhere;
when you can't any longer choose
even the death you wanted as your own—
hearing a cry,
even the wolf's cry,
your due:
let your hands go traveling if you can
free yourself from unfaithful time
and sink—
sinks whoever raises the great stones.

analysis of the existing fabric of oia

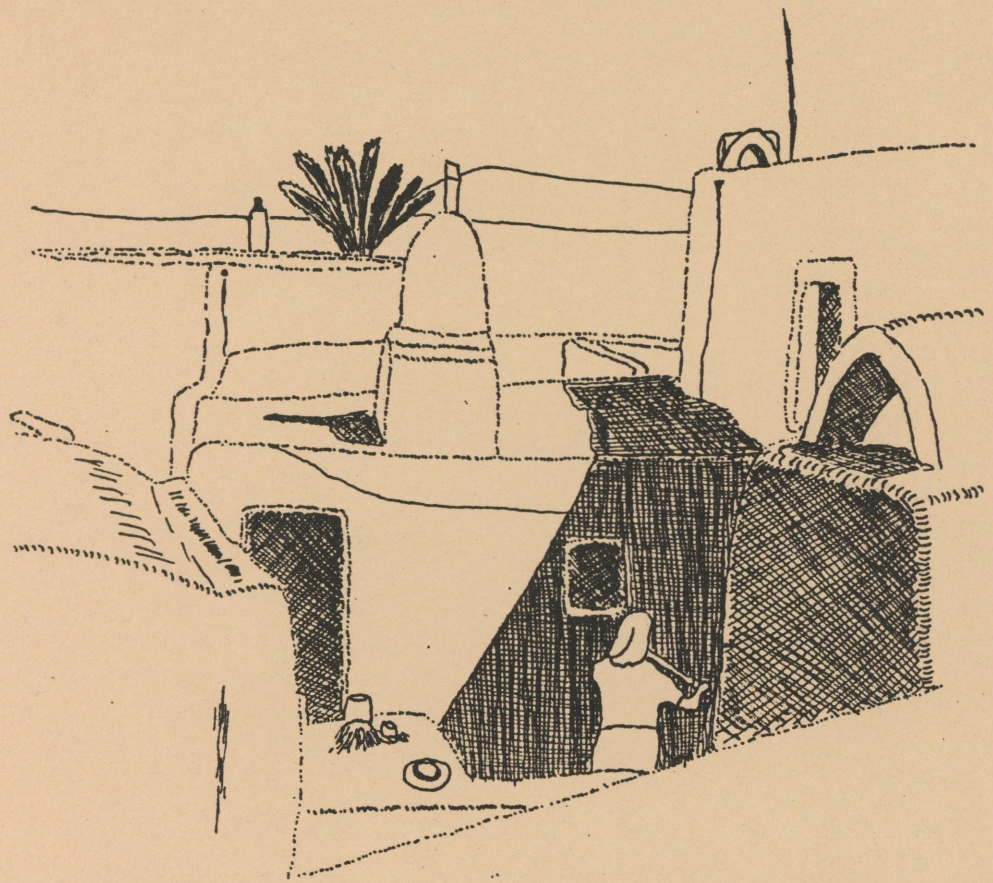


Above all else, the essense of Oia is to be found in a sense of timelessness. Structures have evolved from the ground in response to human needs and the limitations imposed by the natural environment.

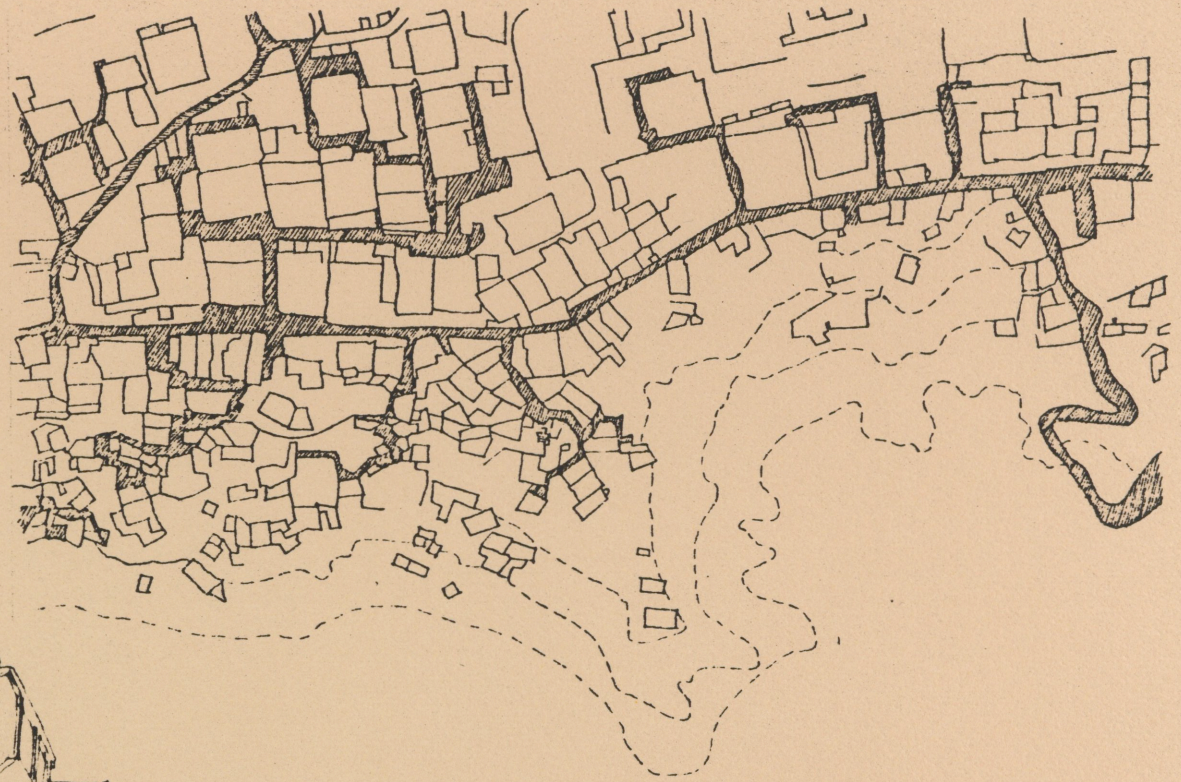
Thousands of years of occupation have defined a traditional existence that capitalizes upon the earth context. Site has been carefully chosen along the upper reaches of the cliff face to avoid the predominant winds sweeping across the gentle back slope and in order to preserve as much of the agricultural base as possible. The situation of Oia also allows its occupants the most favorable solar orientation by having the sun come from behind them in the summer and in front of them in the winter when its warmth is most desirable.

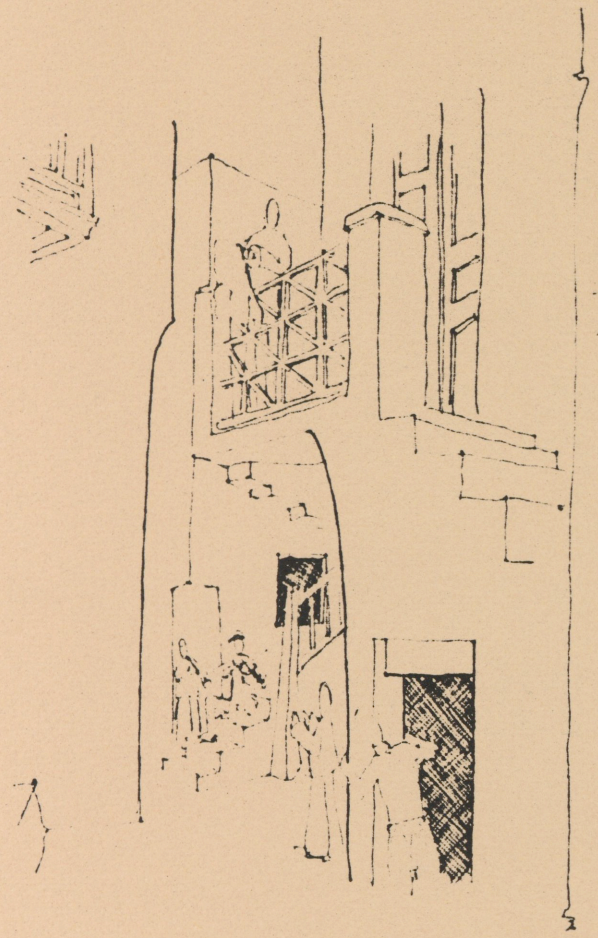
The paucity of building materials and the necessity for strong support has fostered an evolution from out of the earth itself. Base structures are composed of a set of rooms carved out of the soft volcanic cliff face. As more occupation space was required, structures of rubble, surfaced with a pumice plaster, were accreted around these cliff rooms. The dictates of the microrelief and the understood human necessity for unobstructed view have determined the organic form which juts, bobs, and weaves exuding the natural flow of the terrain.

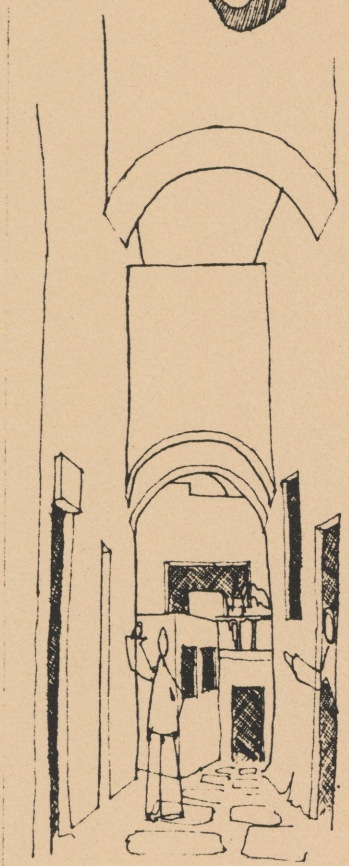
An essentially free people with no domineering political or social organization has assured a sense of human scale since the labor of the building has been confined to the restricted needs of very small groups of people. The shaking of the earth has continually reminded people of their need for solid structural support and has undoubtedly led to the predominance of barrel-vaulted forms. which seem to have a greater survival rate than others. Building so as to use mutual buttressing must also have proved its usefulness through time.

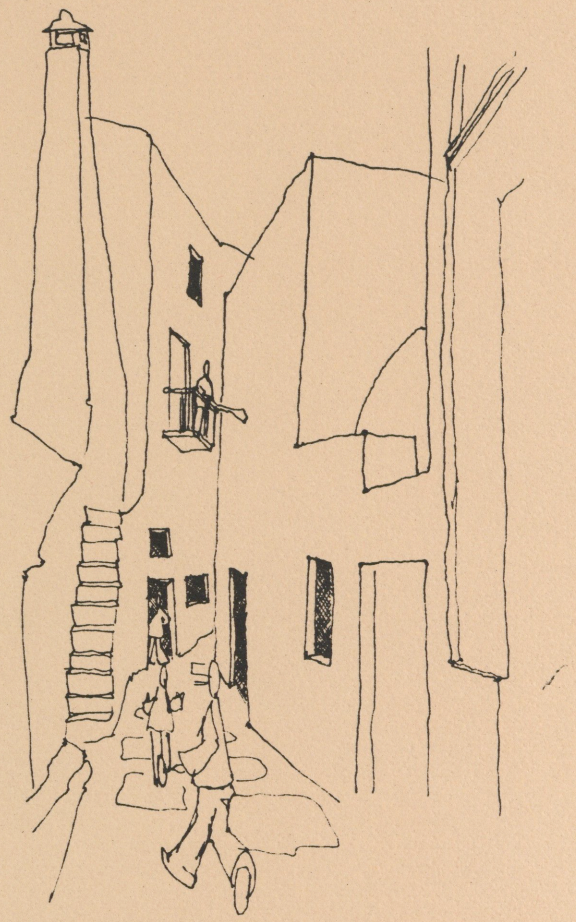


The huddled character with narrow winding passages provides the same sense of security and wind shelter today as it did in the former times of pirates. The dynamism of form and movement is reinforced by the contrast between brilliant white surfaces and a continually changing shadow pattern throughout the day and season.



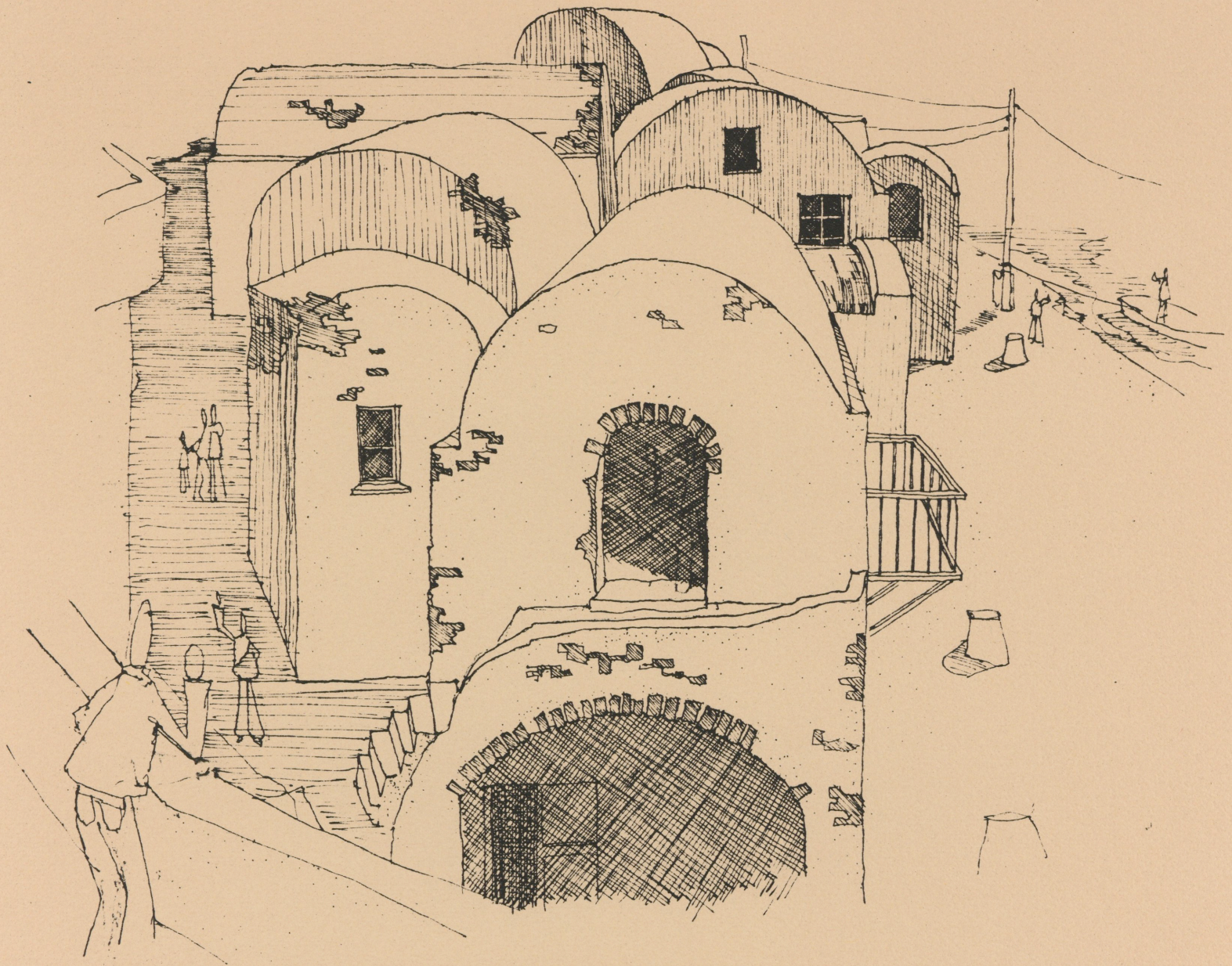






structures built upon and out of the ruins provide a sense of continuum. The building materials are only slightly altered forms of the natural surroundings, thus when structures decay, they become a logical extension of the earth base. They serve as a reminder of the past and as a possible resource for the future.

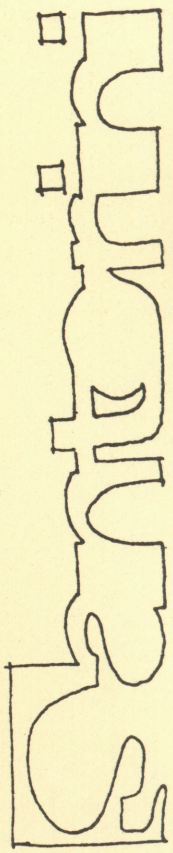
The austerity of the environment has fostered a ~~precise~~ aesthetic that maximizes upon it, use of form such as vaulted roof edges that become gutters along path ways to collect rain water for cisterns. Stones projecting from church domes serve not just as sculptural ornaments but also footholds for dome maintenance.



A particular sense of position in space is achieved by the view in the middle distance of the ancient volcanic cones forming a small island of like material as the island of Thera itself. On clear days, Crete and other islands may be seen in the distance. The middle distance serves as a link between the foreground and the far distant which allows for a unique sense of awareness about one's position in the universe.

The central theme of timelessness is thus suggested in many ways: via the powerful imagery of the ever-present sea view, by the occupation among ruins, and in an overwhelming sense of place which makes time stand still. Secondary themes of an aesthetic preciseness of form and of a dynamism created by organic pathway and changing light and shadow also serve to reinforce the main theme. Any attempt at duplication of this fabric in the same way will inevitably be doomed to failure, but the principles of timelessness, of economy of form, and of dynamism should be the inspiring principles for a new aesthetic expression.

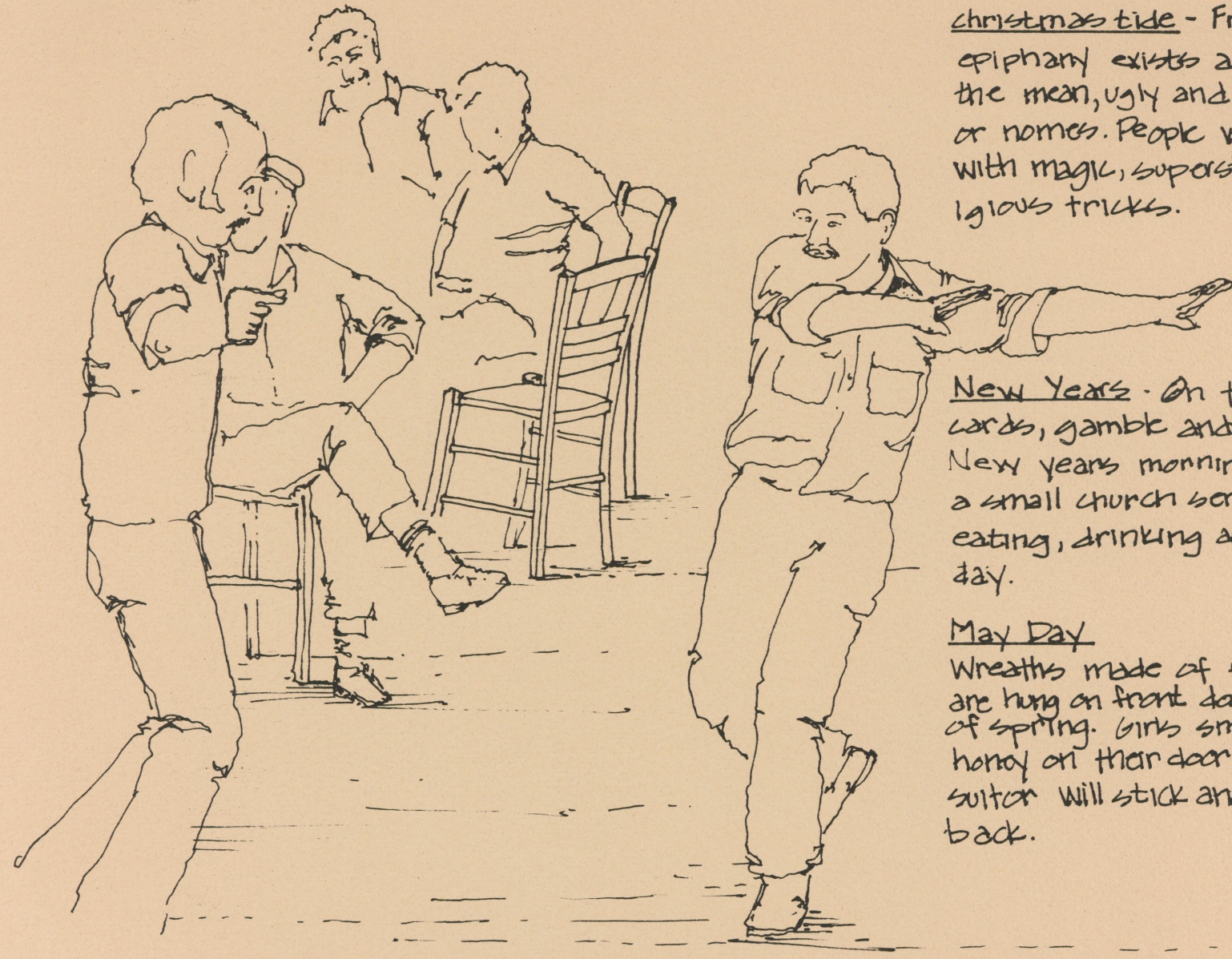
quantitative measures



Daily life is made up from the daily pleasures in which the Greek people work, eat, socialize, and sleep. Work is such a necessity the children attend school for only half a day so they can go out and help provide for the family needs. Their schooling lasts for nine years at which time there are four choices for the student: 1) quit school 2) vocational school 3) general school to prepare for University 4) special school to study humanities, languages, histories etc. For the Greek, post elementary education is a privilage and an honor; but relativly few go on through school because of family economics.

After work the socializing begins with the men at the favorite discussing the days events, exchanging ideas and engaging in politics the Greeks view politics as a passion, for it is a means of expressing ones individual thoughts.

Thinking is one of the Greeks most revered functions of life; there are no limits to their thought and no boundrys to their dreams. Personal expressions also with the physical forms of music and dance at the taverna or at the festivals. The festivals are a celebration of either a religous event or a family event, and they are another link with the family and community. After socializing closes out the day sleep beckons the Greeks to a few passionate moments before the voyage that takes them on to a new day.



festivals

christmas tide - From Christmas to epiphany exists a battle against the mean, ugly and imaginary spirits or nomes. People ward them off with magic, superstition and religious tricks.

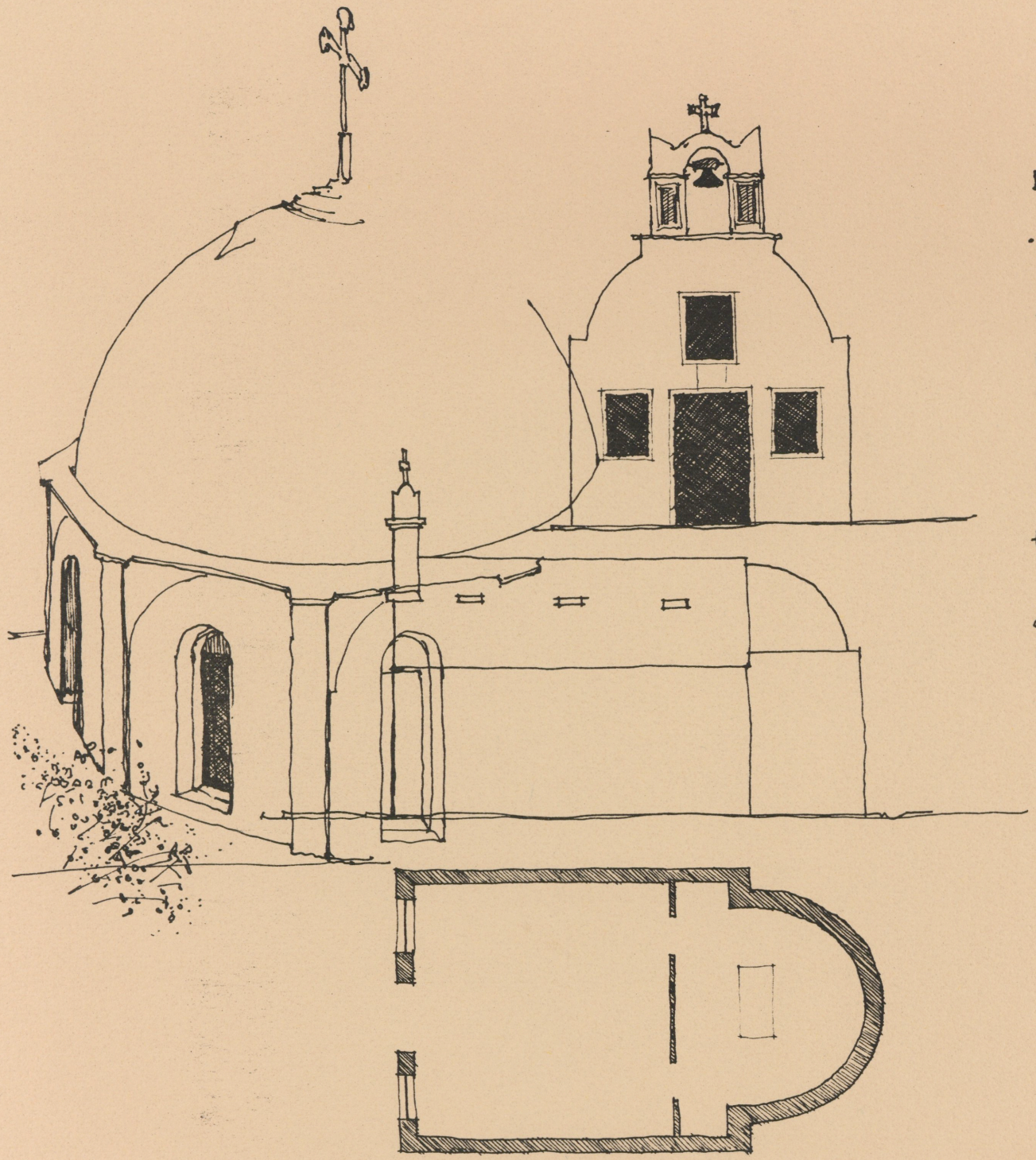
New Years - On the eve men play cards, gamble and drink all nite. New years morning begins with a small church service followed by eating, drinking and dancing all day.

May Day

Wreaths made of fruit and plants are hung on front doors in celebration of spring. Girls smear a cross of honey on their door so that their suitor will stick and keep coming back.

festivals

Easter - Midnight mass in the Orthodox church is followed by a procession through the streets with lit candles, singing hymns of thanksgiving composed in the earliest years of the Byzantine empire. Afterward there is the traditional breakfast, a thick soup brewed from the entrails of paschal lamb.



religion

- Religious reasoning taught by philosophers through history who were convinced of religious necessity for moral continuity.

