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PASSIVE SOLAR SYSTEMS FOR DOMESTIC ARCHITECTURE IN SOUTHERN AFRICA

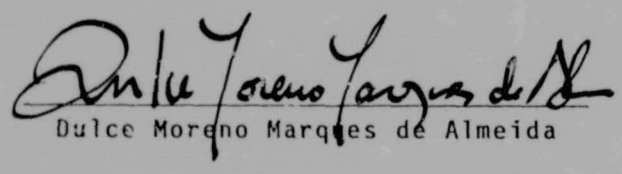
DULCE MORENO
MARQUES DE ALMEIDA

A Thesis submitted to the Faculty of Architecture, University of The Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master in Architecture

Johannesburg 1988

DECLARATION

I declare that this thesis is my own, unaided work. It is being submitted for the degree of Master of Architecture in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.



Dulce Moreno Marques de Almeida

Johannesburg, the 31st of January 1988

CONTENTS

	Page n°
Title	i
Declaration	ii
Table of Contents	iii
Abstract	iv
Preface/Acknowledgment	v
List of Tables	vii
List of Graphs	viii
List of Charts	ix
List of Figures	x
List of Drawings	xiv
Sources	xv

CHAPTERS:

	Page n°
1. Worshipping the Sun	1
2. Vernacular Architecture	6
3. Vitruvius	22
4. From Vitruvius Todate	28
5. A matter of Interest "Sundials"	38
6. The World's Climate (Köppen Classification)	51
7. Southern Africa Climate	62
8. Four Different Climates	88
9. Four Different Projects	96
Project 1	114
Project 2	131
Project 3	146
Project 4	161
10. Tests	165
Postscript	200
Glossary	204
Selected Bibliography	209

ABSTRACT

There are few places in the World where the climate allows life to take place without protection from the elements.

The need to control and improve human living conditions, is one of the major reasons for the existence of buildings.

No matter how we approach the subject, through scientific, physiological considerations or via accumulated experiences and tradition, building design must have an integrated correlation with its environment, sustain "quality of life".

The building form and envelope should be used as a mediator between climate and people, providing confort by natural energy flows.

Energy appears as a standpoint from which to better understand building design, making possible the balance between the inner and outer realities.

This thesis brings together key articles, and references that offer the basic directions necessary for reasoned approach to energy conscious design.

Four design concepts are presented to exemplify some of the attitudes which can be taken to improve comfort conditions using passive means.

Four regions with the most significant climates in southern Africa were chosen, and their climatic design data analysed to be part of fundamental information for the concept of the four houses.

A computer program was used to test their thermal perfomance. Results are presented.

The intention of this study is to bridge information gaps between research and practice and to communicate with anyone interested and involved - as we all should be - in the still undetermined impact of energy resource constraints on our lives.

PREFACE-ACKNOWLEDGEMENT

My interest in "energy efficient design" began many years ago while I was still studying to become an architect.

My first research in this field was undertaken in the Department of Mechanical Engineering at the University of Porto under the supervision of Prof. E. de Oliveira Fernandes whose support and encouragement to continue my studies I wish to acknowledge.

The idea of writing a Master's at the University of The Witwatersrand came later when I first met Professor Amancio Guedes, Head of the Department of Architecture of the University of the Witwatersrand , who was at the time on Sabbatical in Portugal.

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LIST OF TABLES

Table.n°	Description	Page n°
1.	Main Vegetation Zones	56
2.	Modified Koppen Climate Classification	58
3.	Climatic Design Data Four Cities	90
4.	Climate Design Decisions and Design date	94
5.	Summary of Requirements for Building Form in Relation to Climate	95
6.	Wind Speed and Sand Movement	100
7.	Comparative Study of Building Materials and its Areas	175
8.	Building Construction Details	177
9.	Clothing and Activity Values and Wind Velocity, its effect on Man	186

LIST OF GRAPHS

Graph.n°	Description	Page n°
1.	Comparative Study of Rainfall Temperature and humidity	91
2.	Comparative Study of Global Solar Radiation on Vertical Surface	92
3	Comparative study of surface winds.	93
	THERMAL ANALYSIS SIMULATION GRAPHS	
4.	Keetmanshoop - Summer	167
5.	" - Winter	168
6.	Durban - Summer	169
7.	" - Winter	170
8.	Johannesburg - Summer	171
9.	" - Winter	172
10.	Cape Town - Summer	173
11.	" - Winter	174

LIST OF CHARTS

THERMAL COMFORT CHARTS

Chart.n°	Description	Page n°
1.	Key Chart	185
2.	Keetmanshoop-Hot Season	187
3.	" Cold Season	188
4.	Durban - Hot Season	191
5.	" Cold Season	192
6.	Johannesburg-Hot Season	194
7.	" Cold Season	195
8.	Cape Town - Hot Season	197
9.	" - Cold Season	198

LIST OF FIGURES

Fig.n°	Description	Page n°
1.	Egyptian Sky Goddess Nut	2
2.	Aztecs	2
3.	Stonehenge	3
4.	Temple of Karnak	3
5.	Pantheon	3
6.	Osiris	4
7.	Tut-ankh-Ammon and Queen Inkhenpaaten	4
8.	Mape of Indian migration across the American Continent	7
9.	Igloo	8
10.	Typical Indian dwellings in the cool zone of America	9
11.	The Wigwam	9
12.	Typical communal structure in the hot and dry zone of America	10
13.	Pueblo Bonito - California	10
14.	Typical Indian dwelling in the hot humid zone of America	11
15.	Malay House	12
16.	Malay House - shutters	14
17.	Typical pit dwelling in Tunisia	16
18.	Inside of pit dwelling in Tunisia	17
19.	African dwelling (S.A.)	18
20.	African dwelling (S.A.)	18

LIST OF FIGURES

Fig.n°	Description	Page n°
1.	Egyptian Sky Goddess Nut	2
2.	Aztecs	2
3.	Stonehenge	3
4.	Temple of Karnak	3
5.	Pantheon	3
6.	Osiris	4
7.	Tut-ankh-Ammon and Queen Inkhenpaaten	4
8.	Mape of Indian migration across the American Continent	7
9.	Igloo	8
10.	Typical Indian dwellings in the cool zone of America	9
11.	The Wigwam	9
12.	Typical communal structure in the hot and dry zone of America	10
13.	Pueblo Bonito - California	10
14.	Typical Indian dwelling in the hot humid zone of America	11
15.	Malay House	12
16.	Malay House - shutters	14
17.	Typical pit dwelling in Tunisia	16
18.	Inside of pit dwelling in Tunisia	17
19.	African dwelling (S.A.)	18
20.	African dwelling (S.A.)	18

LIST OF FIGURES (cont.)

Fig.n°	Description	Page n°
21 a).	African Grass Beehive (S.A.)	18
21 b).	Detail of Grass Beehive (S.A.)	19
22 a).	Portuguese Dwelling-North Region	19
22 b).	Portuguese Dwelling - detail of fire place	19
23 a).	Portuguese Dwelling-South Region	20
23 b).	Detail of Lettuce Door	20
24.	Sturges House	30
25.	Gropius Study of sun penetration	31
26.	Plan of "Une Ville Contemporaire" - Le Corbusier	32
27.	Carthage House	33
28 a).	Alger Housing	33
28 b).	Detail Section of Alger Housing	34
29.	Sketch on Climate/Architecture rela tionship - V. and O. Olgyay	38
30.	Man measuring shadow of rod	
31.	Altitude Dial	40
32.	Compass Dial	41
33.	Quadrant Sundial	42
34.	Ring Dial	43
35.	Greco-Roman Gnonom Sundia	43

LIST OF FIGURES (cont.)

Fig.n°	Description	Page n°
36.	Roman Portable Dial	44
37.	Hemicyclic Dial Pompeii 1854	44
38.	Shepherd Dial	45
39.	Magnetic Sundial - Dupois Blond 1686	46
40 a).	Butterfield Sundial	46
40 b).	Sty-Axe of a Butterfield's	47
41.	Astronomical Ring Dial - Elias Allen	47
42.	English Astronomical Ring Dial	48
43.	Multiple Dial	49
44.	World Map - Vegetation Zones	54
45.	World Map - Climate Distribution	55
46.	S.A. Map - Surface Winds	64
47.	S.A. Map - Atmospheric Moisture	65
48.	S.A. Map - Summer Converging air-stream	69
49.	S.A. Map - Isobars	72
50.	S.A. Map - Mean annual sunshine (hours/day)	74
51.	S.A. Map - Mean annual precipitation	75
52.	S.A. Map - Rainfall	77
53.	S.A. Map - Thunder Occurrence	79

LIST OF FIGURES (cont.)