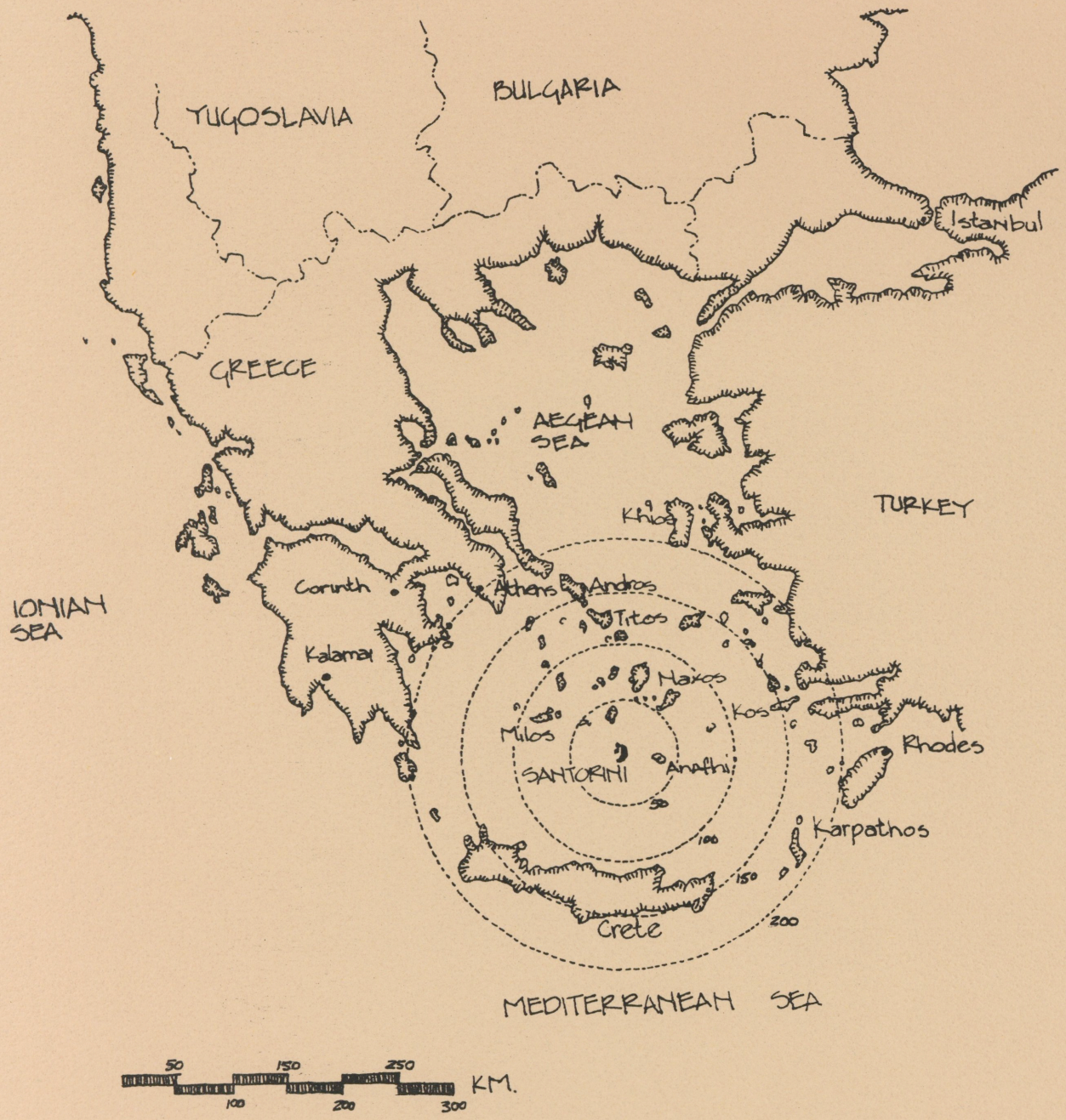
Church doesn't have a great influence on the people today, attendance is dominated by the older generation.

The three dogmatic influences are, God of Greece, Greek Orthodoxy & Catholic Chapel.

patriarchical family

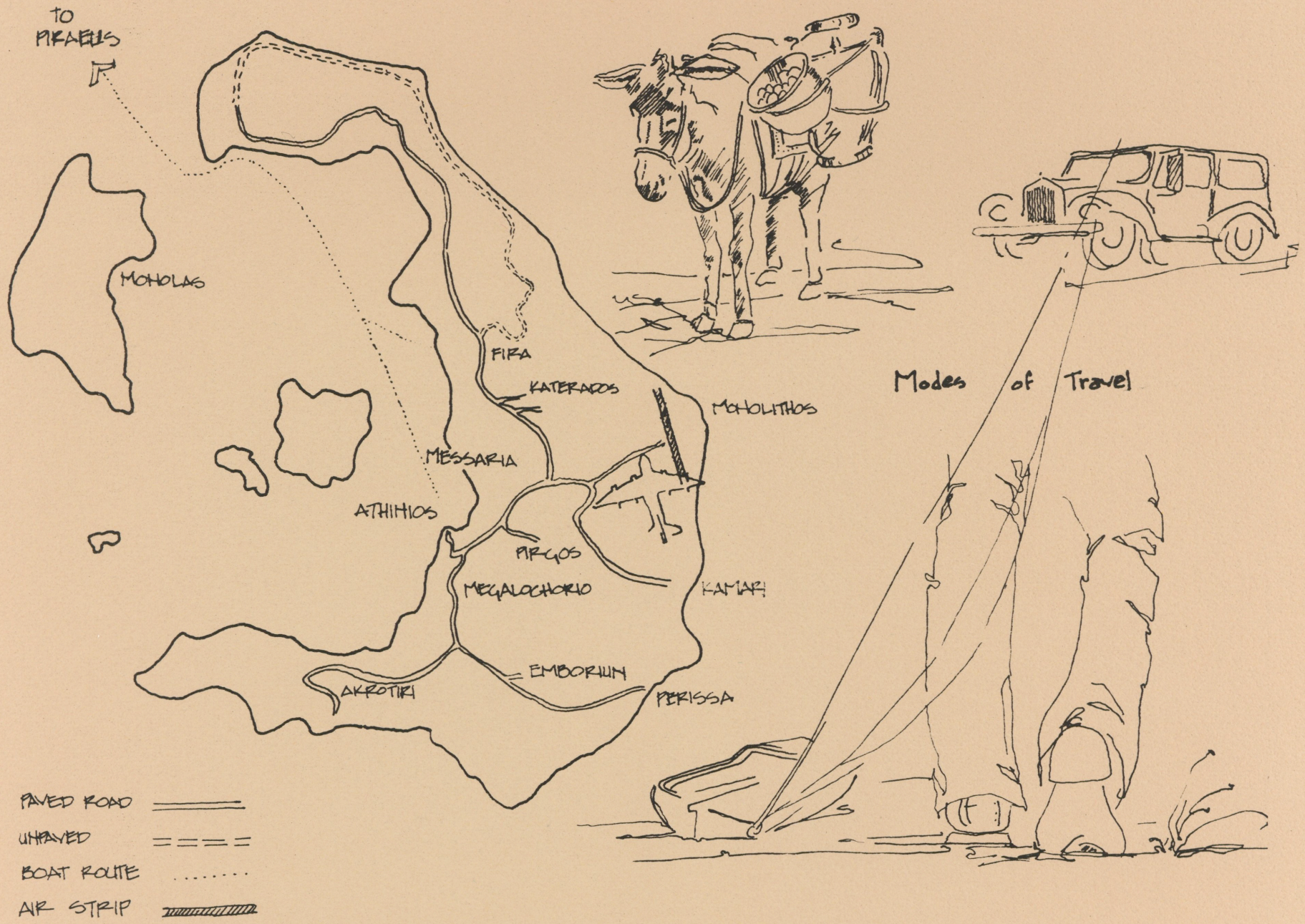
Family honor is the most important concept in family life. The family is a very intimate group, and at festival times it expands into the community.

The man is the provider, the authoritative figure. The woman maintains the household and along with the children help out in the field. The young men work until marriage to preserve the wealth and the property of the family. The young women, the pride of the family build their dowery and contribute to the family wealth.



Santorini's economy produces much of the food for the island, either through the fields or the backyard gardens.

The main crops are, barley, tomatoes, faves beans, and grapes. The grapes are made into a wine that is exported through out Europe. Occasionally when the winter is dry water must be imported to fill the cisterns. Wood is another commodity that is imported because the island has none.


TO PIRAEUS
MOHOLAS
FIRA
KATERADOS
MOHOLITHOS
MESSARIA
ATHINIOS
PIRGOS
MEGALOCHORIO
KAMARI
EMBORIUM
AKROTIRI
PERISSA
PAVED ROAD
UNPAVED
BOAT ROUTE
AIR STRIP
Modes of Travel

occupational types according to social classification

an individual's wealth in terms of cash, property, and possessions influences ones social status...

social classes

upper

- generally higher education means a higher social classification
- Authoritative figures
  - clergy members
  - political figures
  - policeman and officers from the military
  - ultra wealthy members of the community : ship owners
  - wealthy members of community : hotel owners, certain merchants
  - professionals : doctors, lawyers etc.

middle

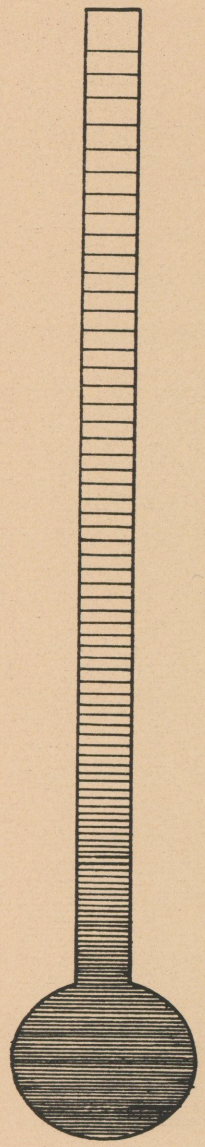
Tourist facilities: shop owners; owners of small hotels, taverna, cafe and resturant owners etc.
Shop Owners: merchant class
Craftsman and skilled labor - cabinet makers, carpenters, plumbers, electricians, general contractors, boat builders, blacksmith, baker, and bus driver etc.

lower

Small scale merchant
Farmers
Fisherman
Laborers

occupational types according to economic classification

a general classification from highest (richest) to lowest (poorest)



→ ship owners – at least 2 families in Oia are on an economic par with Onassis, Niarkos etc.

→ big businessmen - hotel owners, merchants

→ professionals – lawyers, doctors etc.

→ various individuals – with major connections to tourist industry

→ various individuals – with essential stock

→ skilled laborers & craftsmen

→ specialists – bus drivers, boat builders etc.

→ small scale merchants and individuals – with a minor connection to the tourist industry.

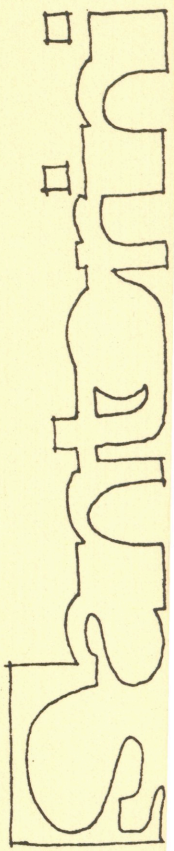
→ farmers

→ fishermen

→ laborers

An awareness of the natural environment is always present.

qualitative measures



The definition of qualitative measures of a group of people is the soul of the people, the essence within the culture which deals with the people's emotions and attitudes about life. It is the prevalent feelings among the people concerning their existence and how it can best be dealt with. For example, is it more of an achievement to accomplish many goals within a span of time or to experience each moment for itself, not as an overall plan? Do the people usually act according to reason or emotion? Are the people tied to strict moral codes?

A large part of what gives an area a sense of place or uniqueness is the true qualitative aspect of the inhabitants. This is important to know as designers but difficult to learn without living among the people. It can best be realized by first hand experience and seeing how the people react physically and emotionally to each situation as it arises.

Therefore, since there is little chance of a class field trip to the site, I have tried to show the qualitative aspects of the people somewhat like they might be learned by visiting the island: through expressions on faces, ideas, and commonly heard phrases. Even more important than trying to understand what types of feelings are shown is to try to understand the intensity and frequency with which they are felt.

one
of the
greatest pleasures
man is capable of
being granted in
this world
is to
sail the aegean
in springtime
when a gentle breeze
is blowing.
i have never
been able to conceive
how heaven
could be in
any way different.

close your eyes
at the horrible hour
of death,
and if you see santorin,
Naxos, Paros, and Mykonos,
you shall enter heaven
directly.

(N. Kazantzakis)

A greek story:

A handsome young stalwart had died in another Cretan village, in the White mountains. His four best friends rose and said, "shall we go and keep the death watch by him, to let the woman rest from their lamenting."

"Yes" they all replied in strangulated voices.

He had been the village's best pallikari, twenty years old, and his death was a dagger thrust in their hearts.

"Someone brought me some raki today", one of the friends remarked "Its mulberry raki, and that can bring even the dead back to life! What do you say, boys, shall I find the bottle and take it along?"

"My ma did her baking today. shall I take a couple barley rolls?"

"I have some pork sausages left. shall I bring along a good string of them?"

"Me, I'll provide the glasses," said the fourth. "And a couple of refreshing cucumbers."

Each took his provisions and thrust them beneath his short shepherds coat of frieze. Come nightfall, all four entered the dead man's house.

Adourned with basil and majoram, the deceased was laid out in his casket, which stood on trestles in the middle of the house. His feet faced the door; around him the woman were wailing the dirge.

"Go and get some sleep, ladies," said the friends, bidding them good evening. "We'll keep vigil by him"

The woman retired to an inner room, bolting the doors. The friends went to the stools, placed the raki and melzedhes at their feet, and gazed tearfully at the deceased. They did not speak. A half hour went by; an hour. Finally one of them lifted their eyes from the corpse.

"What say boys, shall we have a drink?"

"Why sure they all replied, We're not stiffs, are we? Lets drink."

They bent down and picked up the food. One of them lighted a paper and broiled the sausages. A delicious odor invaded the death chamber. They filled the glasses and, enlarging them in their fists to keep from making noise, "clinked" them vigorously.

"God forgive him... Here's to our turn."

"To our turn, God forgive him!"

They tossed off one raki, two, three, ate the mezédhes, reached the bottom of the bottle, began to feel jolly.

They gazed at the corpse again. Suddenly one of them leaped to his feet.

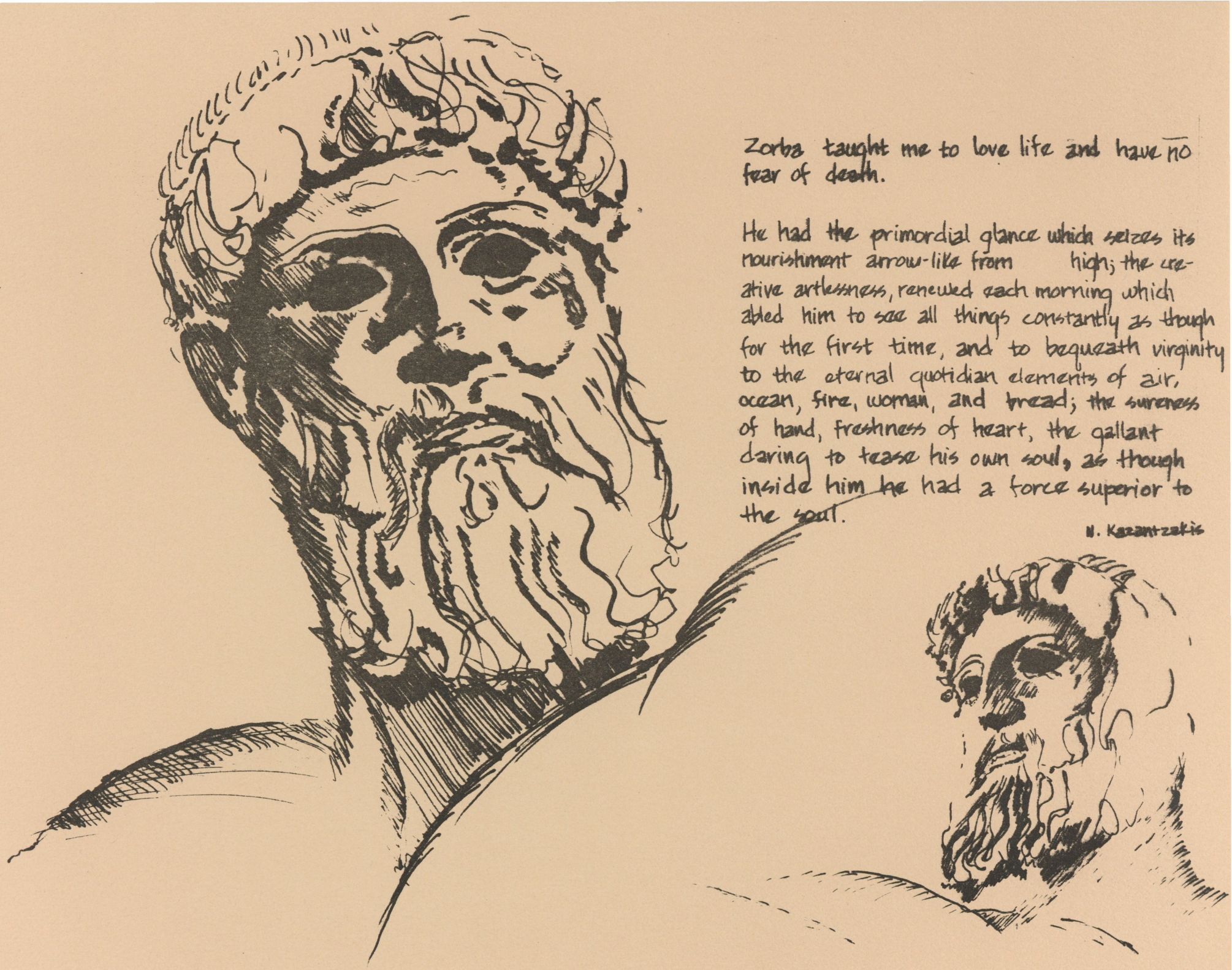
"What say, boys" - he indicated the corpse with a sideways glance - "wanna vault him?"

"Let's"

Tooning up their wide, loose fitting fou fou's they stuffed the ends into their cummerbunds so they would not be hindered in running. Then they transferred the casket to the threshold and opened the door leading to the

courtyard.

Pfft! Pfft! They spat into their palms, took a running start, and began to vault the corpse.



Zorba taught me to love life and have no fear of death.

He had the primordial glance which seizes its nourishment arrow-like from high; the creative artlessness, renewed each morning which abled him to see all things constantly as though for the first time, and to bequeath virginity to the eternal quotidian elements of air, ocean, fire, woman, and bread; the sureness of hand, freshness of heart, the gallant daring to tease his own soul, as though inside him he had a force superior to the soul.

N. Kazantzakis

Nikos Kazantzakis' discription of time spent with Zorba:

I listened to him tell me about his village on the flanks of Mt. Olympus, about snow, wolves, Komitadjis, St. Sophia, lignite, women, God, patriotism, death,— and when the words became too constricting for him and he felt suffocated, he leaped to his feet and began to dance on the shore's coarse pebbles.

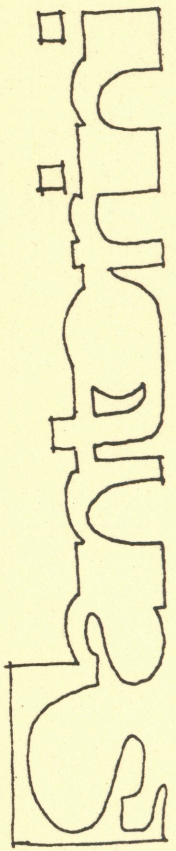
N. Kazantzakis
Report to Greco

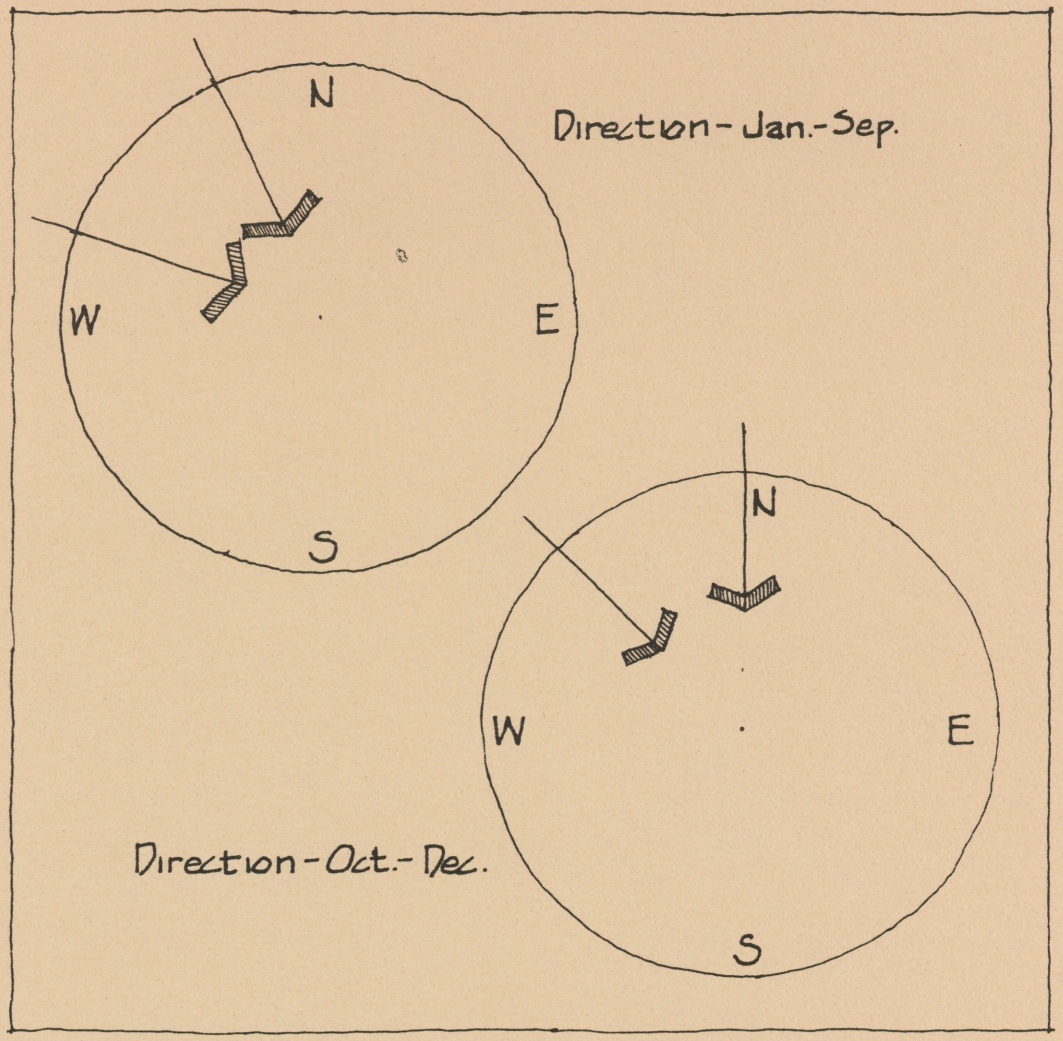
Zorba's dying words to Nikos:

. . . And if any priest comes to confess me and give me communion, tell him to make himself scarce, and may he give me his curse! I did this, that, and the other thing and yet I did very little. Men like me should live a thousand years. Good Night!

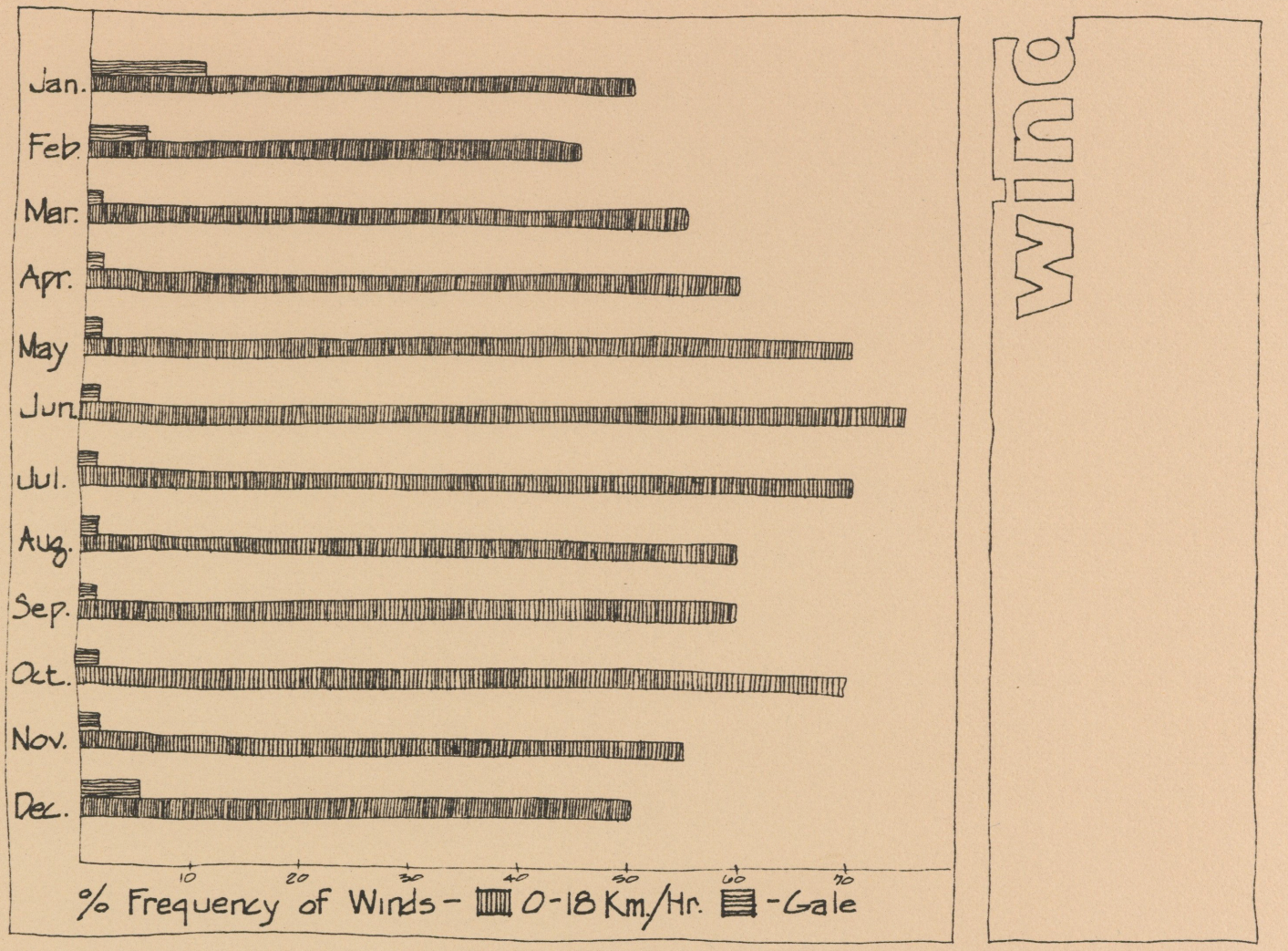
Alexis Zorba.
Report to Greco.

environmental factors





wind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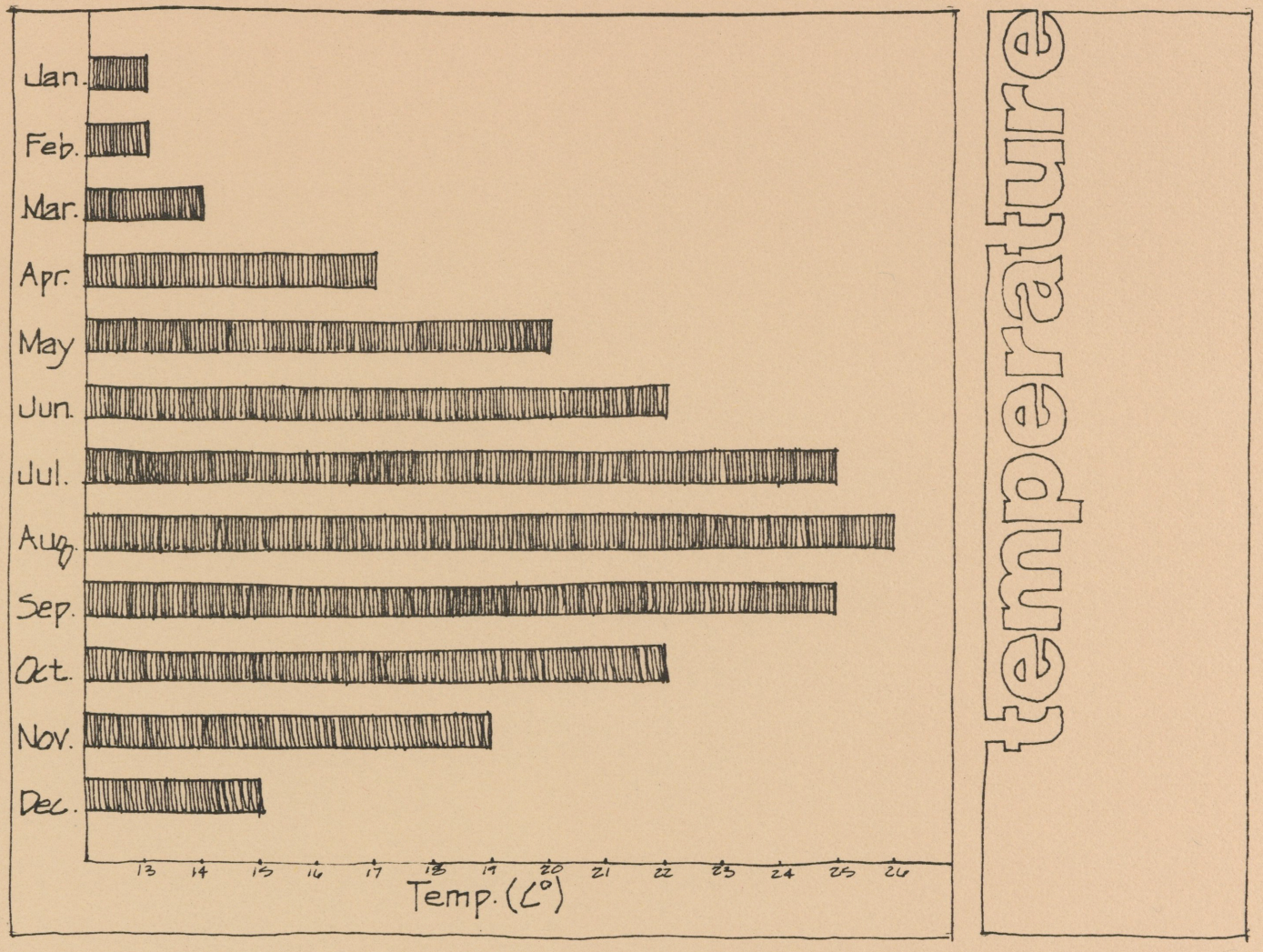
70
% Frequency of Winds - 0-18 Km./Hr. - Gale
wind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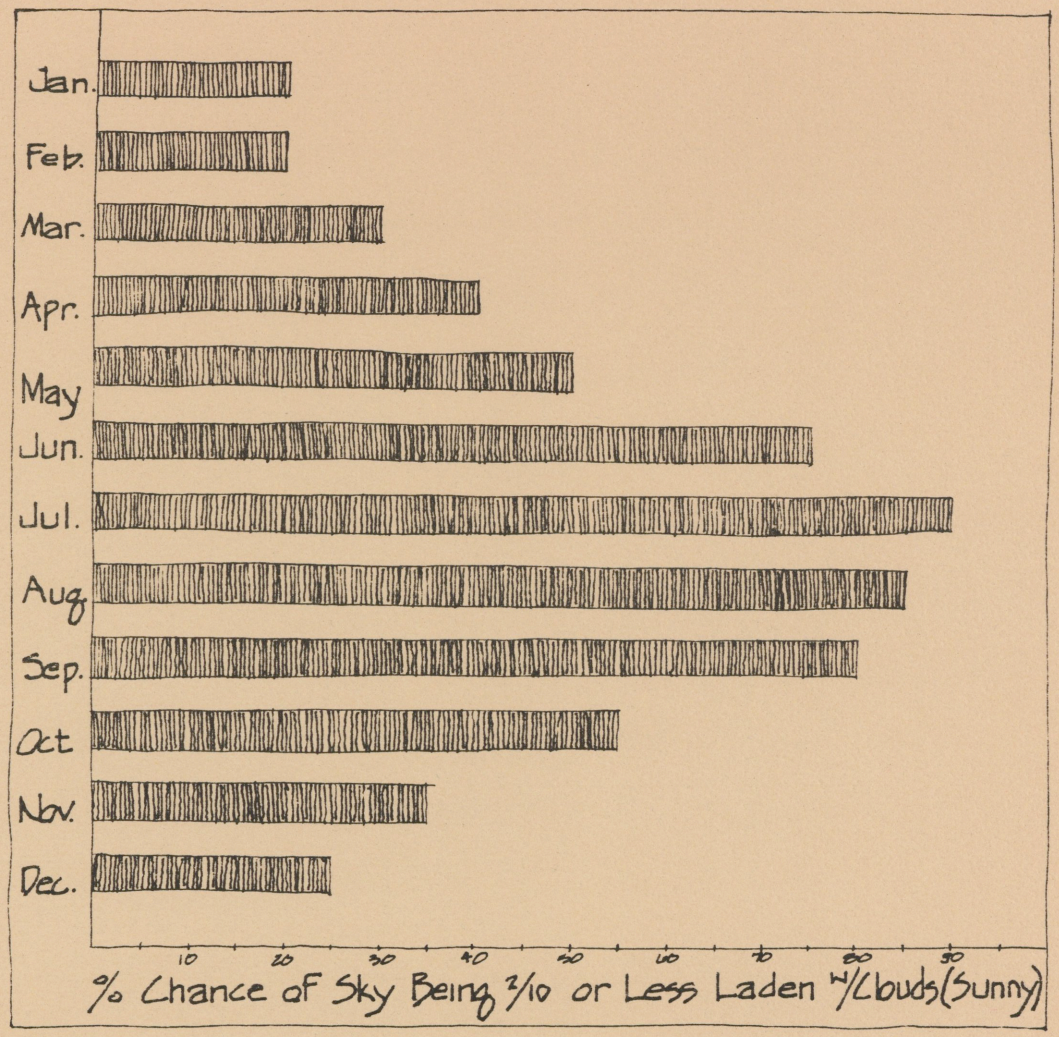
13 14 15 16 17 18 19 20 21 22 23 24 25 26
Temp. (C°)
temperature

cloud cover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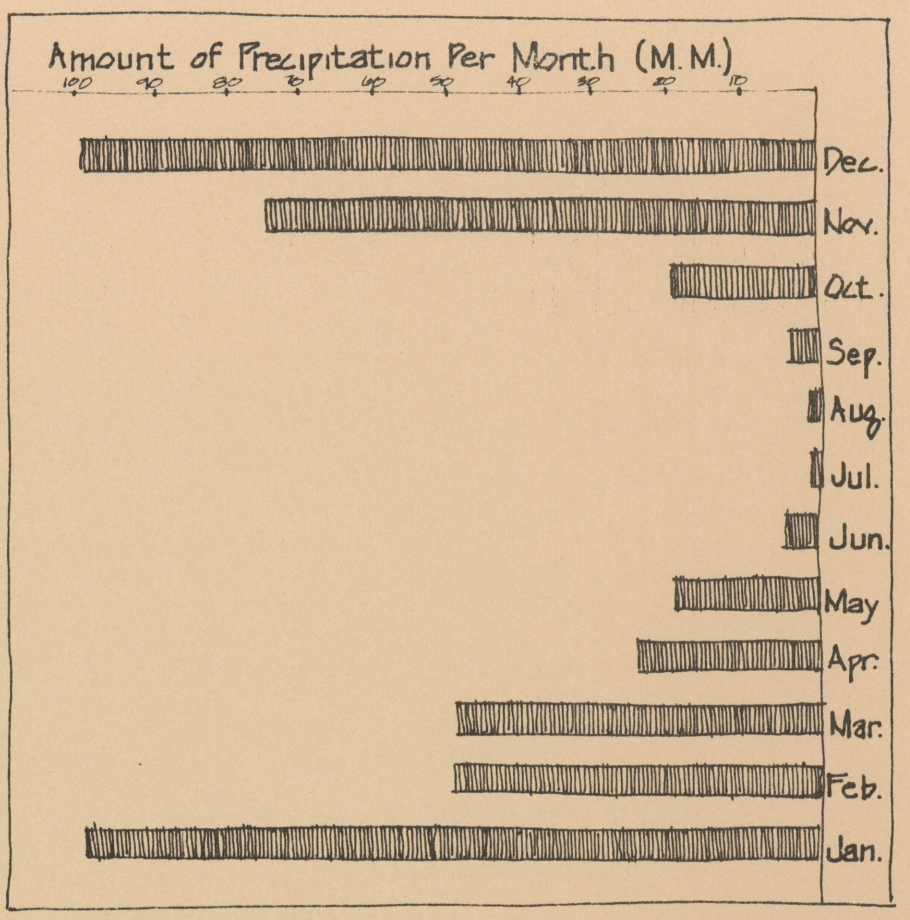
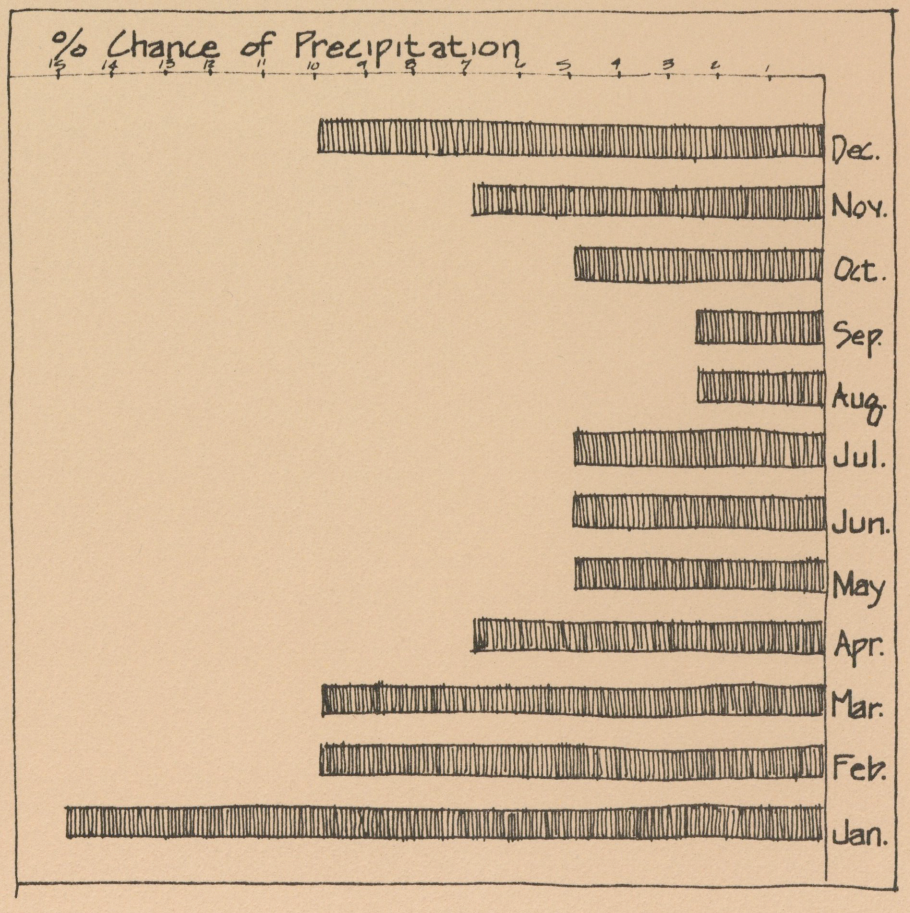
60
70
80
90
% Chance of Sky Being 3/10 or Less Laden W/Clouds (Sunny)

precipitation



precipitation

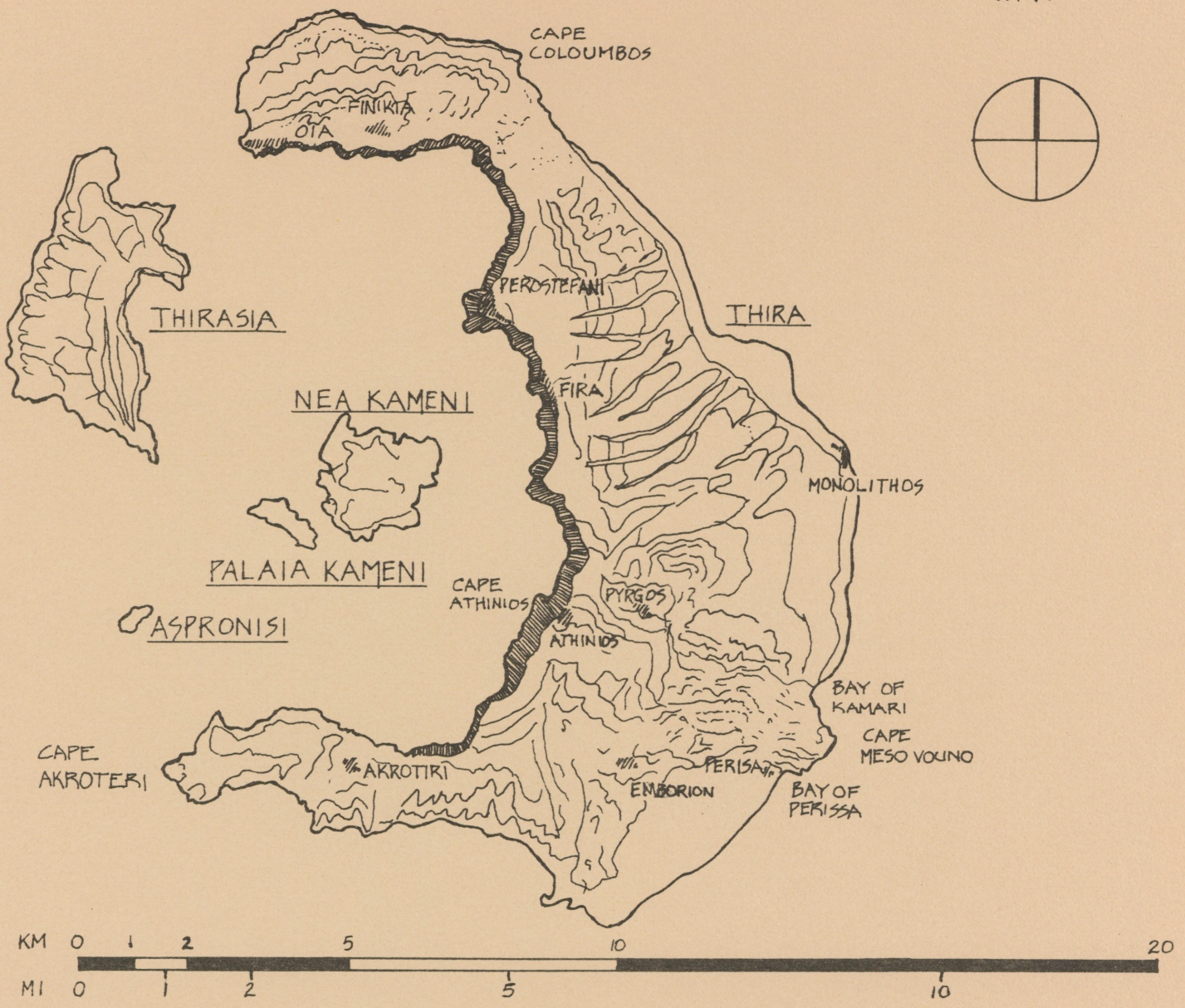


trees

maps & metrics

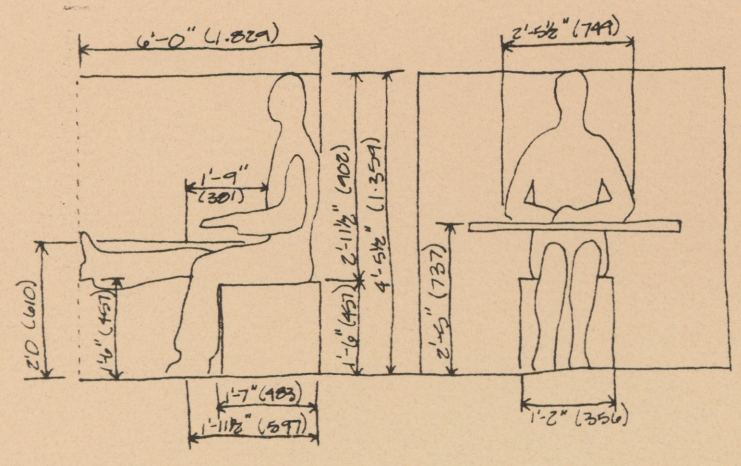
BALGARIJA
JUGOSLAVIJA
TÜRKIYE
ALVANIA
ITALY
Kastoria
Konitsa
Yoannia
Serrai
Drama
Kavalla
Komotini
Thessaloniki
THASOS
SAMOTHRAKI
LIMNOS
Larissa
Volos
SPOADES
AEGAEON
PÉLAGOS
LESVOS
Mytilini
Lamia
Aghrinion
IONION
PÉLAGOS
KEFALLINIA
Patras
ATHINAI
CHIOS
ANDROS
SAMOS
ZAKYNTHOS
Tripolis
Sparti
Kalamai
KYKLÁDES
NAXOS
DODEKÁNISOS
MILOS
SANTORINI
Rodos
RÓDOS
KRITI
Iraklion
TURKIYE

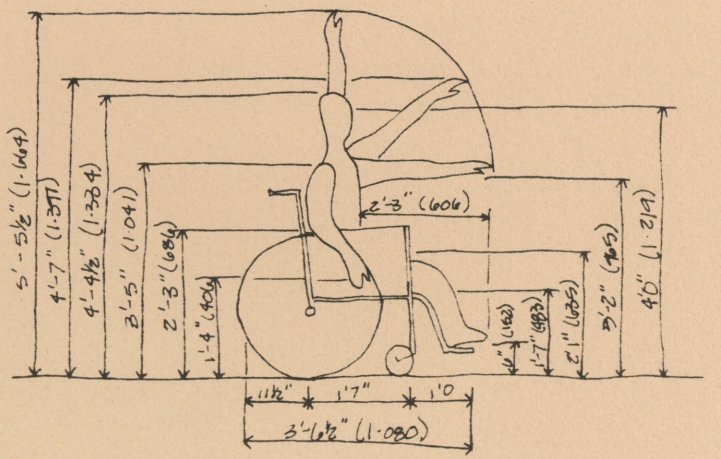
ISLAND OF SANTORINI

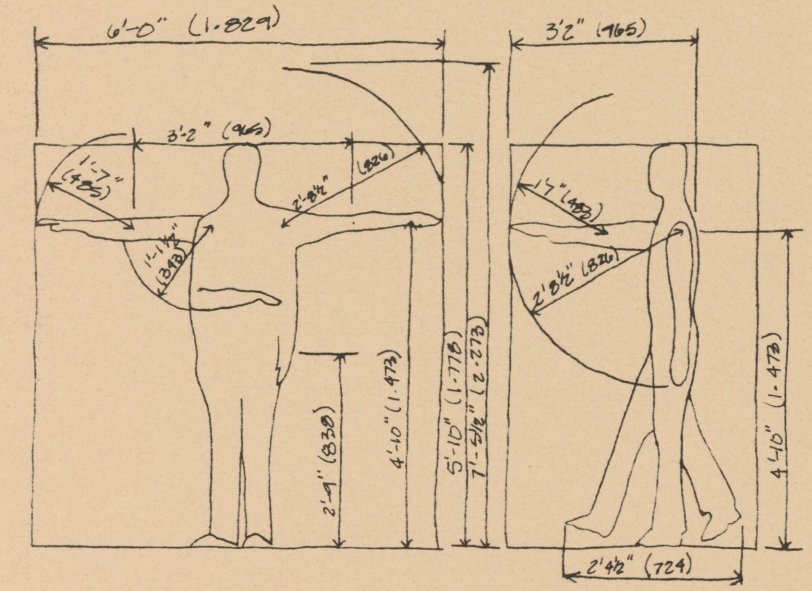


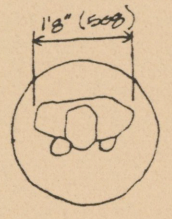
Northern End
of Santorini
MAJOR VEHICULAR ROUTE
PEDESTRIAN-MULE PATHS
THIRA
FIRIRA
OIA
0
250 M
500 M
1 KM
2 KM
Linear Scale
1
2
5
10
20
30
Walking Scale (Minutes)

Meters
10 5 0 10 20 30 100
0 .5 1 1.5
Walking in Minutes
Contours Every 2.0 Meters
Site Plan
95 M
200 M
RETAINING WALL
PAVED ROAD
RETAINING WALL
190 M
ELEV. +18 M
TO DIA.
200 M
FOOT PATH
RETAINING WALL


6'-0" (1.829)
2'-5½" (749)
1'-9" (301)
2'-11½" (902)
1'-6" (457)
4'-5½" (1.359)
2'0 (610)
4'6" (457)
2'-4½" (737)
1'-7" (483)
1'-11½" (597)
1'-2" (356)


5'-5½" (1.664)
4'-7" (1.397)
4'-4½" (1.384)
3'-5" (1.041)
2'-3" (686)
1'-4" (406)
2'-3" (606)
6" (152)
1'-7" (483)
2'1" (635)
3'-2" (965)
4'0" (1.219)
11½"
1'7"
1'0
3'-1½" (1.080)


6'-0" (1.829)
3'2" (965)
3'-2" (965)
1'-7" (483)
2'-8½" (826)
1'-7" (483)
1'-11½" (597)
2'-8½" (826)
2'-9" (838)
4'-10" (1.473)
5'-10" (1.778)
7'-5½" (2.273)
4'-10" (1.473)
2'4½" (724)


1'8" (508)

Ft.	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"
0	0	3	5	8	10	13	15	18	20	23	25	28
1	31	33	36	38	41	43	46	48	51	53	56	58
2	61	64	66	69	71	74	76	79	81	84	86	89
3	91	94	97	99	102	104	107	109	112	114	117	119
4	122	125	127	130	132	135	137	140	142	145	147	150
5	152	155	158	160	163	165	168	170	173	175	178	180
6	183	185	188	191	193	196	198	201	203	206	208	211
7	213	216	218	221	224	226	229	231	234	236	239	241
8	244	246	249	252	254	257	259	262	264	267	269	272
9	274	277	279	282	285	287	290	292	295	297	300	302
10	305	307	310	312	315	318	320	323	325	328	330	333
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12	366	368	371	373	376	379	381	384	386	389	391	394
13	396	399	401	304	406	409	412	414	417	419	422	424
14	427	429	432	434	437	439	442	445	447	450	452	455
15	457	460	462	465	467	470	472	475	478	480	483	485
16	488	490	493	495	498	500	503	506	508	511	513	516
17	518	521	523	526	528	531	533	536	539	541	544	546
18	549	551	554	556	559	561	564	566	569	572	574	577
19	579	582	584	587	589	592	594	597	599	602	605	607
20	610	612	615	617	620	622	625	627	630	633	635	638
21	640	643	645	648	650	653	655	658	660	663	665	668
22	671	673	676	678	681	683	686	688	691	693	696	699
23	701	704	706	709	711	714	716	719	721	724	726	729
24	732	734	737	739	742	744	747	749	752	755	757	759
25	762	765	767	770	772	775	777	780	782	785	787	790
26	793	795	798	800	803	805	808	810	813	815	818	820
27	823	826	828	831	833	836	838	841	843	846	848	851
28	853	856	859	861	864	866	869	871	874	876	879	881
29	884	886	889	892	894	897	899	902	904	907	909	912
30	914	917	920	922	925	927	930	932	935	937	940	942

i must go down to the sea again, for the call of
the running tide
is a wild call that may not be denied...
and all i ask is a windy day
with the white clouds flying
and the flung spray and the blown spume
and the sea gulls crying

john masefield

available resources

physical properties of native materials

	soft	hard	porous	non porous	light	dense
red rock	●		●		●	
black rock		●		●		●
pumice ash	●		●		●	
concrete block		●	●		●	
poured block		●		●		●
wood	●		●		●	

note: The material provided in this section is to inform you on the available resources and materials on this island. It is not intended to limit your design to those materials.

materials readily available on island

red volcanic rock
black volcanic rock
pumice ash
concrete block

note: it is assumed that all of the materials available to us now will be available to the island, for a price.

construction techniques

most work done now is by hand, without the use of power tools.

note: It is assumed that all modern equipment is also available

construction uses of native materials

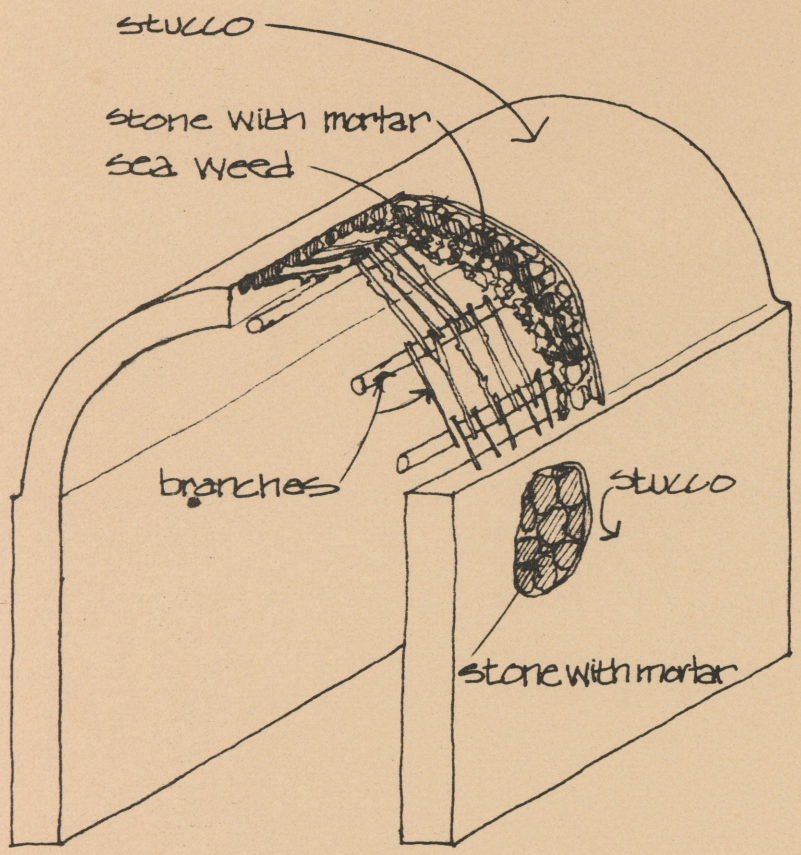
materials \ construction use	insulation	acoustical barrier	water proofing	vaulting	structual walls	beams	finishing material	paving material
red rock	●	⊗	○	●	●	▭	⊗	○
black rock	⊗	⊗	⊗	⊗	●	▭	⊗	●
pumice ash[1]	●	⊗	○	▭	▭	▭	▭	▭
concrete block	⊗	⊗	⊗	▭	●	⊗	⊗	▭
reinforced conc.	●	●	●	●	●	●	●	●
wood	⊗	⊗	⊗	●[2]	●	●	●	▭
sea weed	⊗	⊗	●	●[3]	▭	▭	▭	▭
stucco	⊗	⊗	●	▭	▭	▭	●	▭