Fig.n°	Description	Page n°
54.	S.A. Map - Mean daily maximum temp.	80
55.	Absolute Temperature Minima for some S.A. Stations	74
56.	Different forms of windborne sand	100
57.	Typical Middle Eastern Wind Scoop	190

LIST OF DRAWINGS

Dwg.n°	Description	Page n°
1.	Namibia House - plan and South Elevation	113
2.	Namibia House - Section and North Elevation	114
3.	Namibia House - Roof Plan and Side Elevation	115
4.	Namibia House - Axonometric	116
5.	Durban House - Plan; East and West Elevation	131
6.	Durban House - Roof Plan; Section and Side Elevation	132
7.	Durban House - Axonometric	133
8.	Johannesburg House - Plan; North and South Elevation	134
9.	Johannesburg House - Roof Plan; West Elevation and two Sections	146
10.	Johannesburg House - Axonometric	147
11.	Cape Town House - Plan; North Elevation and Section	148
12.	Cape Town House - Roof Plan; South Elevation and Side Elevation	162
13.	Cape Town House - Axonometric	163
14.	Plan of Standard S.A. House	164

All Drawings by Author.

TABLES SOURCE

Table n°	Source
1.	Housing Climate and Comfort by Martin Evans p.44
2.	op cit. p.45
3.	Climatic Design Data by J. D. Wentzel, R.J. Page-Shipp, H. Kruger and D.H. Meyer - N.B.R.I. p.8 and p.11
4.	Housing Climate and Comfort by Martin Evans p.50
5.	op cit. p.74
6.	op cit. p.56
7.	by author
3.	by author
9.	Energy conservation in Hot Climates by Ocelet Holm p.23

THERMAL COMFORT CHARTS SOURCE

Chart	Source
Key Chart.	Building Climate and Energy by T.S. Markus and E.N. Morris p.84

GRAPHS SOURCE

Graph n°	Source
1	by author
2	by author
3	by author
4/10	Print-outs from "Quick Temp" Thermal Performance Tests