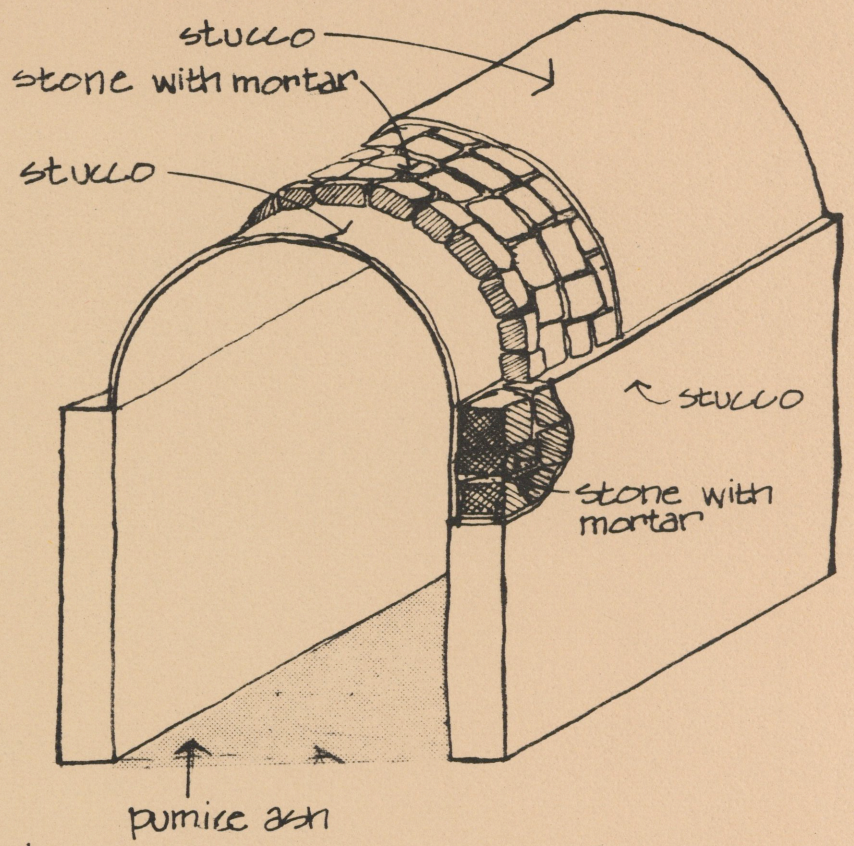
notes:

1. mixed with mortar to form a strong bonding agent
2. used to make forms for vaults
3. used as a sealant in early vaults

legend

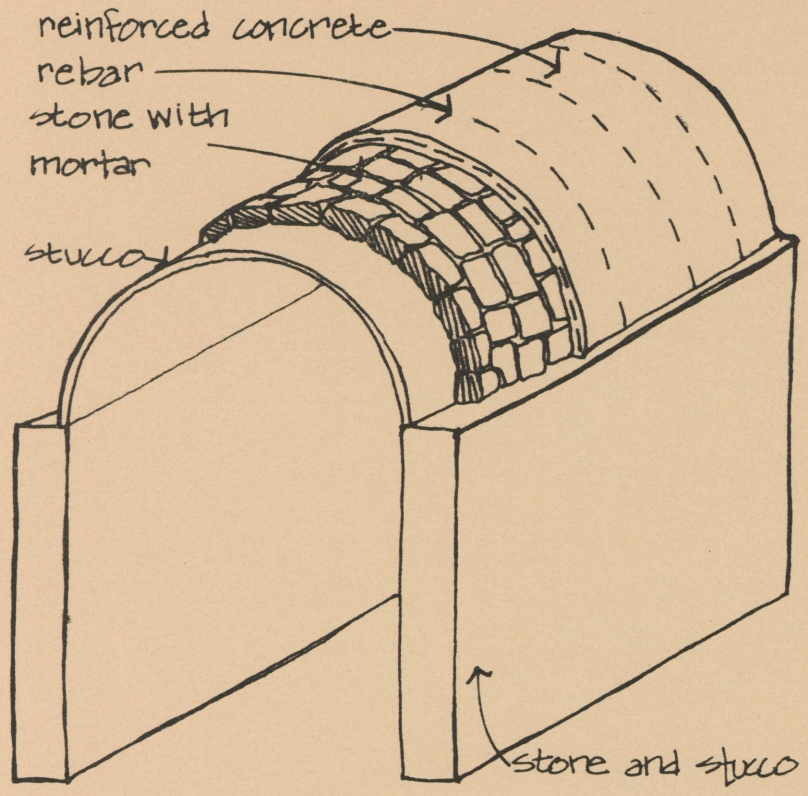
- ● good
- ⊗ fair
- ○ poor
- ▭ not applicable

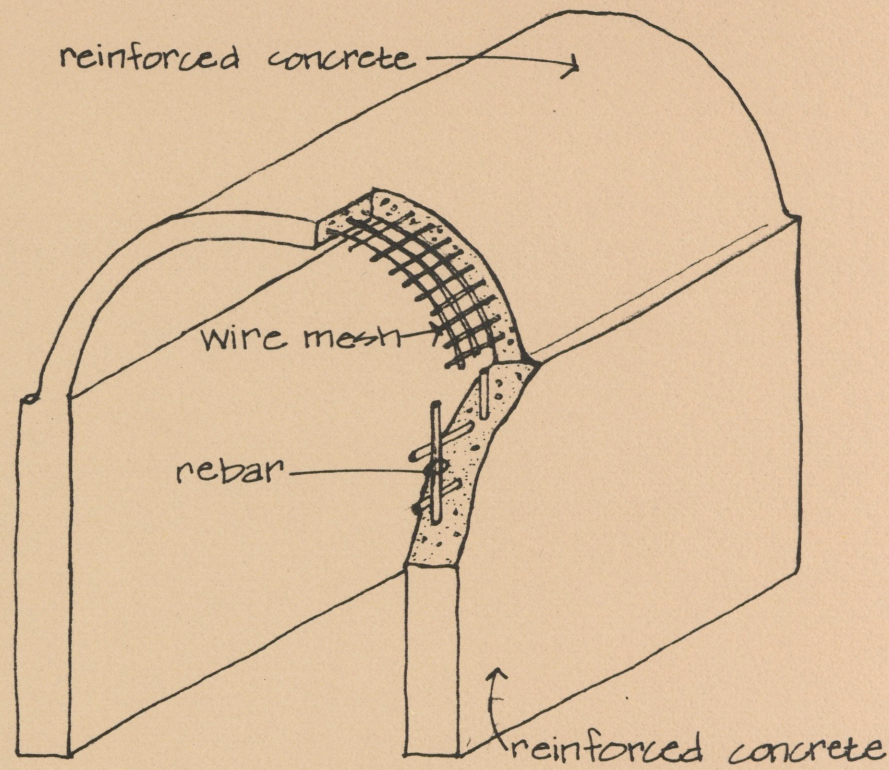




note:

Pumice ash is used to create the form for the barrel vault It was filled in between the structual walls and packed to form the vault. The stone and mortar was placed and when set the ash was dug out of interior and finish applied

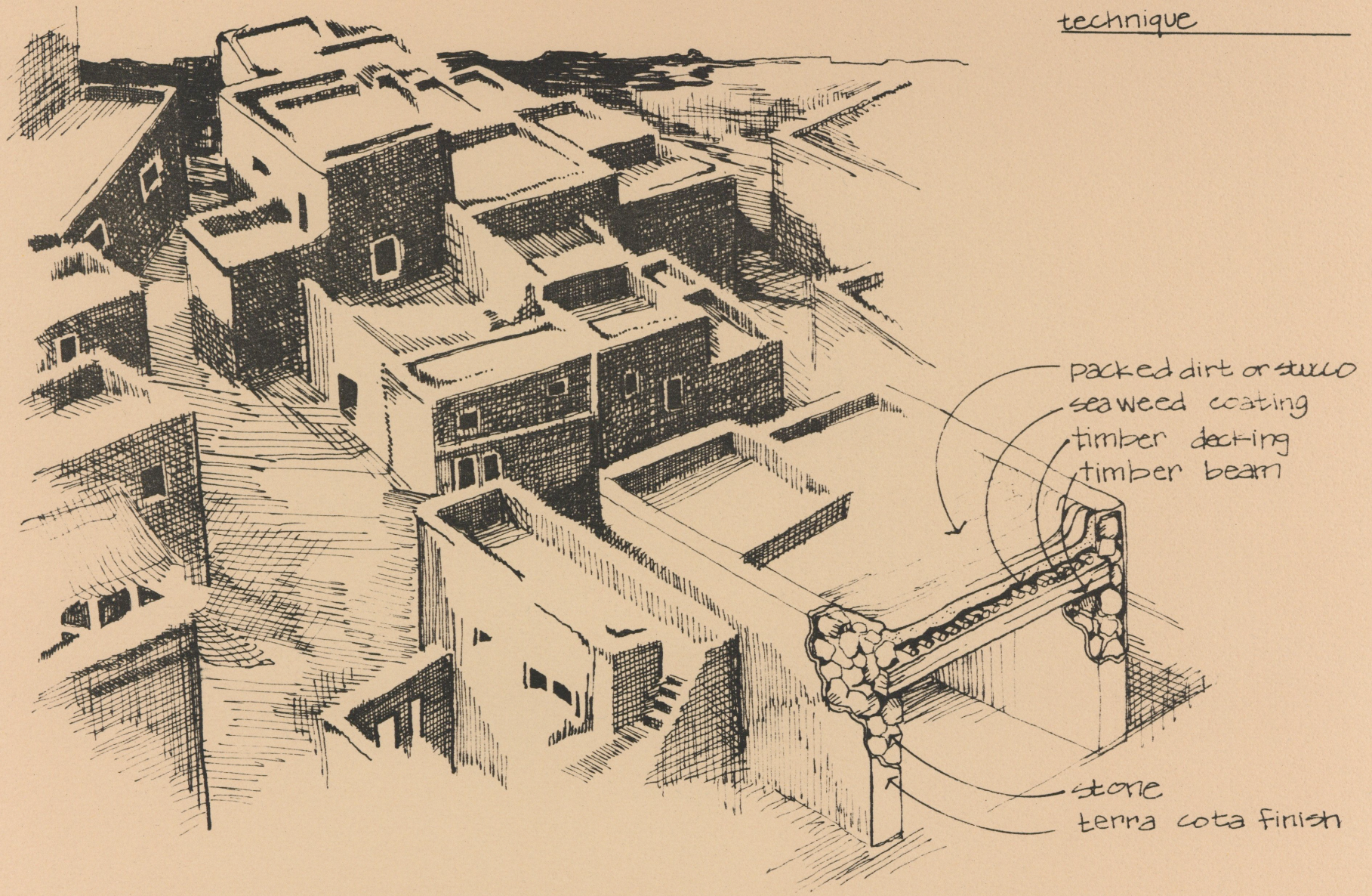


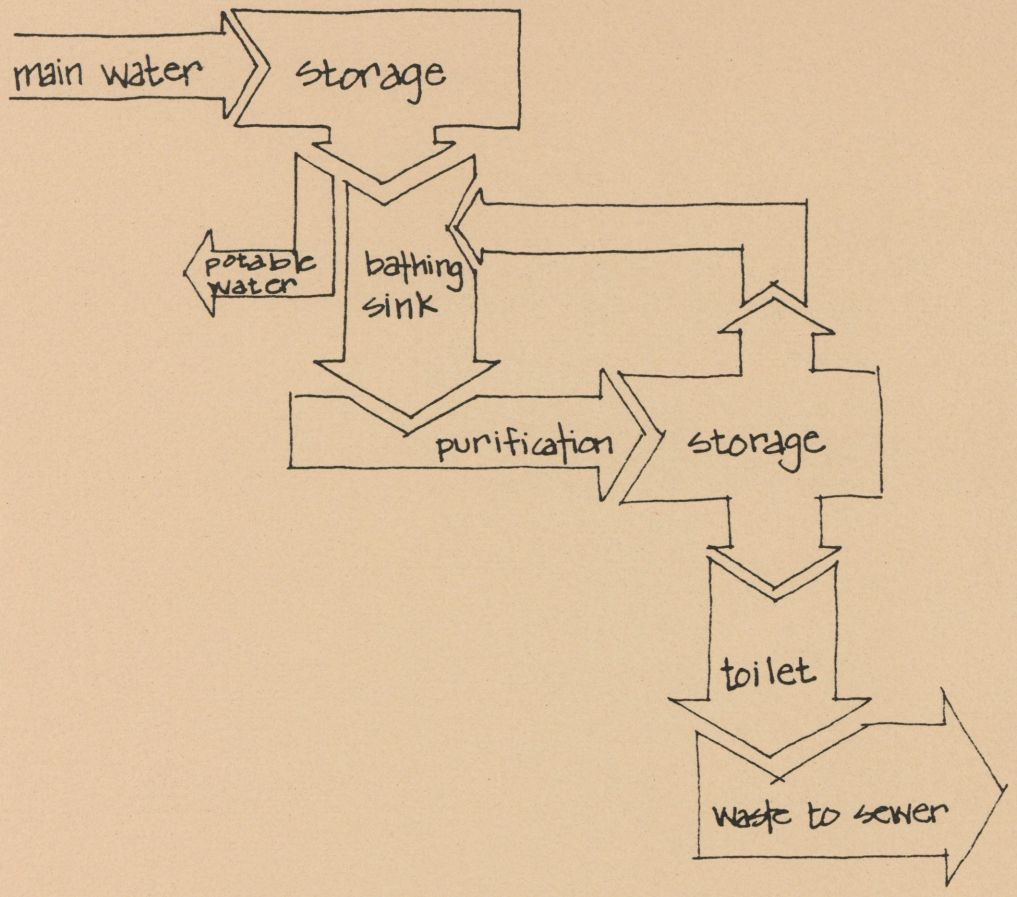


By not providing for lateral reinforcing it shows an attempt of the people to improve technology, but without a full understanding of the properties of materials

note: wood forms are used

minoan constuction technique





three main water systems in the home

1. use of bucket down to cistern
2. gravity feed with storage tank on roof
3. electric pump from cistern to provide pressurized water

cost of bought water

1000 dpx / 6500 liters
$28.50 / 1717 gallons
1.65¢ / gallon

an average tourist uses 6500 liters in 7-10 days

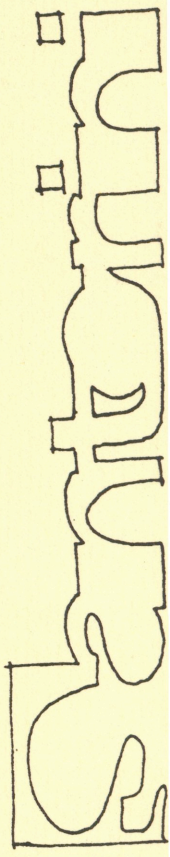
utilities

- propane gas is available as fuel
- electricity is now provided to the entire island by an oil fired generator
- garbage is collected by a person and to a central pit by a burro
- hvac is non existant in the venacular cave as a natural by-product of indigenous materials, but may be essential in other dwellings dependent upon site location and building materials
- waste disposal takes an older form in the use of out houses. A central sewage system does exist and is available for a price in the village.

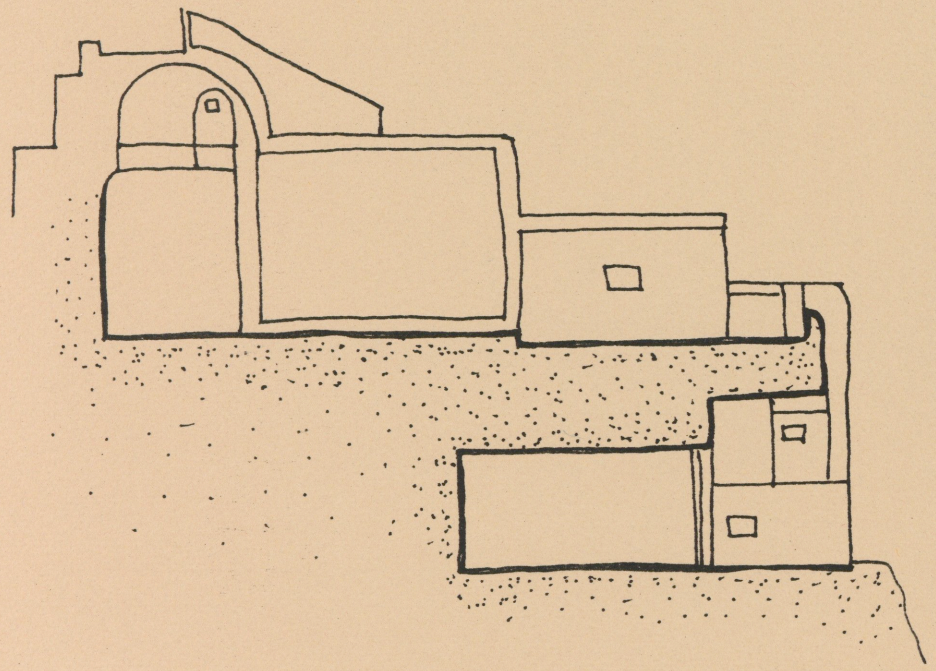
building codes

- traditionally all buildings had to be approved by an archeological society for aesthetics. Jurisdiction has now been taken away from this society and an office of building permits now reviews all proposed plans, focusing on the structual and functional aspects of the building.

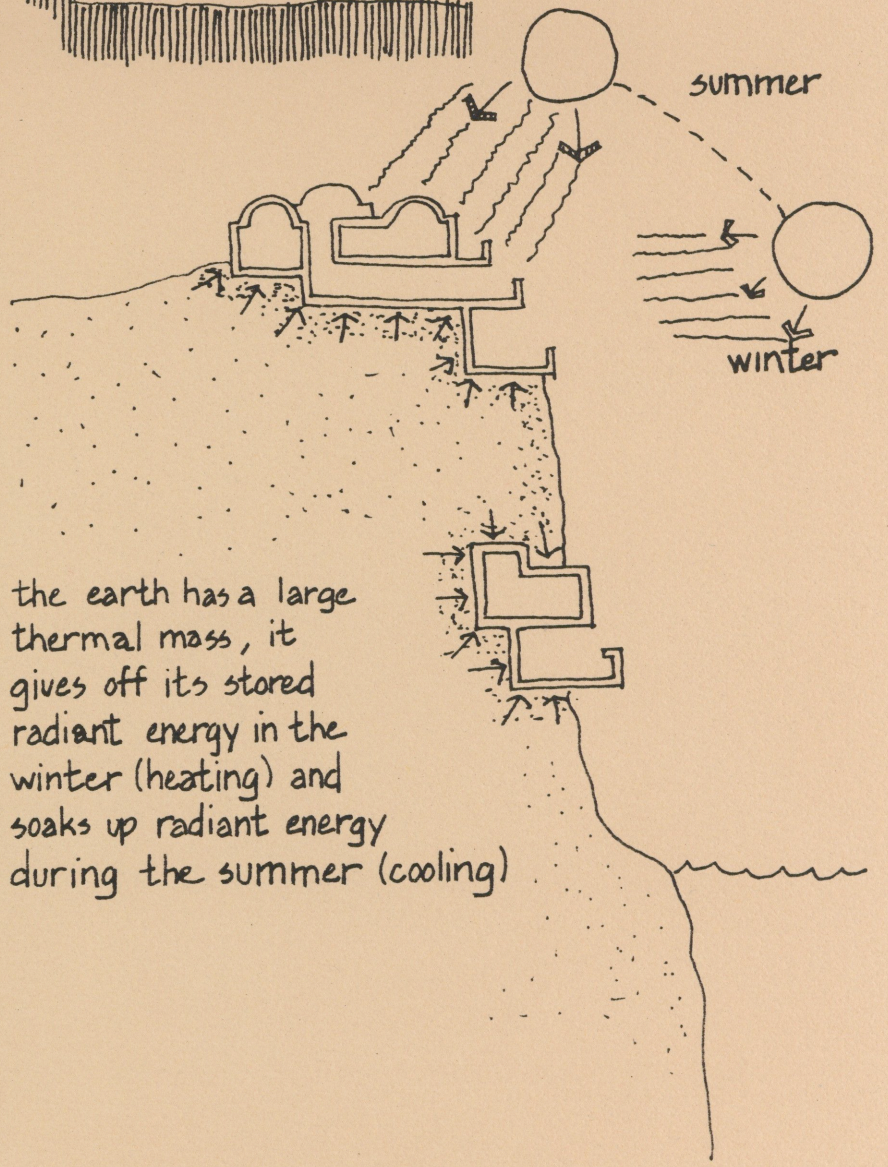
underground architecteure applications



physical dwelling space

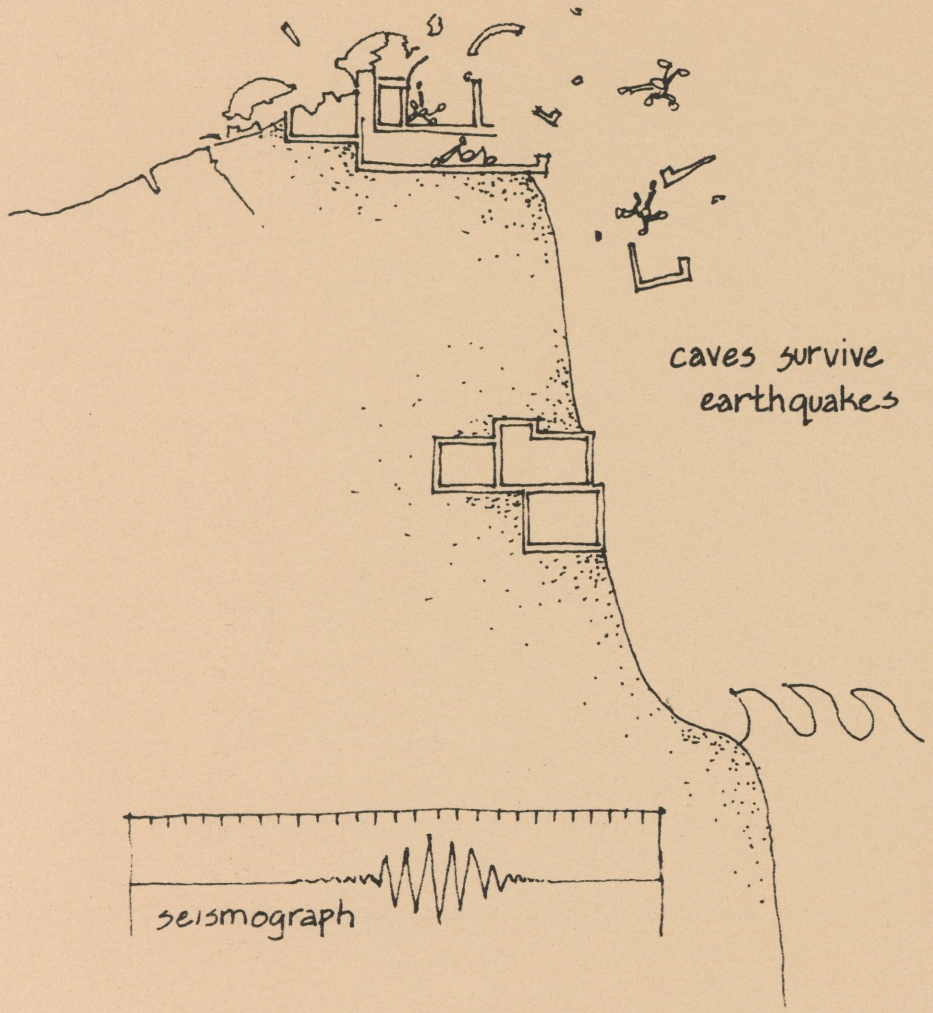


physical insulation

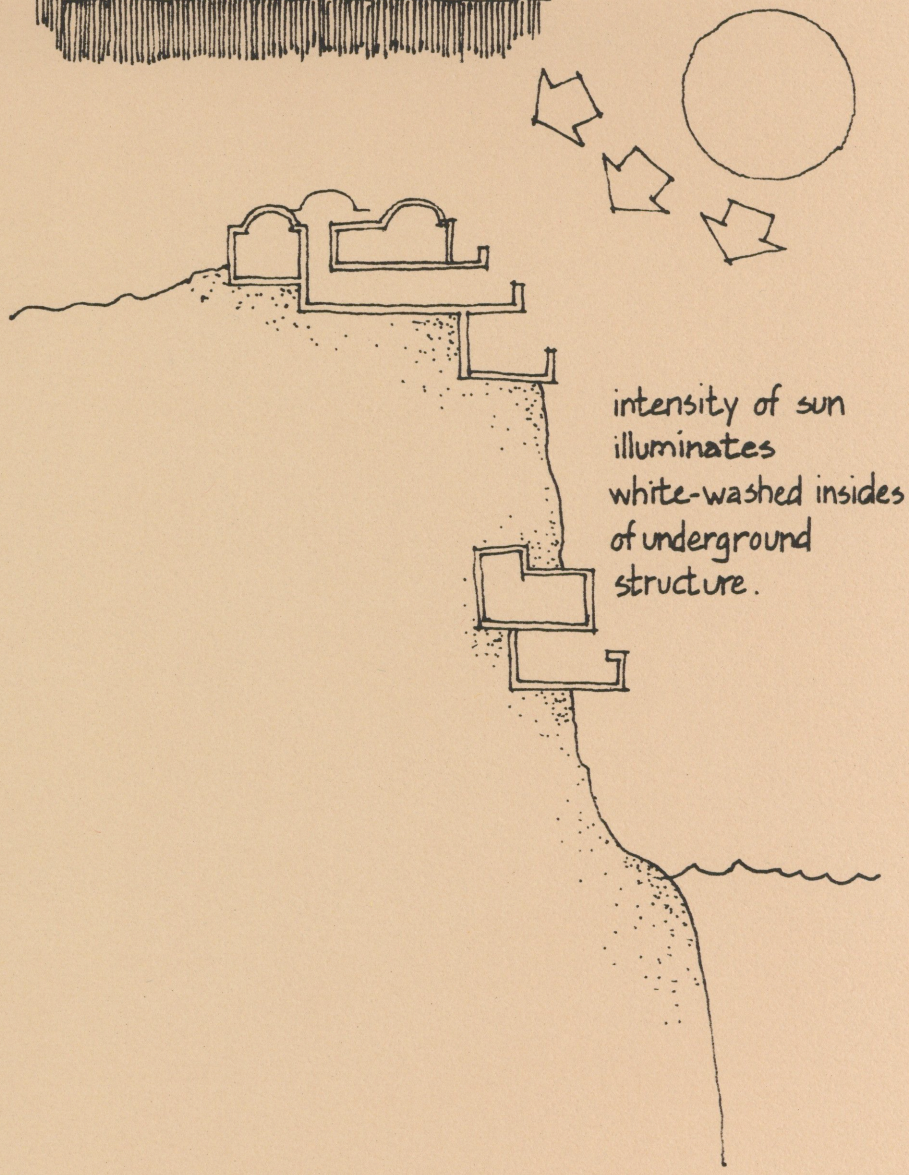


the earth has a large thermal mass, it gives off its stored radiant energy in the winter (heating) and soaks up radiant energy during the summer (cooling)