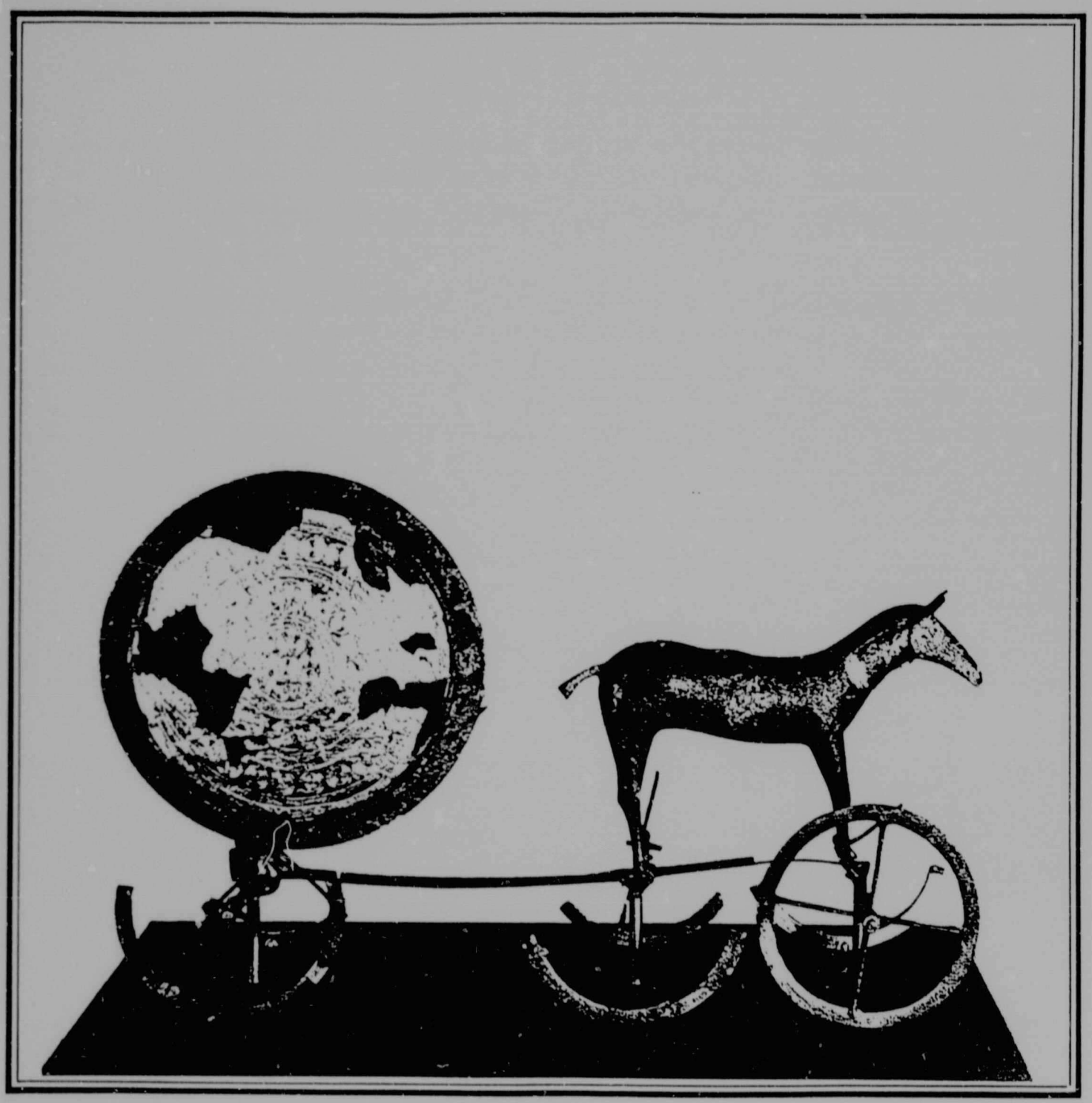
FIGURES SOURCE

Fig.n°	Source
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2.	op cit. p.1.38
3.	op cit. p.1.41
4.	op cit. p.1.40
5.	op cit. p.1.42
6.	op cit. p.1.36
7.	
8.	Design with Climate by Victor Olgyay p.4
9.	Building Climate and Energy by T.A. Markus and E.N. Morris p.142
10.	Design with Climate by Victor Olgyay p.5
11.	op cit. p.5
12.	op cit. p.5
13.	Energy Conservation through Building Design by Donald Watson p.3
14.	Design with Climate by Victor Olgyay p.5
15.	Building Climate and Energy by T.A. Markus and E.N. Morris p.160
16.	op cit. p.162
17.	Passive Cooling Conference, Miami Proceedings p.177
18.	op cit. p.178
19.	Rural Shelter in Southern Africa by Franco Frescura p.73
20.	op cit. p.110
21 a).	op cit. p.44
21 b).	op cit. p.44
22.	Arquitectura Popular Portuguesa by Sindicato dos Arquitectos Portugueses
23.	op cit.
24.	Frank Lloyd Wright- Usonian Houses by John Sergeant, p.53
25.	Building Climate and Energy by T.S. Markus and E.N. Morris p.9
26.	Le Corbusier - The Complete Architectural Works, Vol.1 (19[illegible] 1929) edited by Boesiger and O.Stonorow p.35
27.	op cit. p.177
28 a).	Le Corbusier - The Complete Architectural Works, edited by Boesiger and O. Stonorow Vol.2 (1929 1934) p.163
28 b).	op cit. p.163
29.	Climate and Architecture by Jeffrey Ellis Aronin p.24
30.	Windows and Environment by Pilkington Brothers Limited p.1.39

FIGURES SOURCES (cont.)

Fig.n°	Source
31.	Mesures du Temps et de l'Espace by Samuel Guye et Henry Michel fig.224
32.	op cit. fig.231
33.	op cit. fig.222
34.	Encyclopaedia Britannica p.313
35.	Mesures du Temps et de l'Espace T.80
36.	Encyclopaedia Britannica p.311
37.	op cit. p.310
38.	Mesures du Temps et de l'Espace fig.225
39.	op cit. fig.232
40 a).	op cit. fig.239
40 b).	op cit. T.84
41.	op cit. fig.244
42.	op cit. fig.245
43.	op cit. fig.253
44.	Housing Climate and Comfort by Martin Evans p.46
45.	op cit. p.48
46.	Standard Encyclopaedia of Southern Africa p.259
47.	op cit. p.261
48.	op cit. p.261
49.	op cit. p.262
50.	op cit. p.263
51.	op cit. p.264
52.	op cit. p.266
53.	op cit. p.266
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Worshipping the SUN



From earliest times the Sun has been an object of veneration, revered by all the peoples of primitive civilisations.



Fig.1.