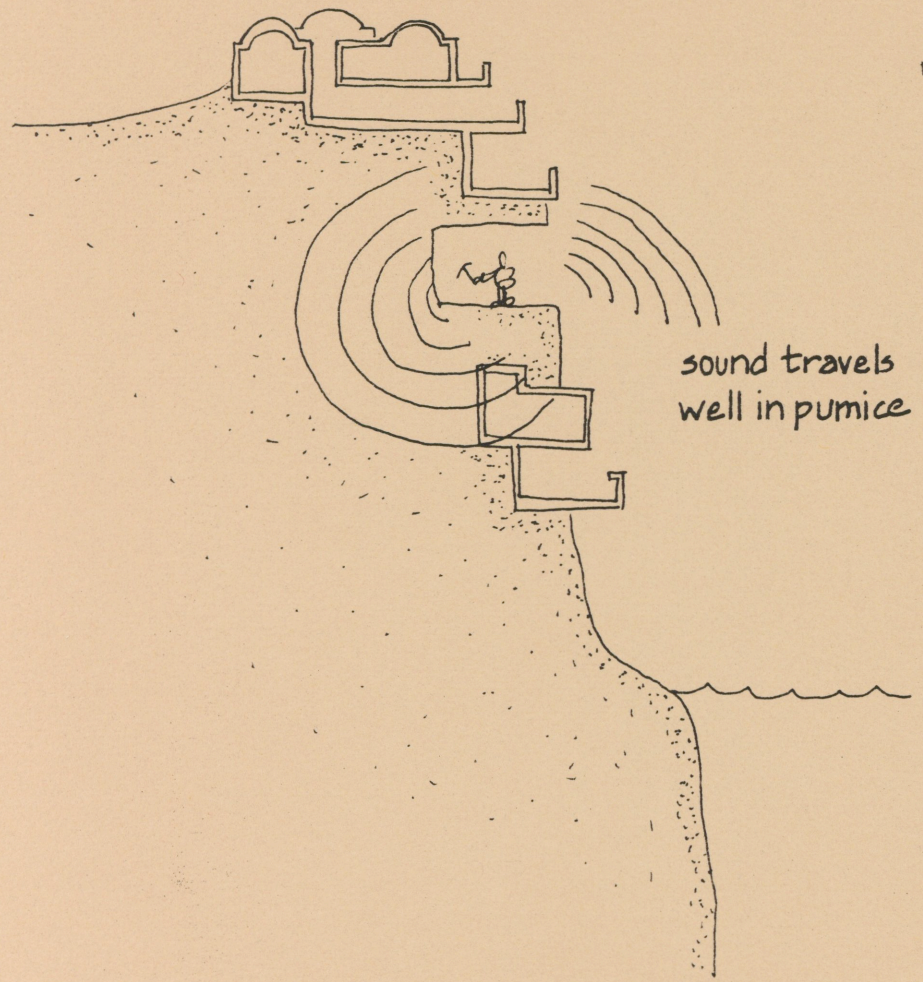
physical
earthquakes



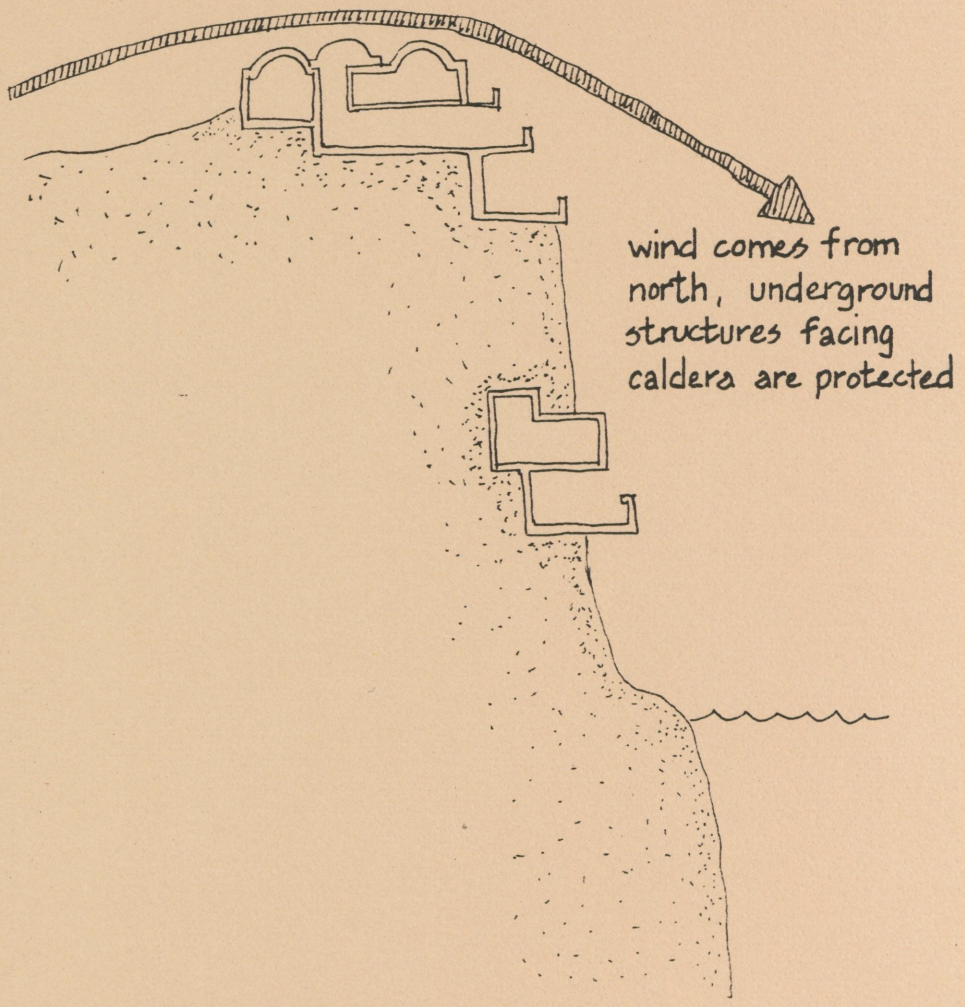
physical
sun



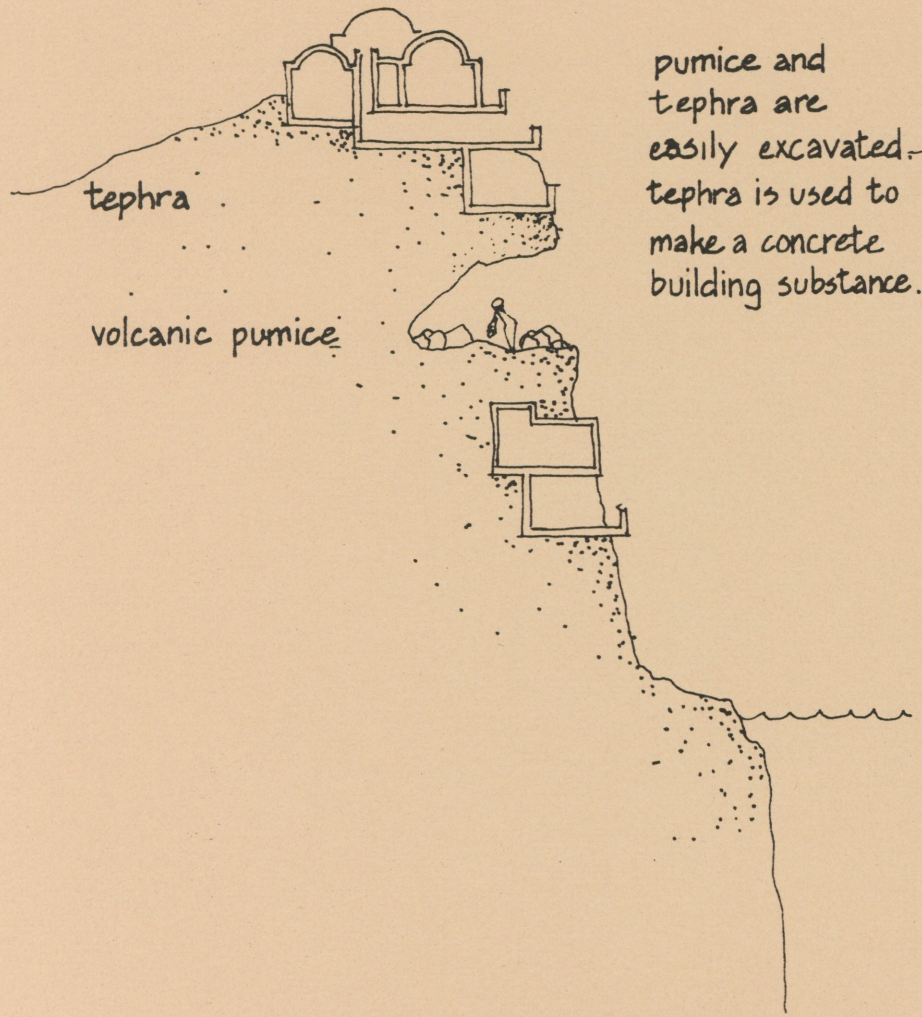
physical acoustics



physical wind

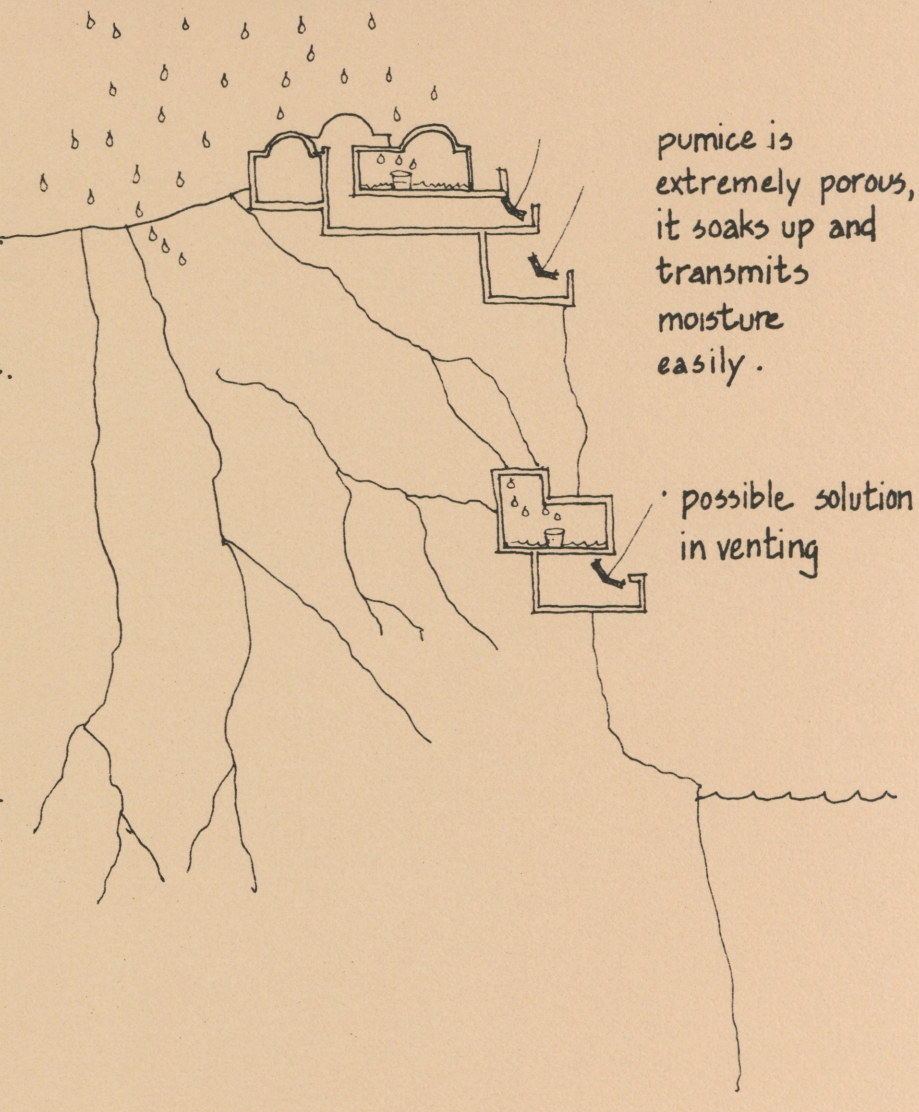


physical
dampness of pumice



pumice and tephra are easily excavated. tephra is used to make a concrete building substance.

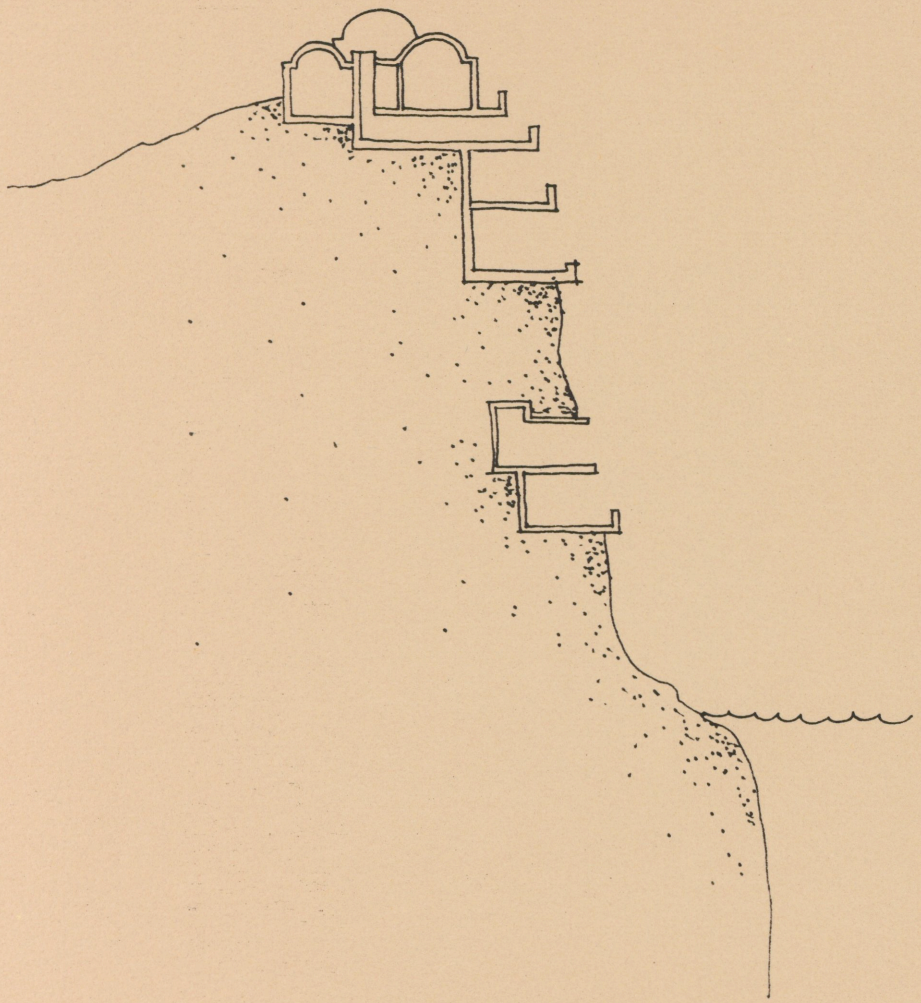
physical
excavation of earth



pumice is extremely porous, it soaks up and transmits moisture easily.

· possible solution in venting

psychological existing structures

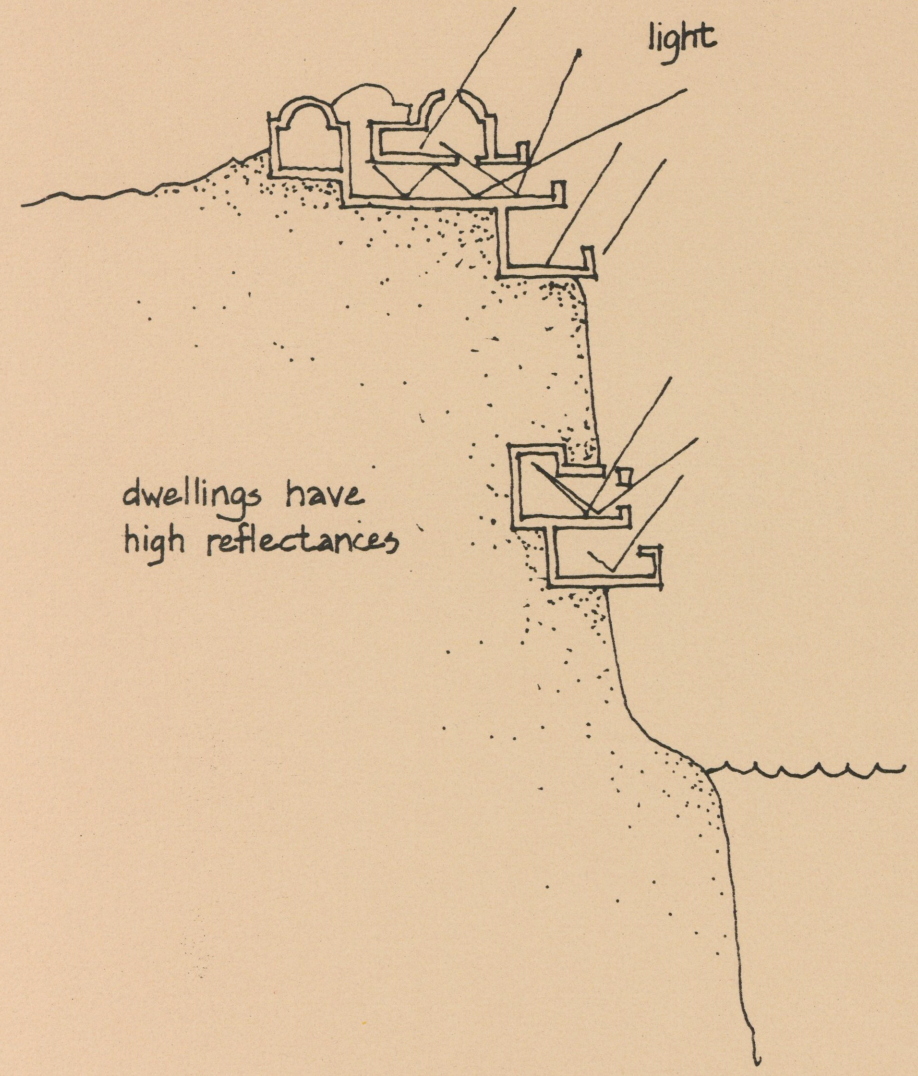


half of the inhabitants of Santorini prefer to live like rabbits in the ground.

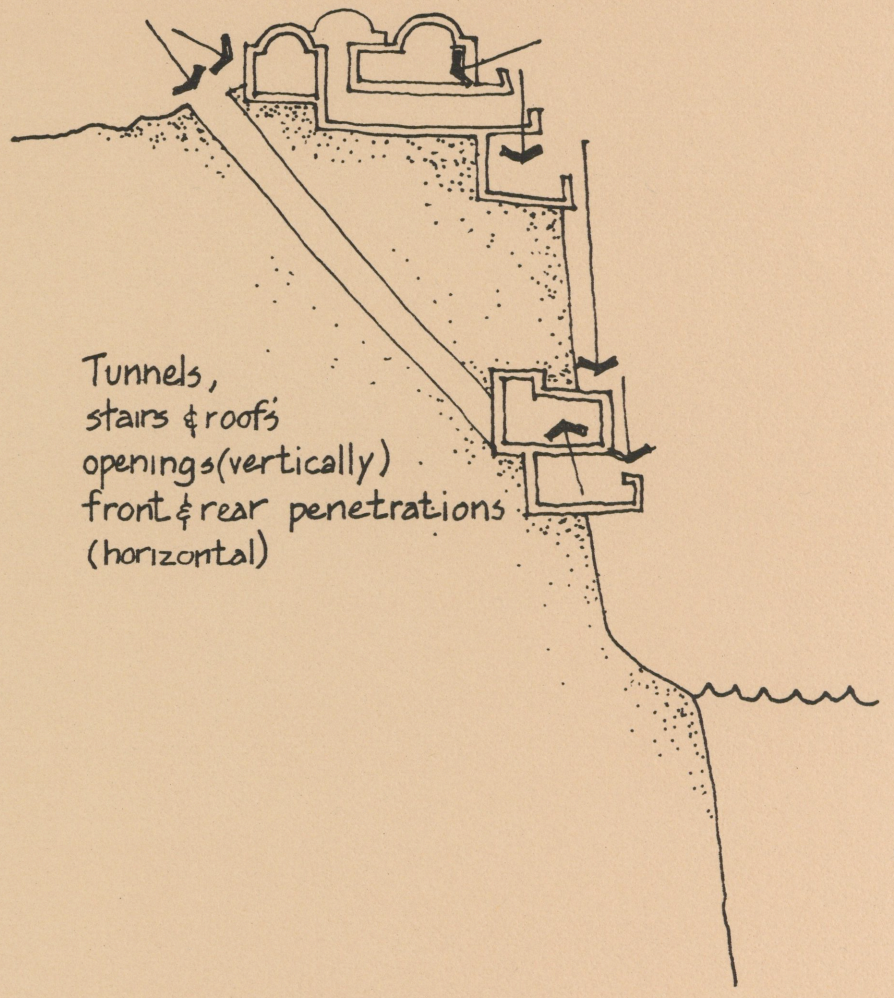
By making a void, a solid is created. The island itself is the building material.

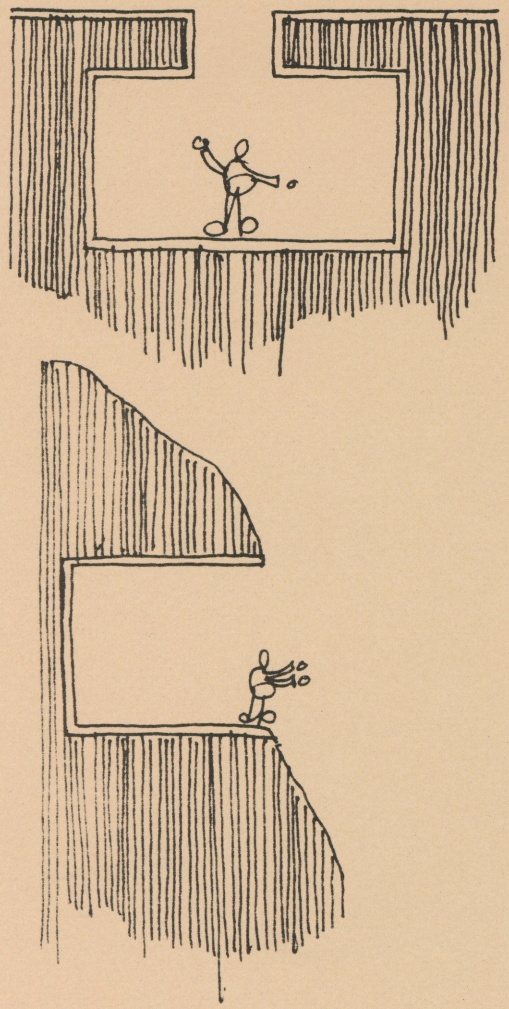
Excavated houses must not extend in height so as to obstruct view, or in width as to cut into someone's foundation.

psychological light

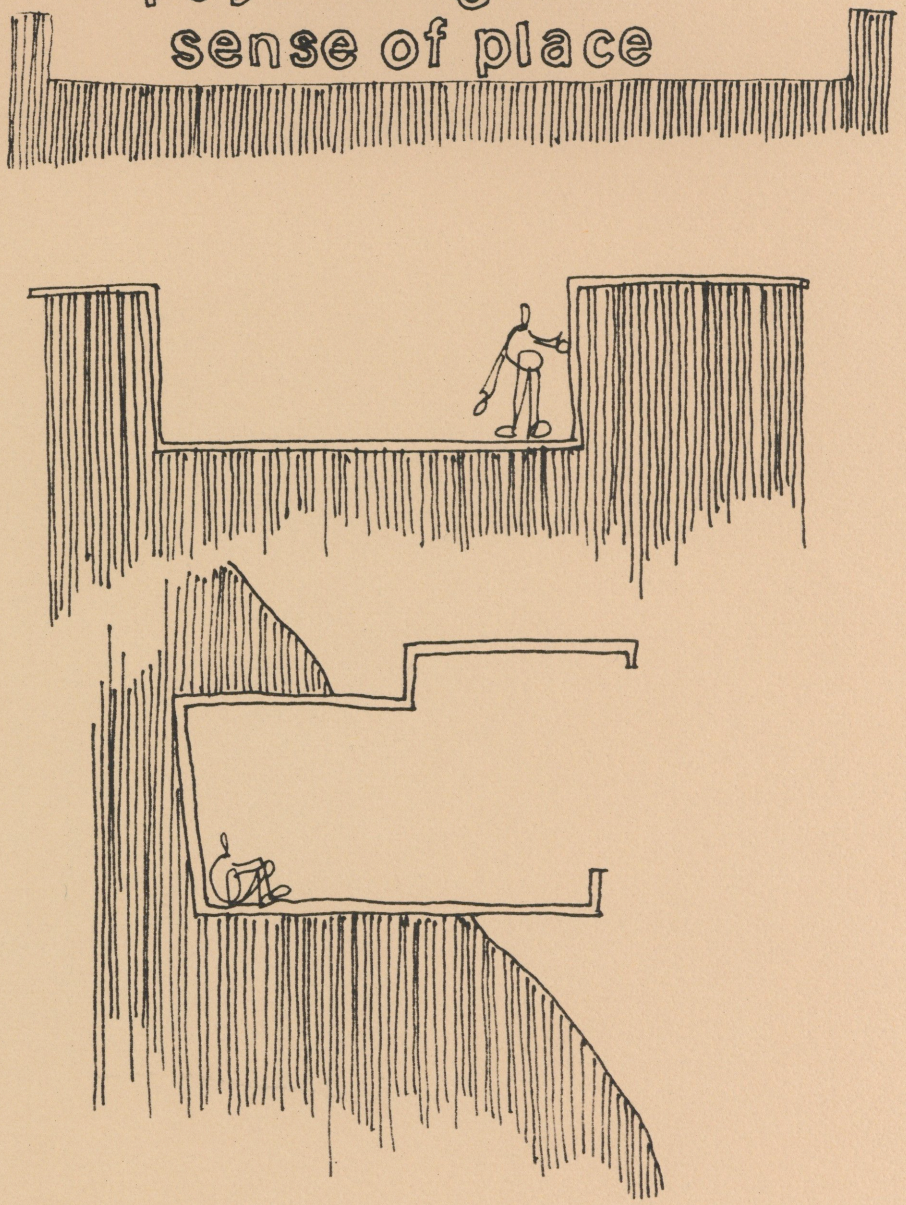


psychological access



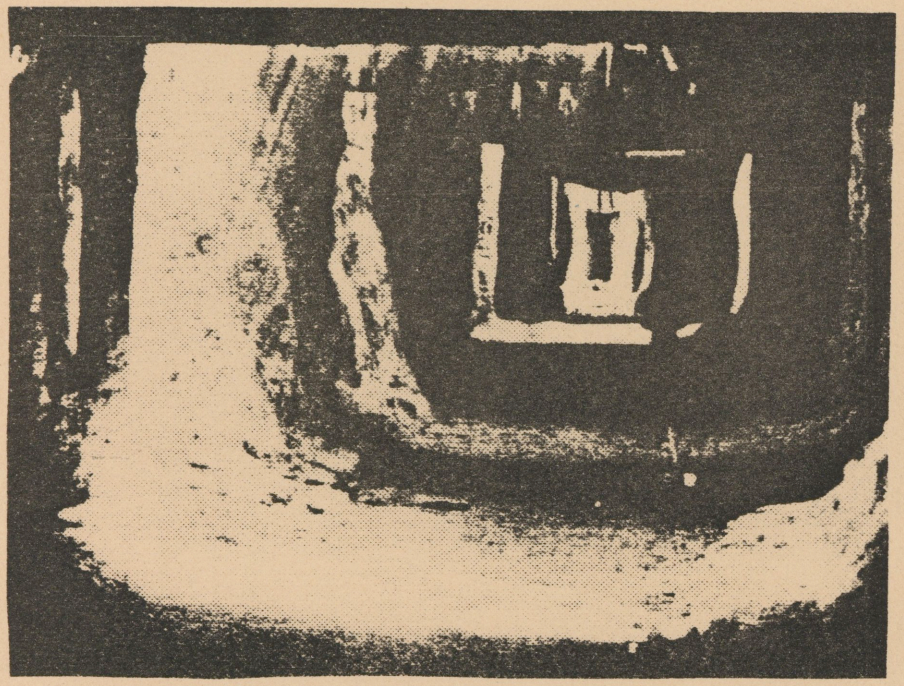


psychological sense of place

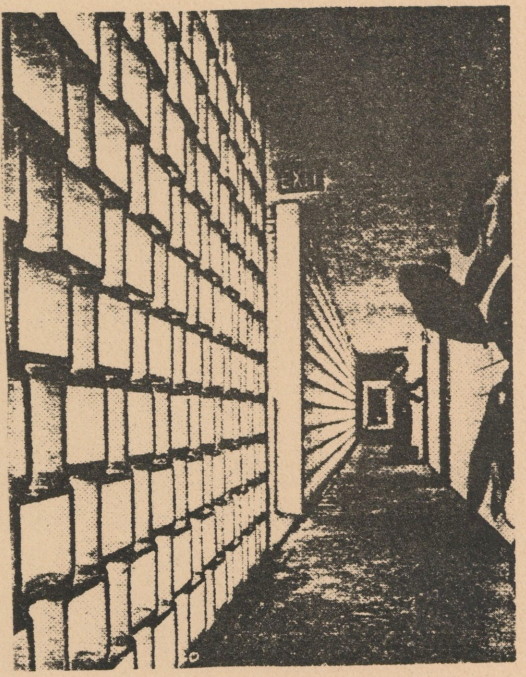


psychological perception

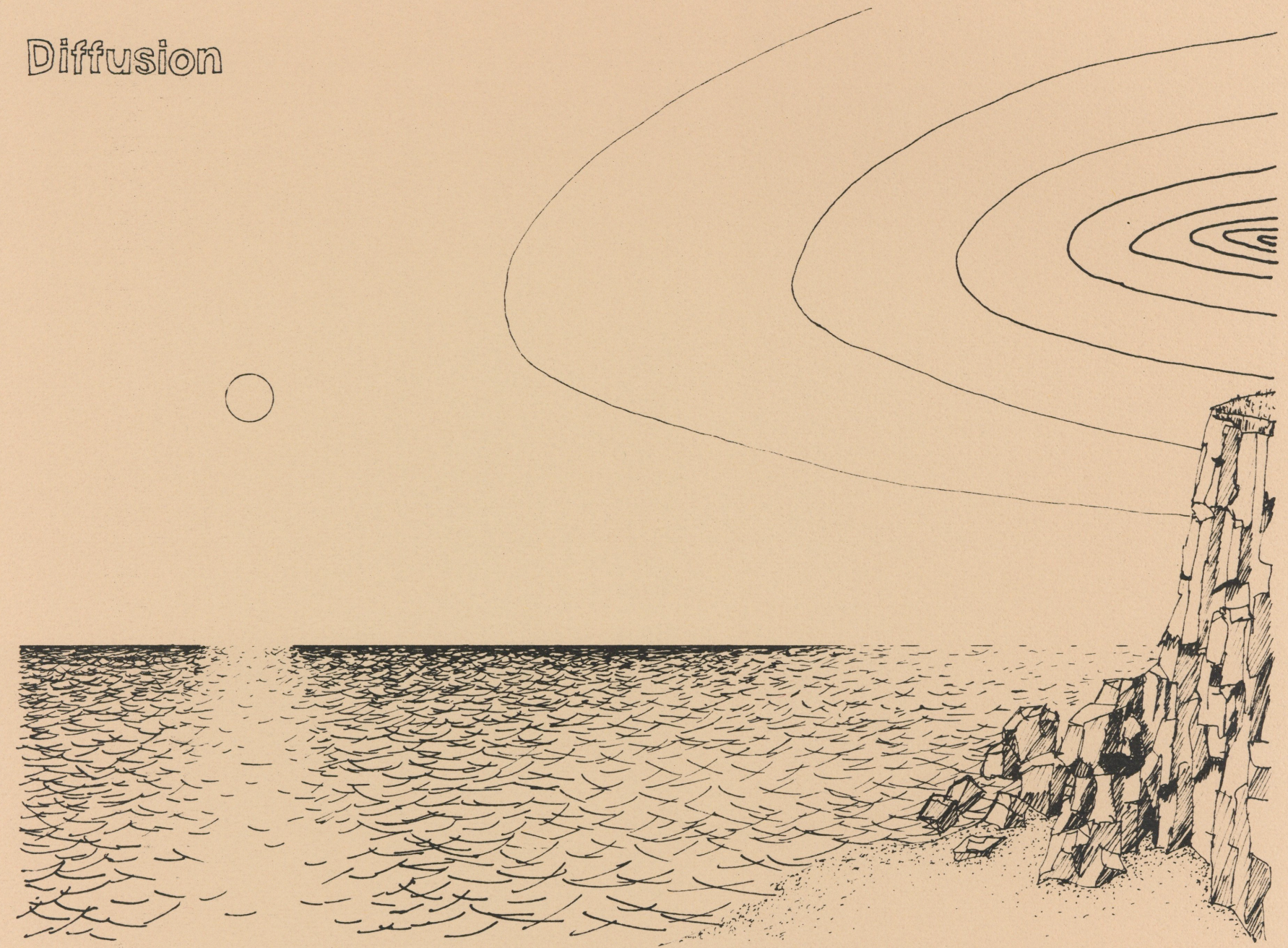
consider what may be perceived here ....

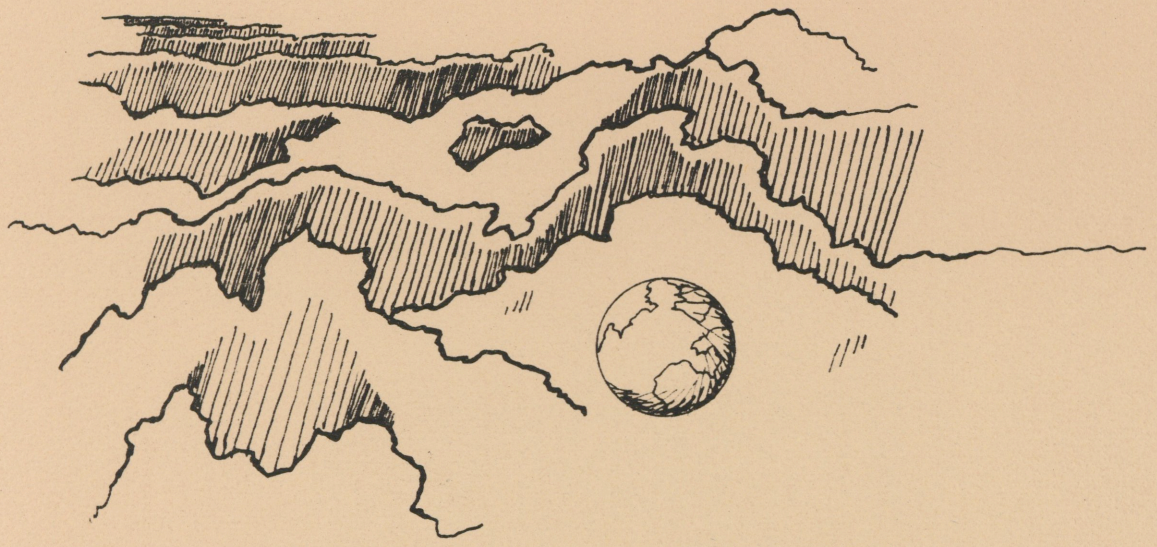


that is not perceived here.

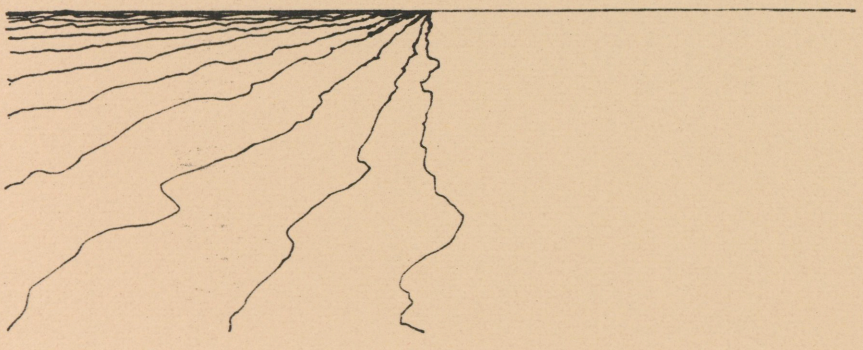


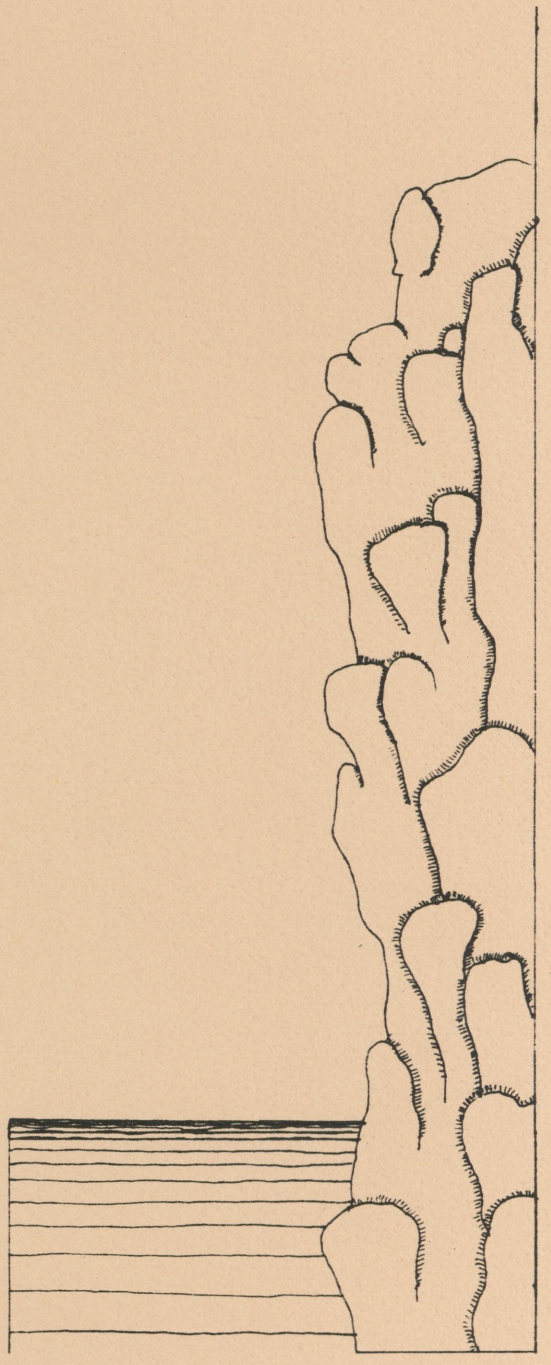
Diffusion



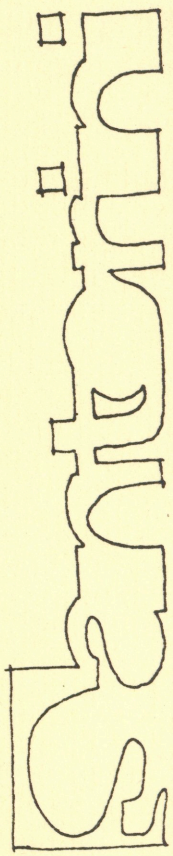


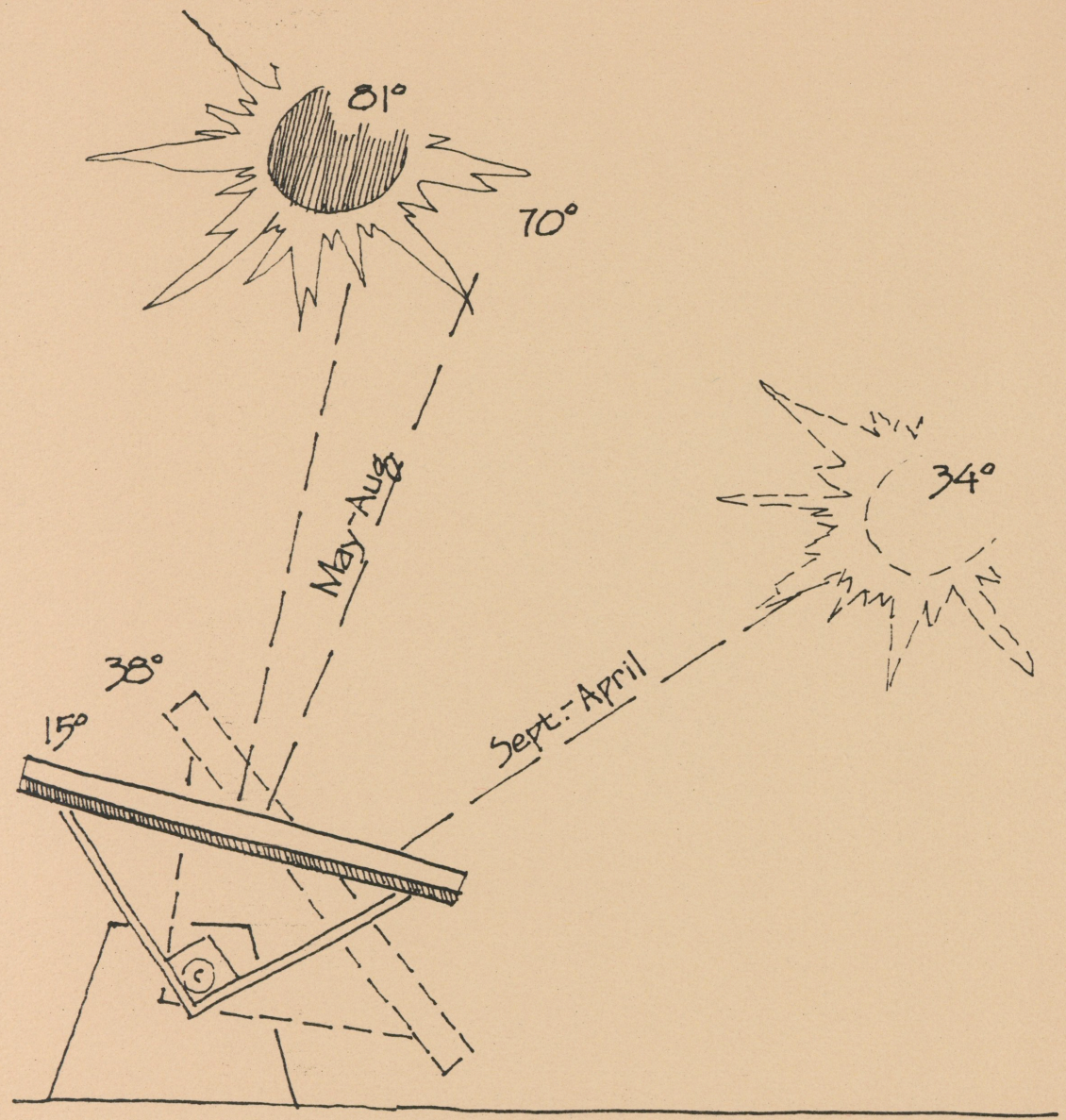
Borderless Boundary





alternative energy applications

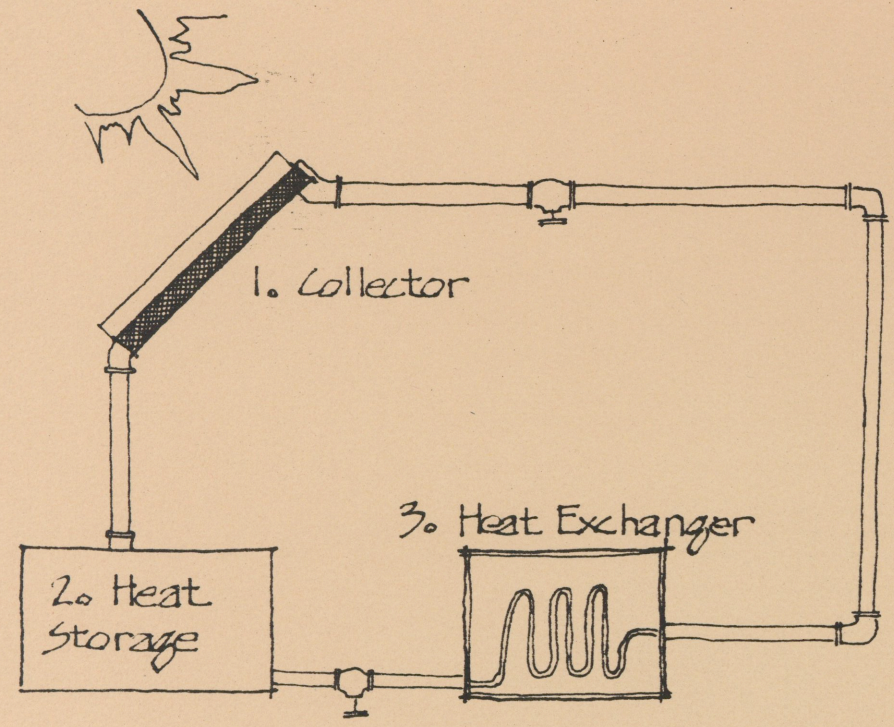


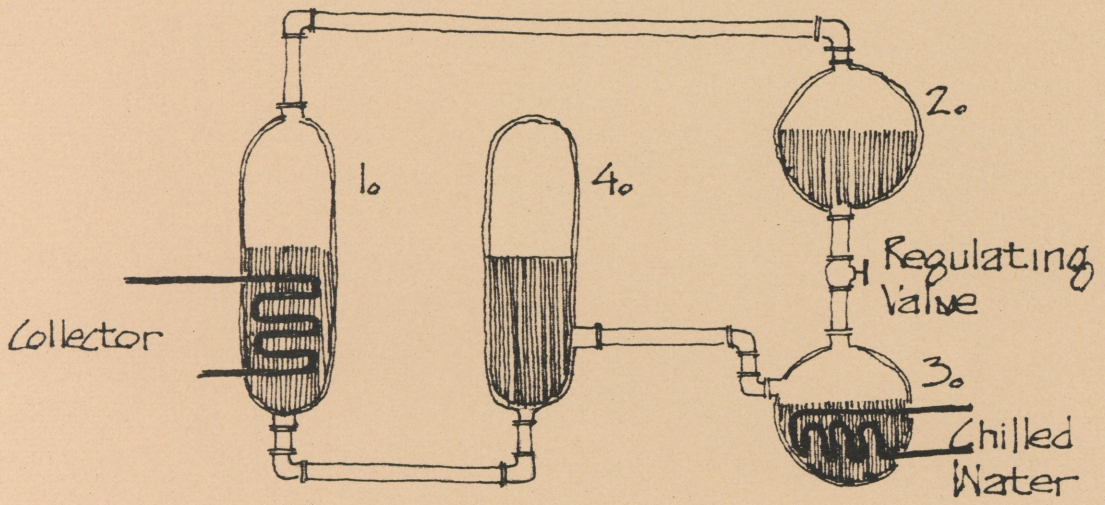


Solar Angles and Recommended Surface Angles:

Rough Design Calculations:
Allow 1 sq. meter of Collector Area for every 40 litres of hot water required per day.

Allow 40 litres water storage for every sq. meter of area to be heated.



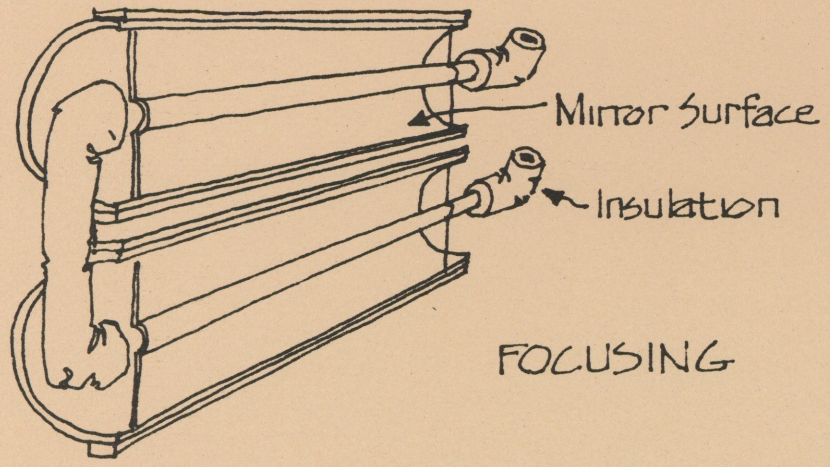


Solar Heating:

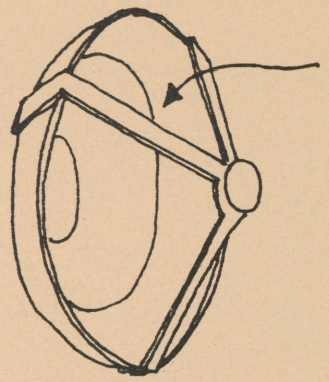
1. Water heated in solar collector (flat plate type or focusing collector)
2. Heat storage medium (lava rock stores heat well).
3. Heat exchanger.
   For heating air, a fan blows air over the coils.
   For heating water (130°F), the water is pumped around the coils.

Solar Cooling:

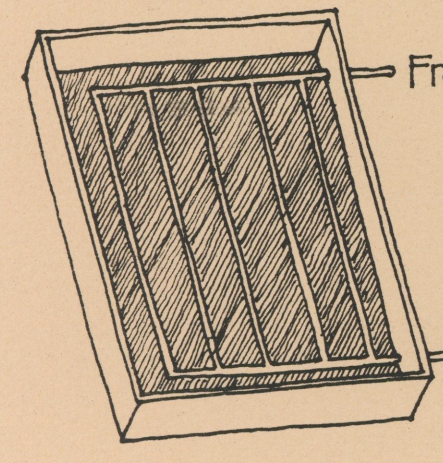
1. High grade solar heat applied to a solution of ammonia and salt water. The heat allows the ammonia to vaporize and pass to another camber (2).
2. Vapor cools and condenses.
3. Condensed ammonia absorbs heat from the space to be conditioned and again vaporizes.
4. Vapor reabsorbed by original solution and repeats cycle.



FOCUSING



FOCUSING

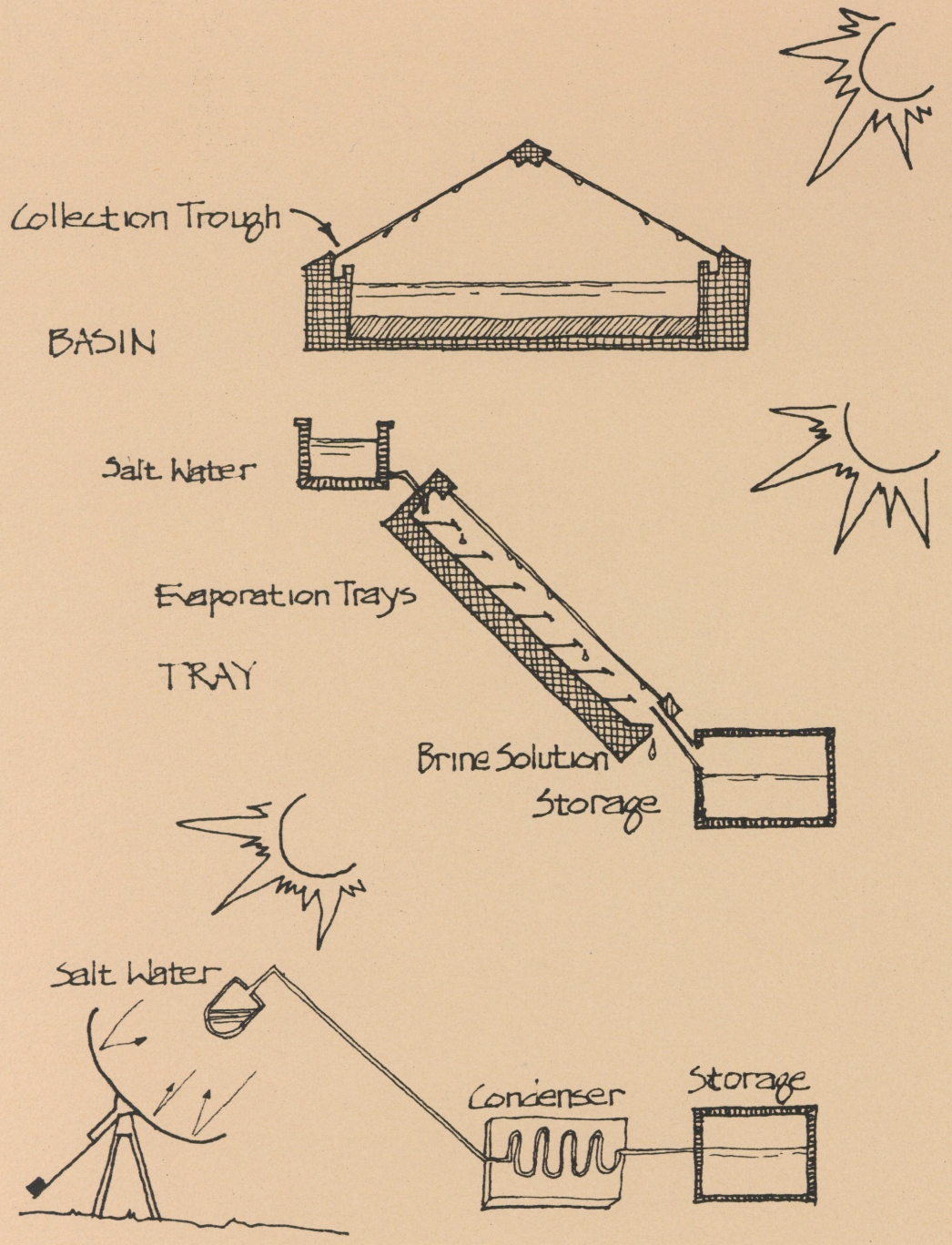


FLAT PLATE

Collector Types:

Focusing:
Very efficient
Reaches Temperatures of
300°-1000° F°
149°-538° C°
Work only with direct sunlight
Expensive due to tracking system (it must always be pointed directly at the sun).