This veneration is not without some justification, for were the sun to fail or were the radiation which it pours forth so profusely to undergo even a slight variation, life on Earth would no longer be possible.

Men thus came to recognize as vital that the Sun should continue to move along its path.



Fig.2.

Before men understood what causes an eclipse, the sudden disappearance of the sun was a frightening phenomenon.

It seemed as though some shadowy demon devoured the source of light and everything must be done to dispel the

forces of darkness.

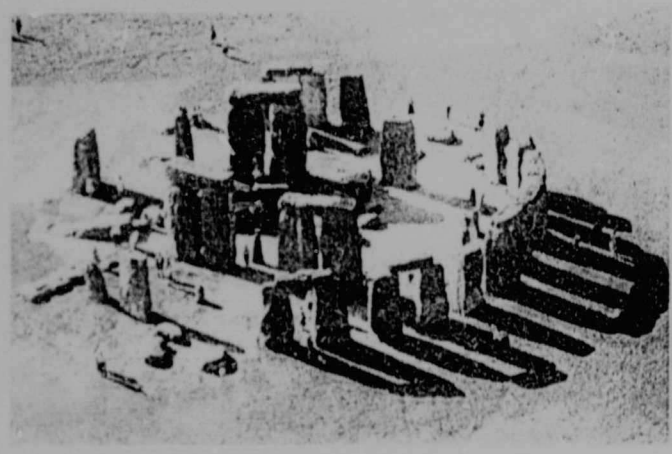


Fig.3.

The Egyptians thought the sun was on a night journey, Fig.1.

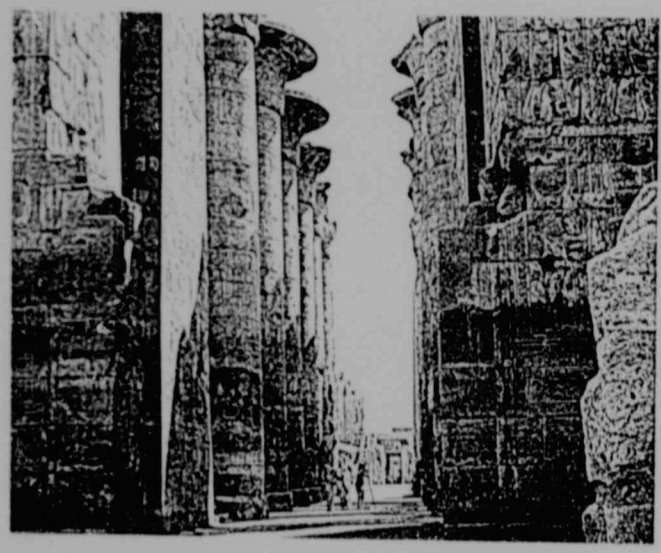


Fig.4.

The Aztecs held that the sun would fail if not constantly placated with the blood of men. Fig.2.

For this they built mighty "pyramids", like those at Teotihuacan.

In their worship of sunlight, men have built great shrines, aligned to gather the sun's rays along special passages at a given moment.

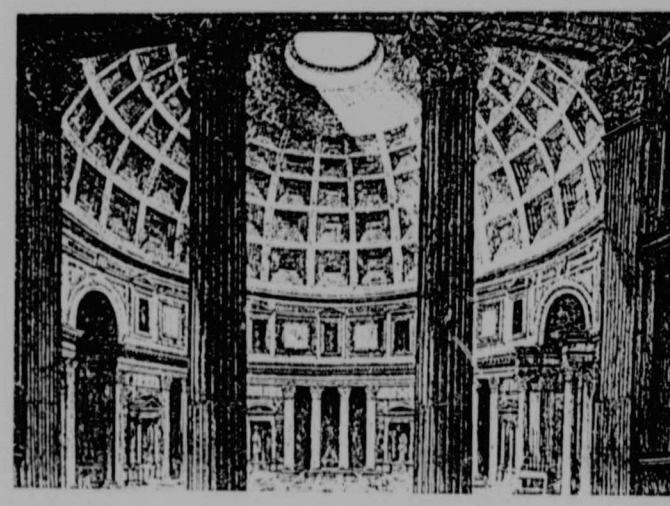


Fig.5.

The shrine at Stonehenge is designed to align the sun's rays at sunrise on summer solstice, with the axis of the structure. Fig.3.

The great hall of columns in the temple of Karnak also gathers the sun's rays at a special time. Fig.4.

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