Flat Plate:
Works in direct and indirect sunlight
Reaches temperature of
210° F
99° C



Water Desalinization:

Distillation of salty and brackish water by trapping solar heat in an enclosure containing brackish water, evaporating the water, and reconciensing it in a collectable form.

Basin Type:

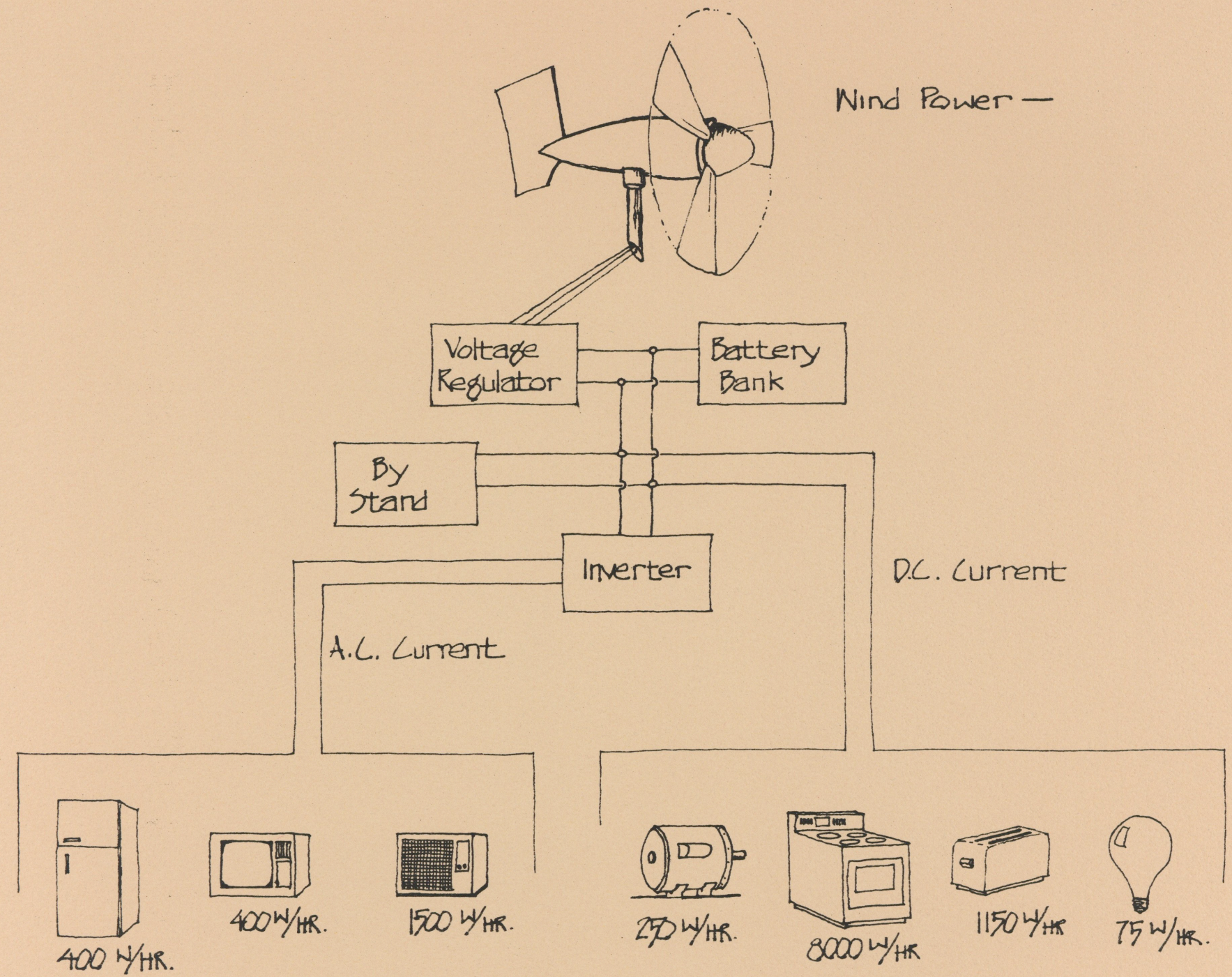
Must be periodically back flushed to remove salt deposits.
Yields: 5 litres/day/sq. meter
.12 gal./day/sq. foot

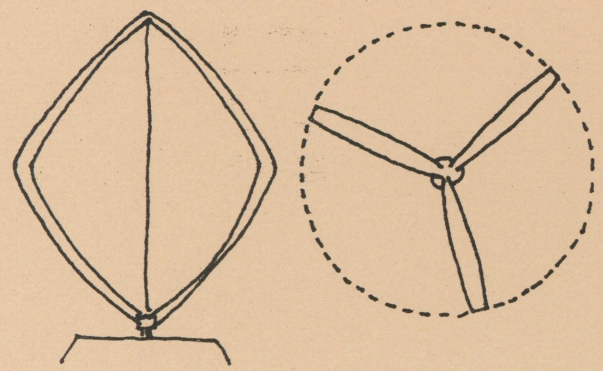
Tray Type:

Must be periodically flushed to remove salt deposits.
Yields: 5 litres/day/sq. meter
.12 gal./day/sq. foot

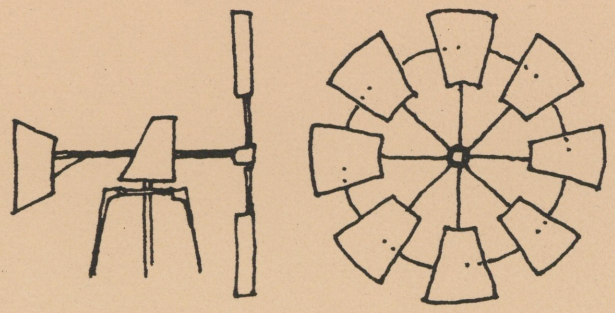
Focusing Type:

Most efficient, reaches temperatures from 300°F - 1000°F (149°C - 538°C)
Yields: 21.5 litres/day/sq. meter
.55 gal./day/sq. foot


Wind Power —
Voltage Regulator
Battery Bank
By Stand
Inverter
D.C. Current
A.C. Current
400 W/HR.
400 W/HR.
1500 W/HR.
250 W/HR.
8000 W/HR
1150 W/HR
75 W/HR.

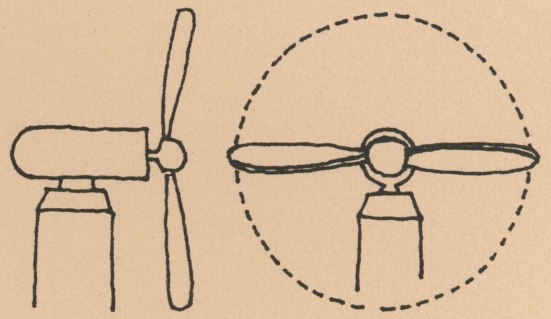


Blade Diameter		4.6	6.1
Output in Watt at	15 KPH	450	800
	25 KPH	1000	2000
	40 KPH	4000	6000



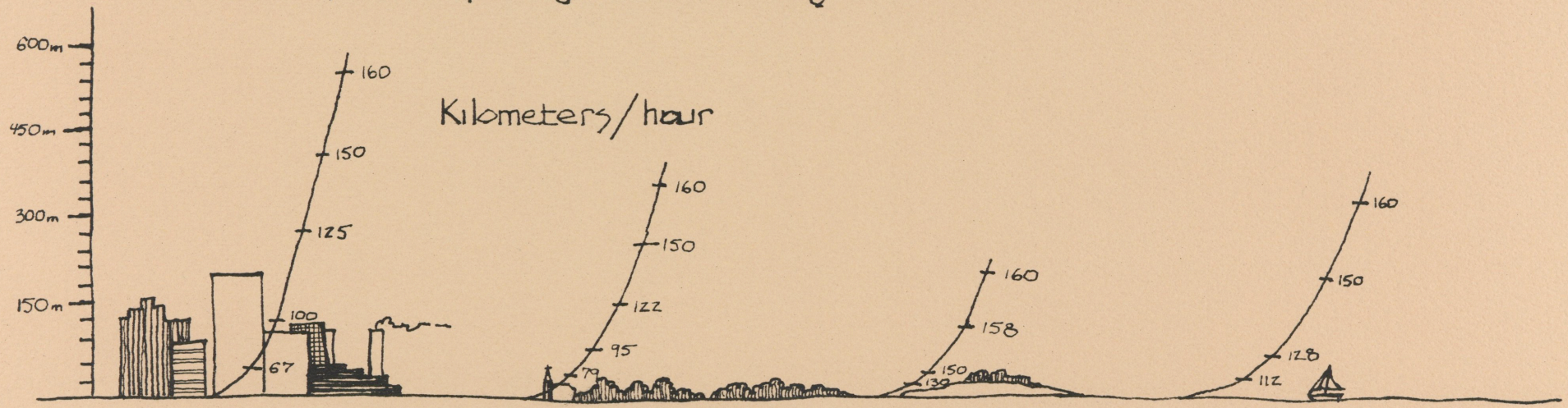
1.8	3.6	4.9
660	2500	4100

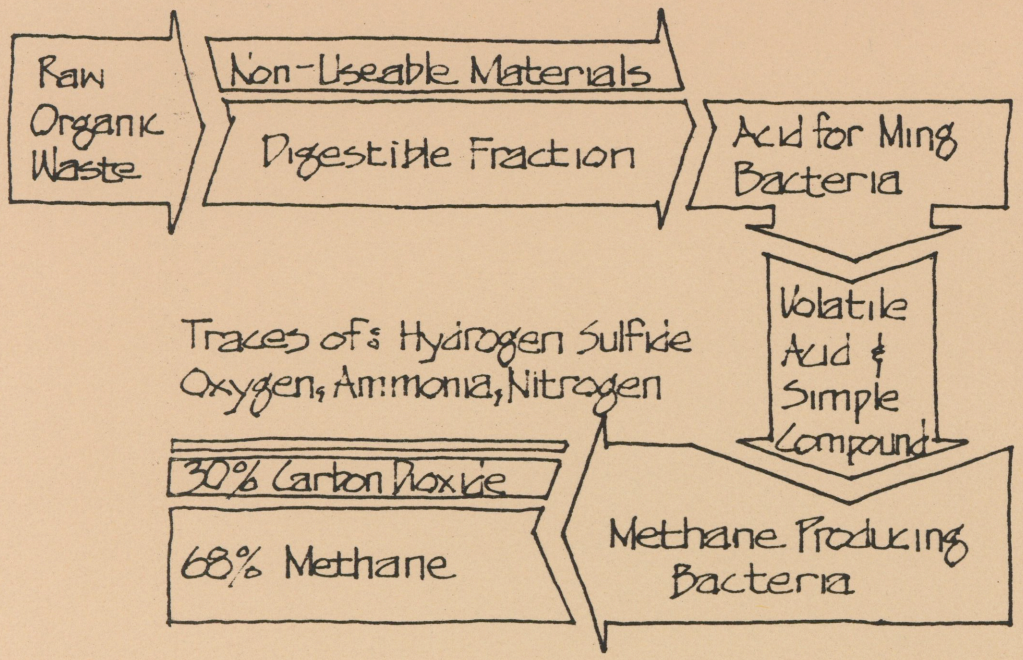
(liters/hour)



3	3.8	5	9.4
80	350	550	1500
650	950	1800	400
1200	2500	5500	4100

Wind Speed – depending on surrounding terrain

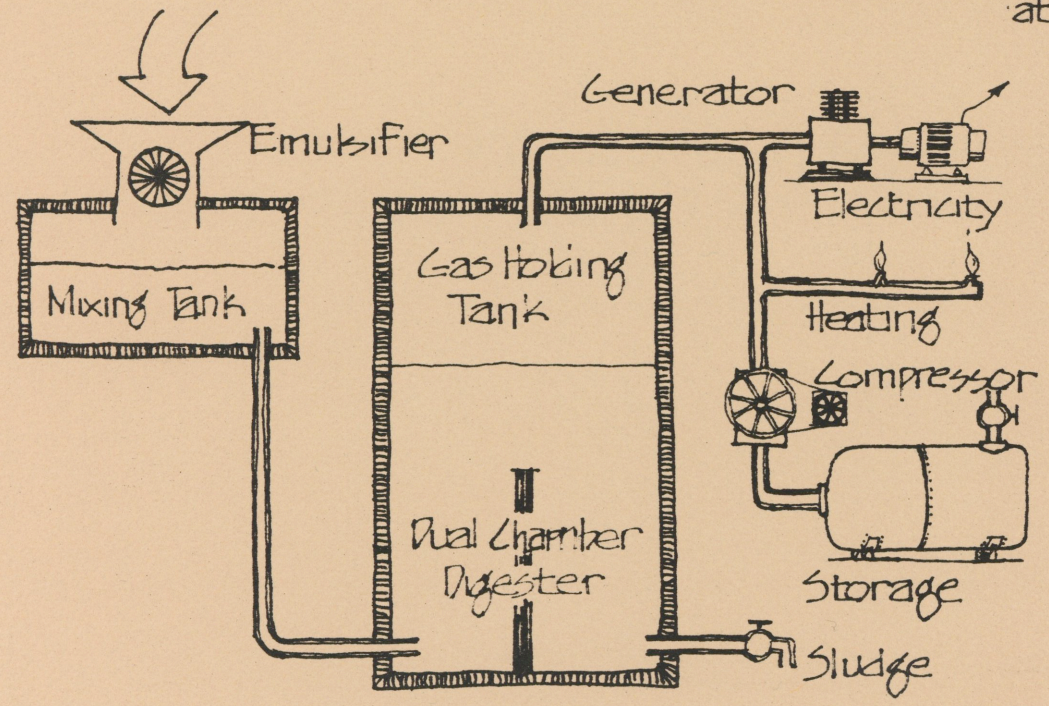


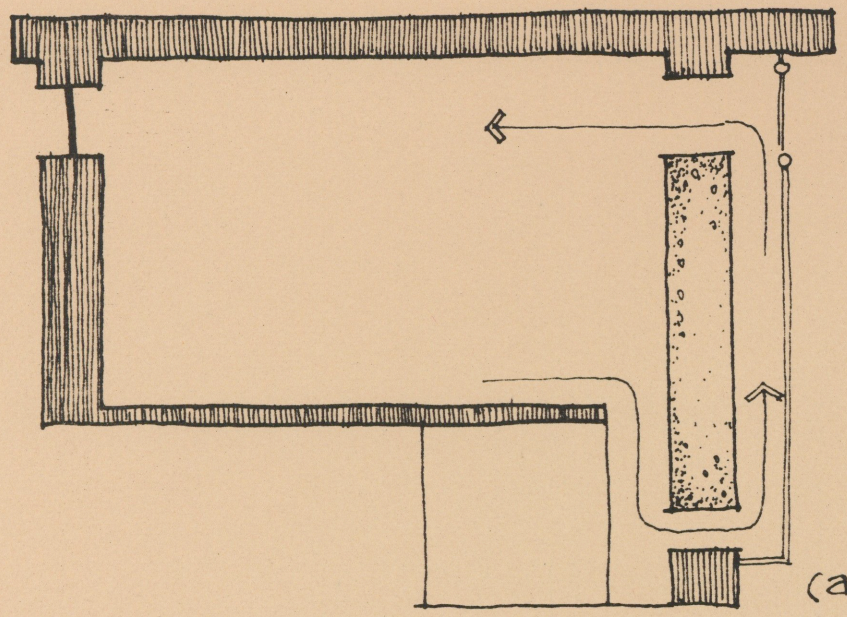


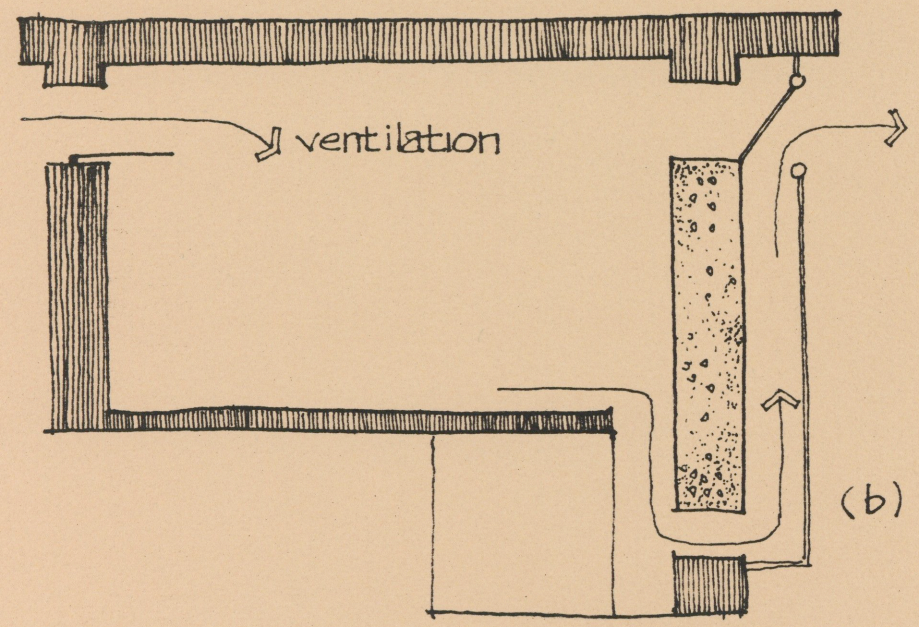
Methane Digestion:
In nature, the process of methane digestion is far older than man. Human excreta, animal manures, garbage and refuse are converted by bacteria into valuable bio-gas and fertilizer.

Rates of Use of Methane: ($ft.^3$)

Lighting	2.5/mantle/hr.
Cooking	8-16/hr./4" burner
Gas Refrig.	1.2/hr./$ft.^3$ of refrig.
Gas Engine	11/brake h.p./hr. at 25% efficiency

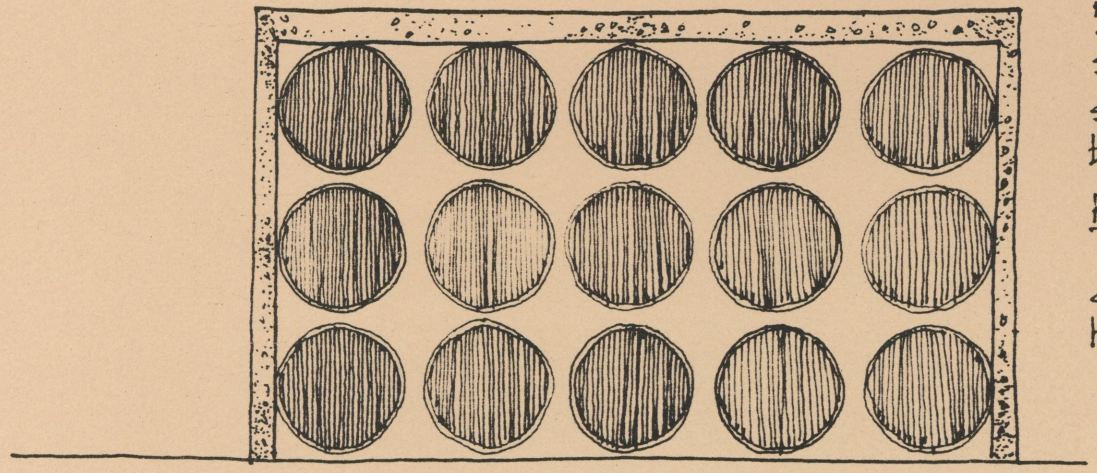




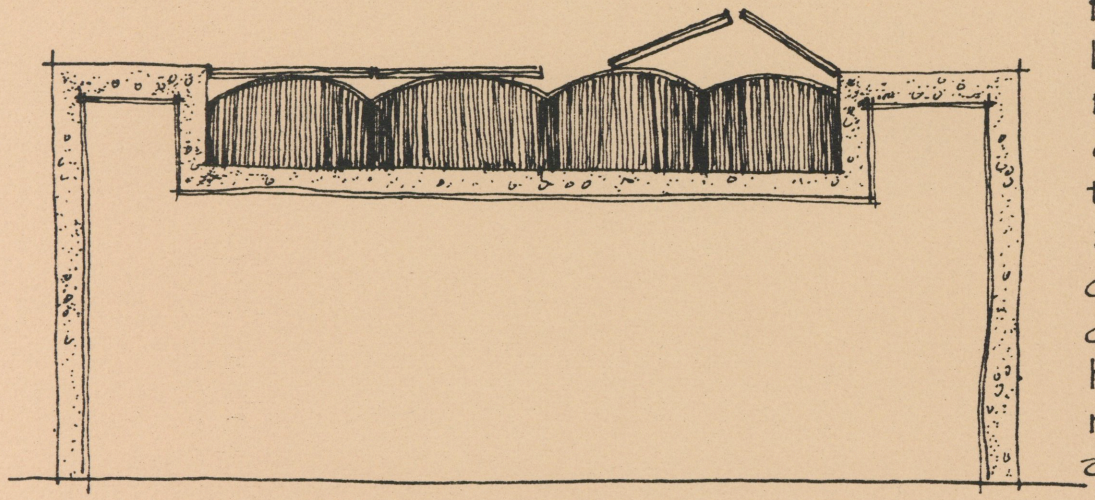


Passive Energy System—
Energy management is accomplished by a natural circulation scheme using two air ducts, one placed at the top of the concrete wall and one below it. The heated air between the glass and the wall expands and rises, entering the area through an air duct near the ceiling. This causes the cooler air to be pushed through a baseboard duct into the bottom of the air space, and circulating upward. (a) There is enough energy stored in any given day to last until the early morning hours. Natural circulation continues during the night.

Also, this process can be reversed for cooling during the night. The duct at the top of the collector is closed to the inside rooms and opened to the outside, so the hot is vented outward (b).



South-Wall Water Barrels –
55 gallon drums filled w/water are stacked horizontally to form a south wall, inside the structure behind the glass. Large hinged insulating panels are placed outside the house. These panels can be open during the day and closed at night to create heat inside.



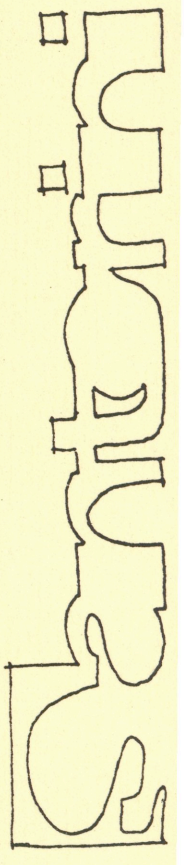
Rooftop Waterbag –
Large bags of water, placed on a flat roof structure can function both as collection and storage units for the solar heat. There is no need for a separate circulation system because the energy is transferred directly through the roof and into the house. During cold nights, the panels are moved back to cover the waterbags and prevent heat from escaping.

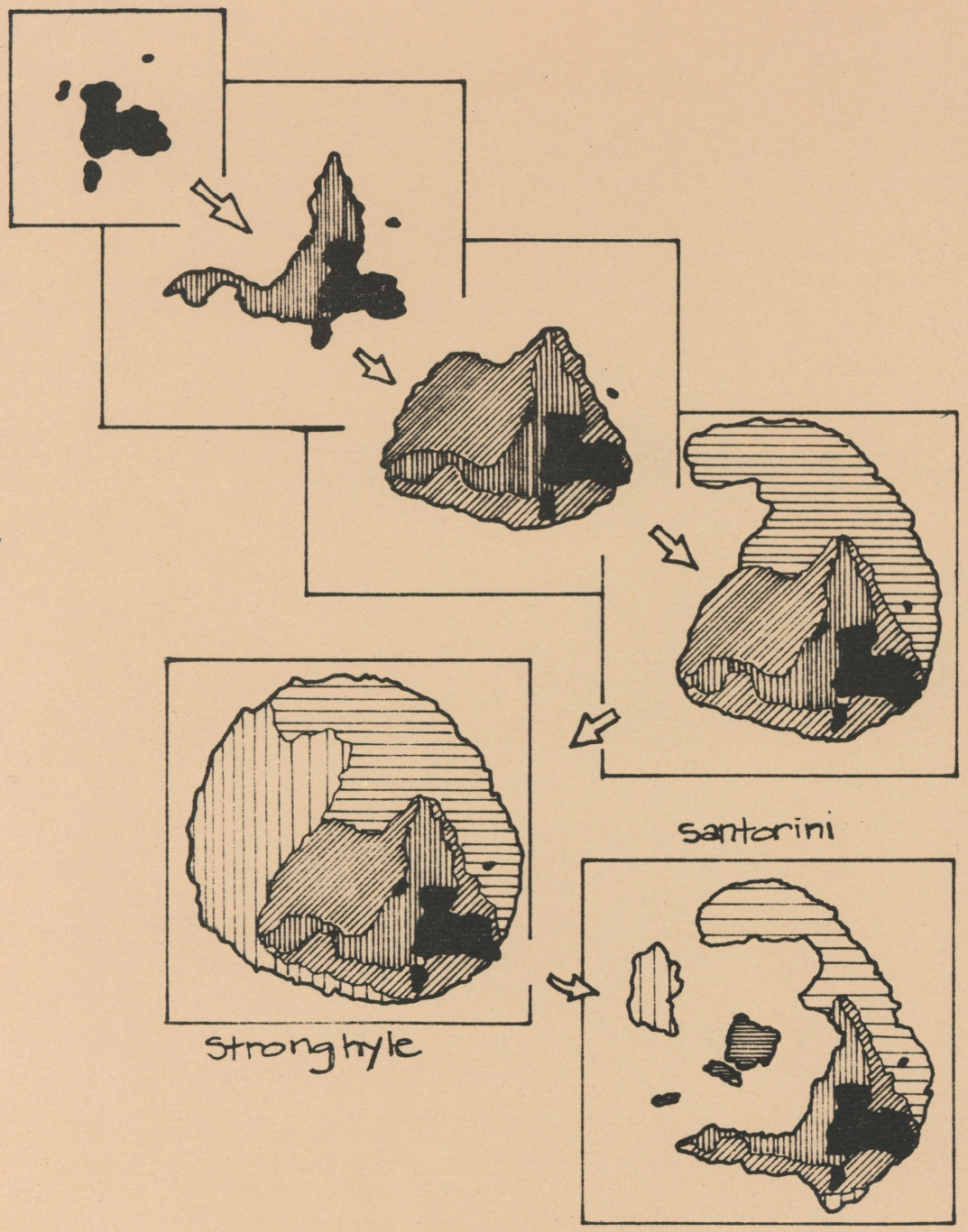
Geothermal Energy —
The underground hot water of Santorini is corrosive because of high salinity. This may make this area, although highly active, impractical

Energy of the Sea —
Tidal and swell characteristics around Santorini (which reaches 4 ft. at best) makes energy from the sea impractical.

Turbine Power —
Since the surface water on Santorini is scare, energy from turbine is not a major consideration.

seismic conditions

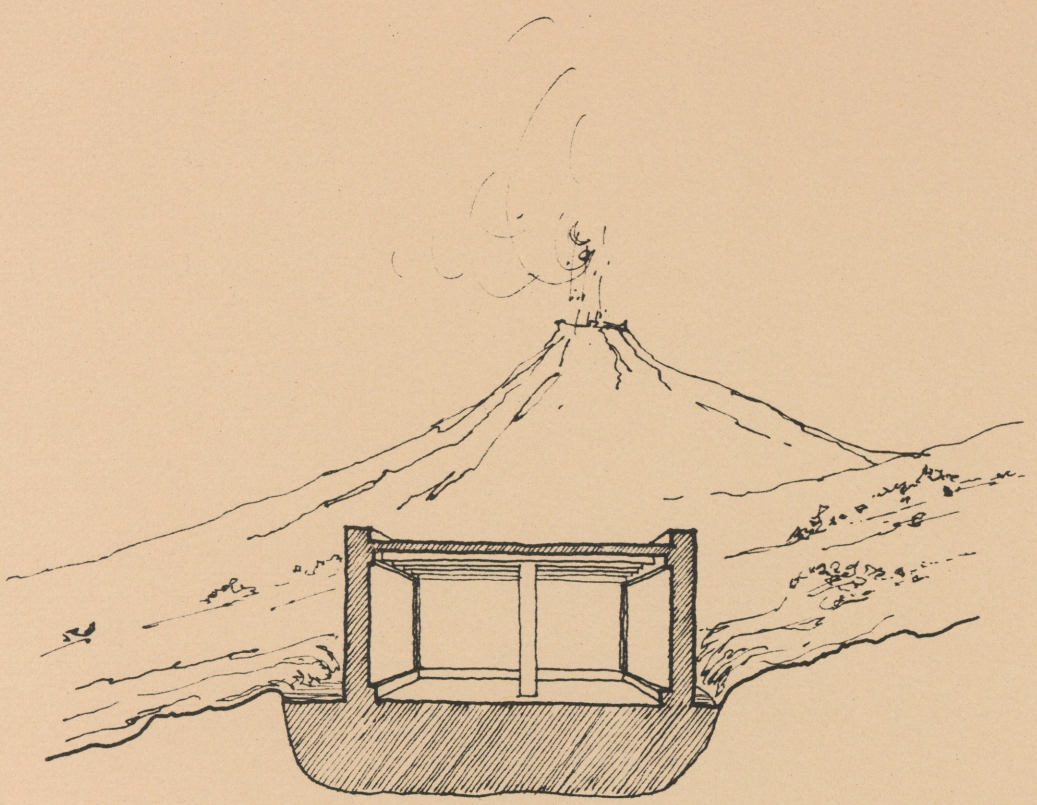




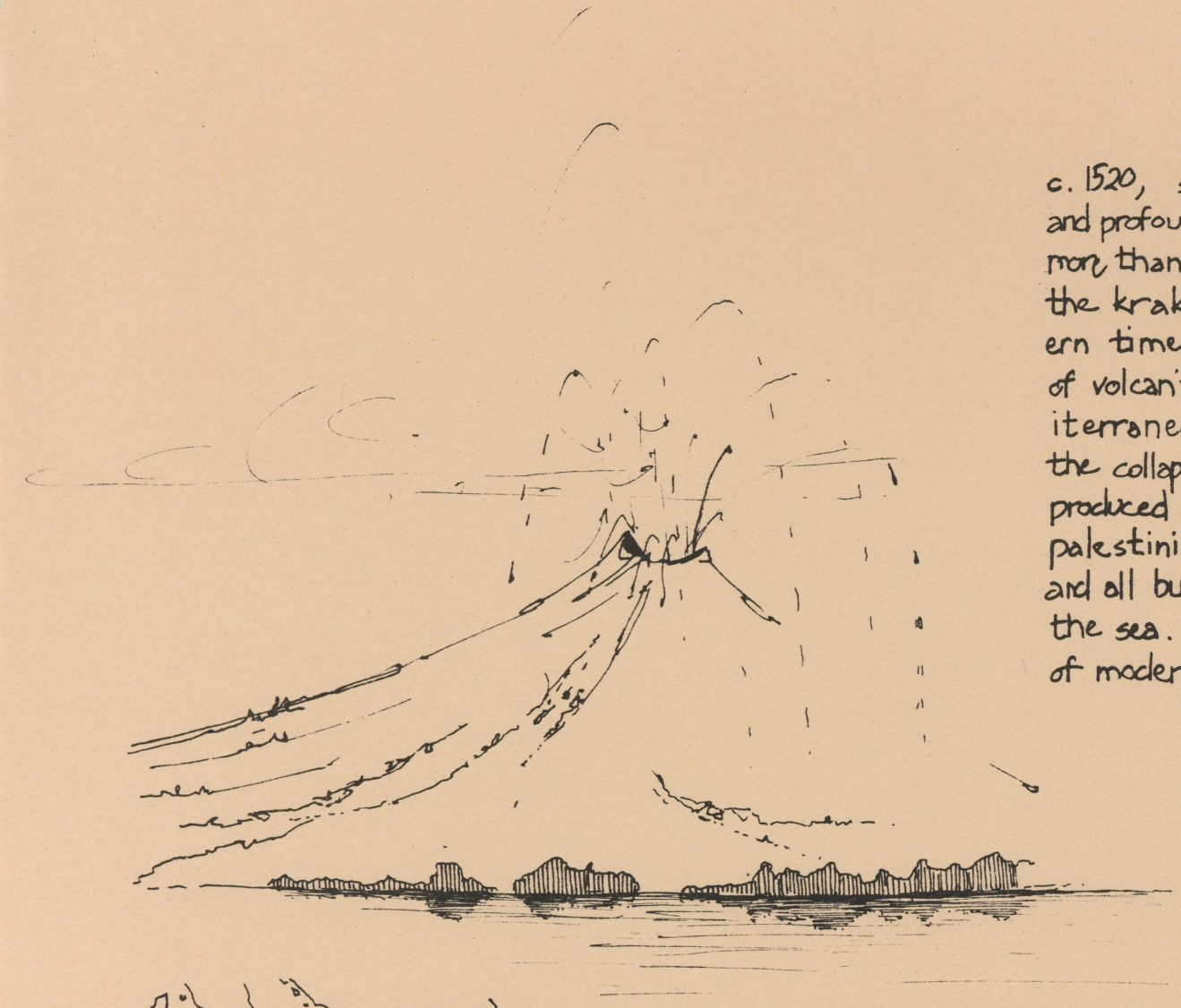
santorini is the result of 12 million years of volcanic activity. volcanic activity originated at what is now mt. monolithos, and culminated in a purely volcanic island the ancients called stronghyle, "the round one."

the immense energy required to build and destroy mountains and islands was acknowledged by the greekss. poseidon "the earth shaker" was the greek god of earthquakes.

stronghyle was inhabited by people of the minoan civilization untill 1520 b.c. it was a lovely island with seven tall peaks, eroded with deep ravines, and it supported an agricultural civilization.



life on stronghyle was precarious; the seven volcanic mountains were a constant reminder of the island's violent beginning. earthquakes were frequent. domestic and imported timbers were used to reinforce masonry homes against lateral earthquake loads. buildings were placed on prepared pads of sand or loose gravel fill in an excavated site.

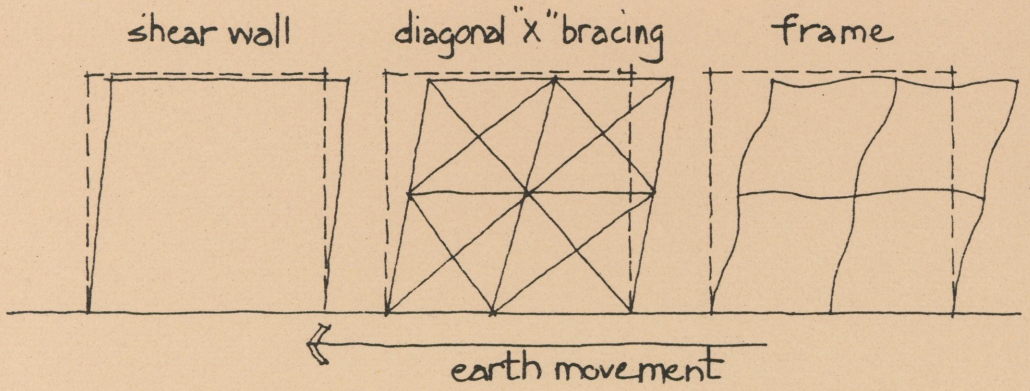


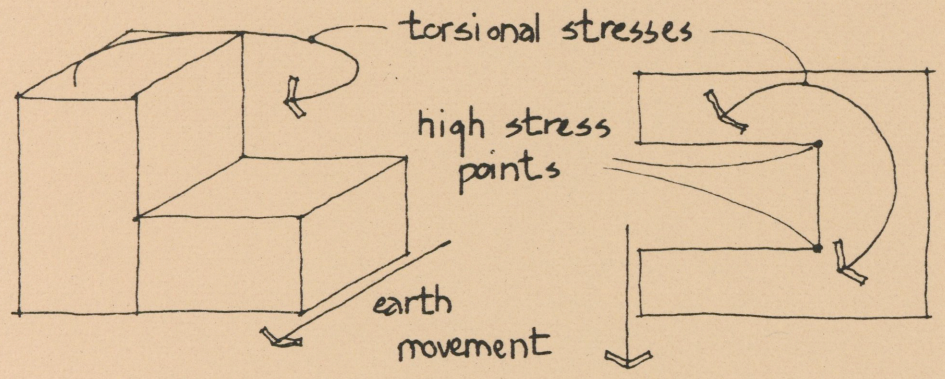
area of ash coverage

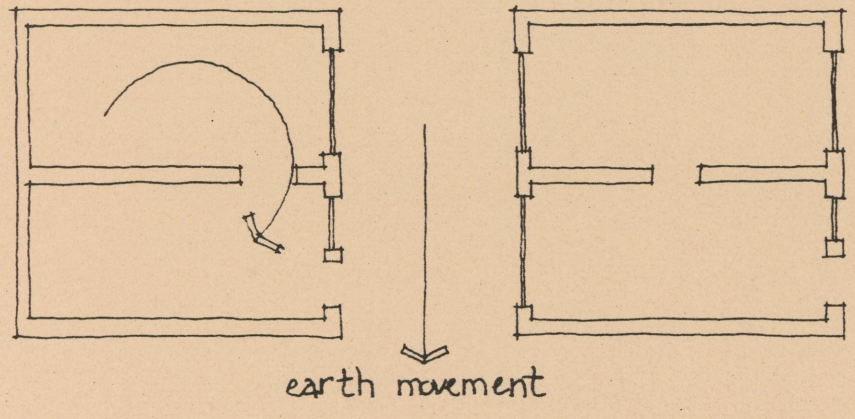
c. 1520, stronghyle's central volcano erupted and profoundly effected the entire mediterranean. more than five times the thermal energy of the krakatoa eruption, the largest of modern times, was expended. sixteen inches of volcanic ash covered the eastern mediterranean, stopping all sea borne traffic. the collapse of the emptied magma chamber produced a tsunami of twenty feet on the palestinian coast five hundred miles away, and all but the top of the caldera sank into the sea. stronghyle took on the shape of modern santorini.

seismic activity continues on santorini. volcanic activity in 198 b.c., in a.d. 46, 60 746, and 1457-1508 produced the island of paleae kameni. volcanic activity in 1573, 1707, 1866, 1925, 1939-41, 1950 and 1956 produced new kameni. the 1956 quake was the last major disturbance.

people at santorini are exposed to nature's most potent, unpredictable, primeval forces but still cling to their small island in the mediterranean.







shear wall:

entire wall transfers forces, little wall movement.

diagonal "x" bracing:

frame members connections must be strong, members should be designed for tension as well as compression, moderate movement of wall.

frame:

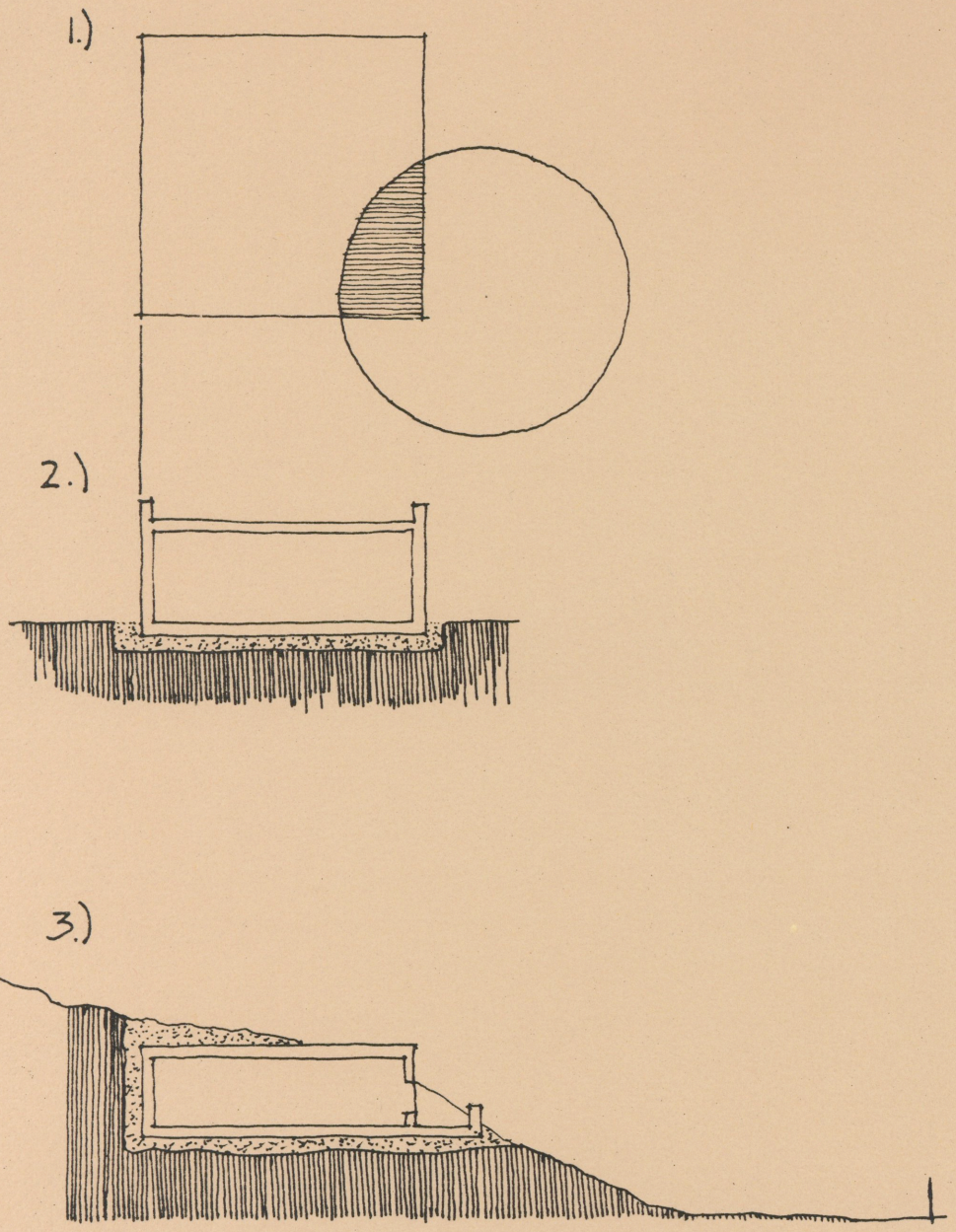
joints must be capable of transfering forces, members should be capable of with standing large moments.

combining dissimilar masses will cause tortional stresses to structure.

a 100 mm joint between masses with covering will eliminate major structural damage. it works like a control joint in a concrete walk. (an attempt to control fracture.)

non-symmetrical openings (which decrease mass) can cause tortional stress on buildings.

balancing the center of gravity with the geometric center of the building will reduce the torsional effect caused by rapid earth movement.



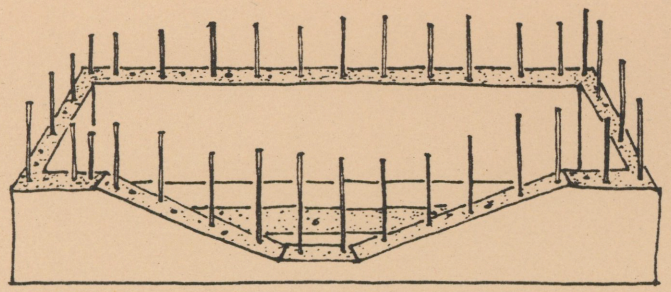
the foundation, building connection is very important. the forces that the moving earth place on the structure must have a direct path into and out of the structure to minimize damages.

1.) pure geometric symmetrical forms lend themselves to earthquake resistant design. other forms can be adequately designed with more attention paid to structural systems.

2.) the floating slab concept:
isolates the foundation from the earth and provides a cushion for the building to move on, thereby reducing stresses on the structure.

3.) underground construction:
- large structural members are required to hold back the earth.
- low inertia forces are applied to the walls of the structure.
- the building is a part of the ground.
- the floating slab concept can be utilized.
- the walls require careful design and must be adequately reinforced.

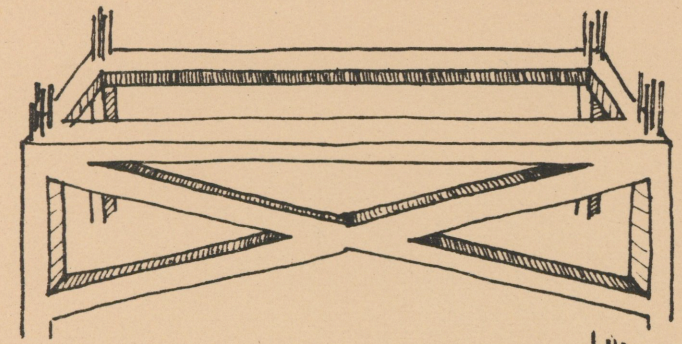
1).



1) reinforced concrete wall construction-
some damage possible to structure during heavy earthquakes.

fair

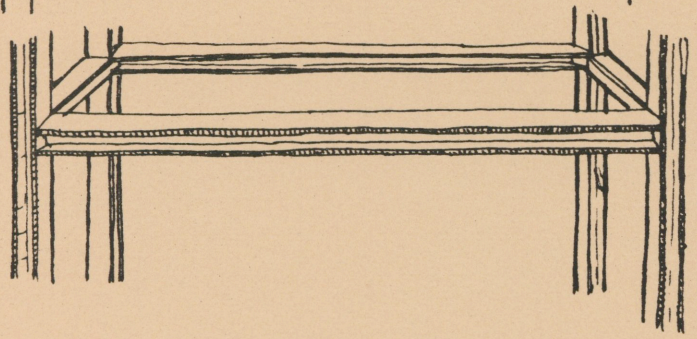
2.)



2.) reinforced concrete columns with side brace construction-
Minor damage to buiding if designed for earthquakes.

good

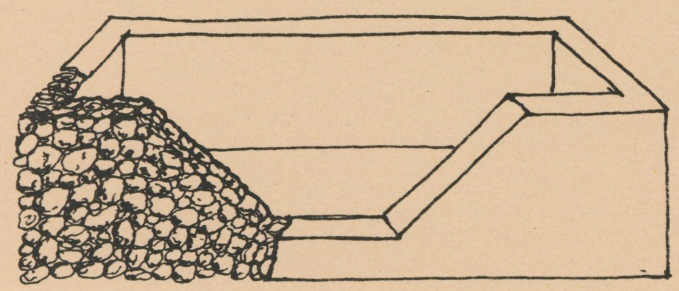
3.)



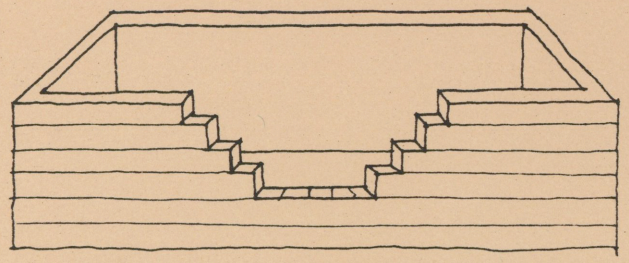
3.) steel construction-
possible surface damage. no structural damage if designed to u.b.c. codes for earthquake loading.

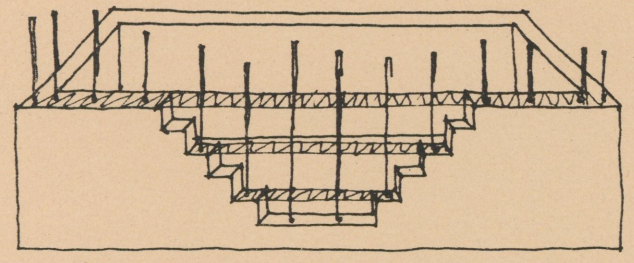
good

4.)



4) stone wall construction-
tendency for total destruction during earth quakes.





5). masonry construction - brick bearing perform poorly under earthquake conditions with virtual destruction of building

poor

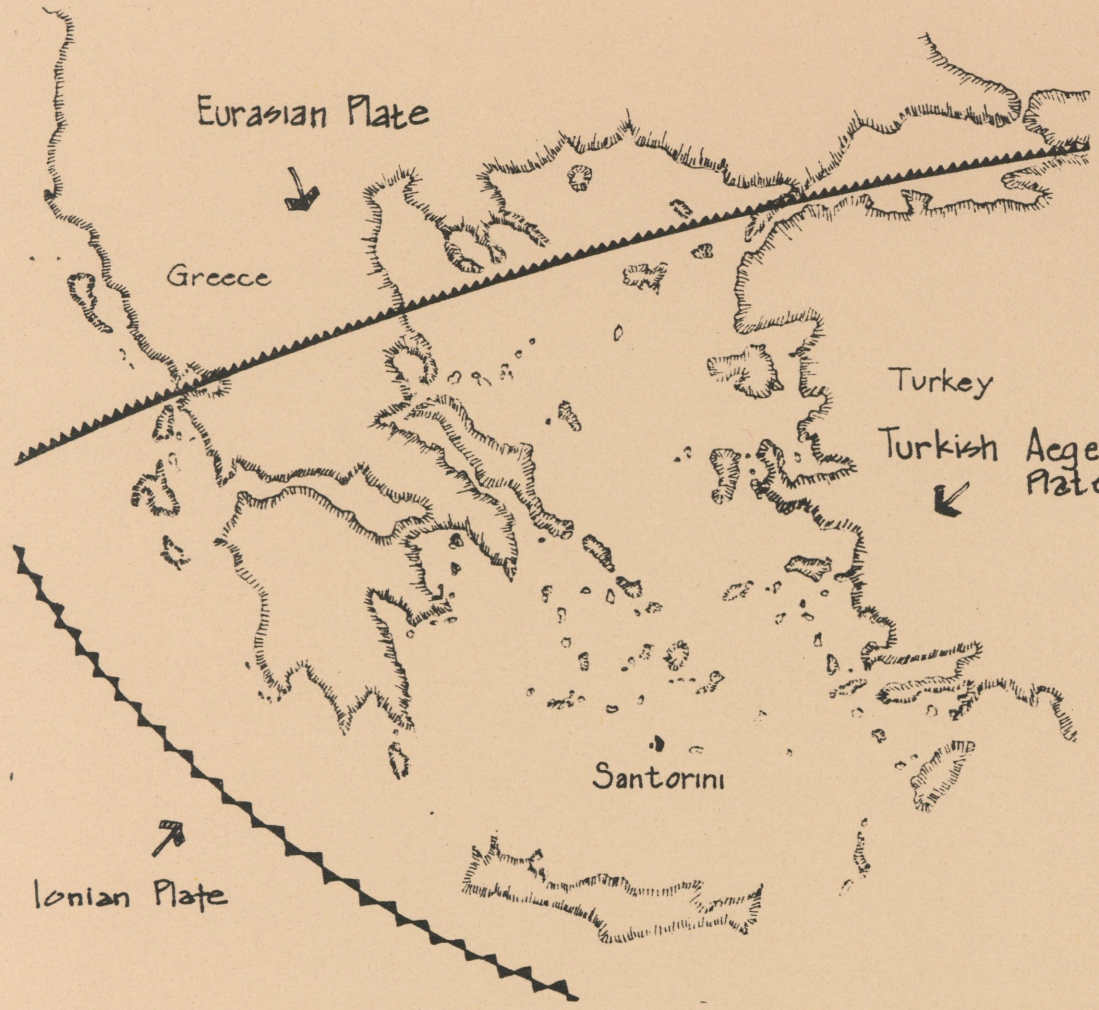
6). reinforced masonry constuction - possible structural damage during an earthquake but the building will stand up.

fair

Conclusion

"the design goal is for the structure to survive moderate earthquakes without damage, to recieve no major structural damage from the most severe predicted, and not collapse or cause loss of life if the abnormal occurs."

from G. cabell childress



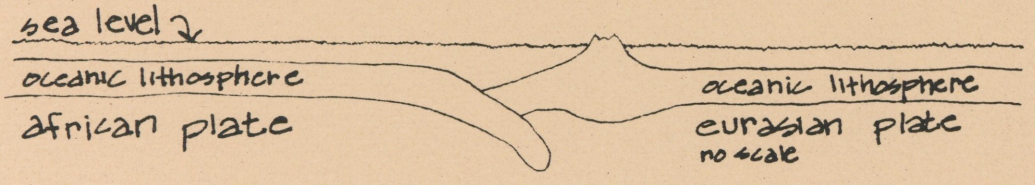
The earth's crust consists of a series of plates which float on the molten mantle.

These plates are in motion at speeds ranging from 2 to 7 mm per year.

When the larger plates make contact, one plate is pushed under the other; shown below in this case the African plate is being pushed under the Eurasian plate.

subduction zone

major plate lines



ΑΛΕΤΗΙΑ, ΚΑΥ ΟΥ·ΗΕ ΦΑΡΑΜΕΤΗΙΑ!
ΤΙ ΝΑ ΚΑΝΟΥΜΕ?
What can I do?
What can I say?

Disunity is a legacy that has been plaguing Greece always and that seems to be destined to prevail forever in the Greek blood.
ZOROS

Really, and that's no fairytail!

... and the last inhabitant, an old woman, had to be dragged away by main force, so attached was she to the home of her ancestors.

A Greek is a person who wants to be a Greek, feels he is a Greek and says he is a Greek. Eleftherios Venizelos

All that I know is that I know nothing.
SOCRATES

ΤΙ ΝΑ ΚΑΝΟΥΜΕ?

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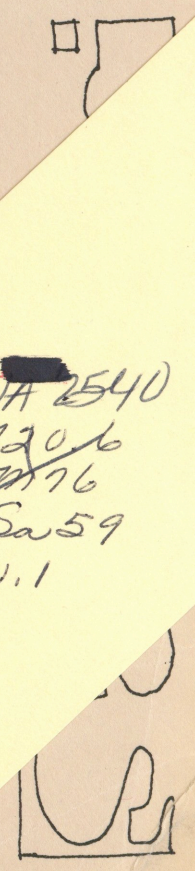

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