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Authors

Yancey, T.
Wilde, Pat

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RECENT SEDIMENTS
OF
MONTEREY BAY

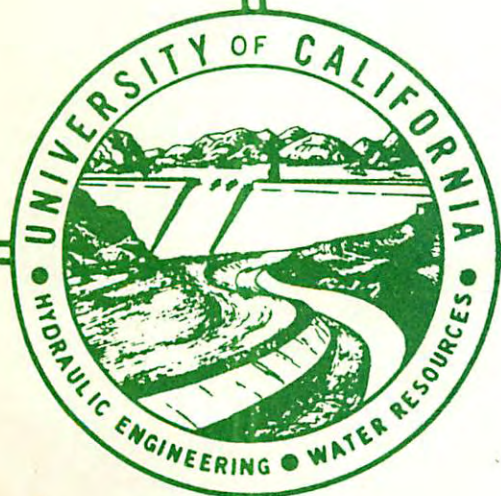
ADDITIONAL MINERALOGICAL DATA

by

T. YANCEY

P. WILDE

HYDRAULIC ENGINEERING LABORATORY
COLLEGE OF ENGINEERING



UNIVERSITY OF CALIFORNIA
BERKELEY
SEPTEMBER, 1971

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Hydraulic Engineering Laboratory

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HEL-2-33

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RECENT SEDIMENTS OF MONTEREY BAY

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ABSTRACT

The heavy mineralogy of the sand fraction for beach samples reported by Sayles (1966) and 10 new offshore samples from South Monterey Bay was determined optically. For each sample the percentage of the more diagnostic transparent minerals is plotted graphically in order of persistence: zircon, garnet, biotite, apatite, clinozoisite and epidote, lawsonite, green hornblende, oxy-hornblende, glaucophane, sphene, zoisite, augite, jadeite, hypersthene, enstatite, and tremolite & actinolite. Additional data on accessory transparent minerals, composite grains (rock fragments) and opaque minerals are listed with each graph. An updated bibliography is presented to include all new work on the geology and sediment of Monterey Bay.

INTRODUCTION

The increased public interest in environmental problems of the Monterey Bay coastal areas such as the loss of sand from Capitola beach and the posting of bathing beaches due to excessive colloform counts indicates that an up to date regional study of the sediments of the offshore and beaches of Monterey Bay is in order. This report gives mineralogical data in the standard Hydraulic Engineering Laboratory format for beach samples examined by Sayles (1966) and for new offshore samples collected by Prof. Andrews of the Naval Postgraduate School in the fall of 1970. See Fig. 1 for location of samples. This data, along with information on the sediments of North Monterey Bay from Yancey (1968) will form the principle basis for a forthcoming compilation and regional interpretation of sediment transport in Monterey Bay. In addition new work on sediments of the Monterey Bay area reported since Yancey's (1968) compilation are listed below in the References.

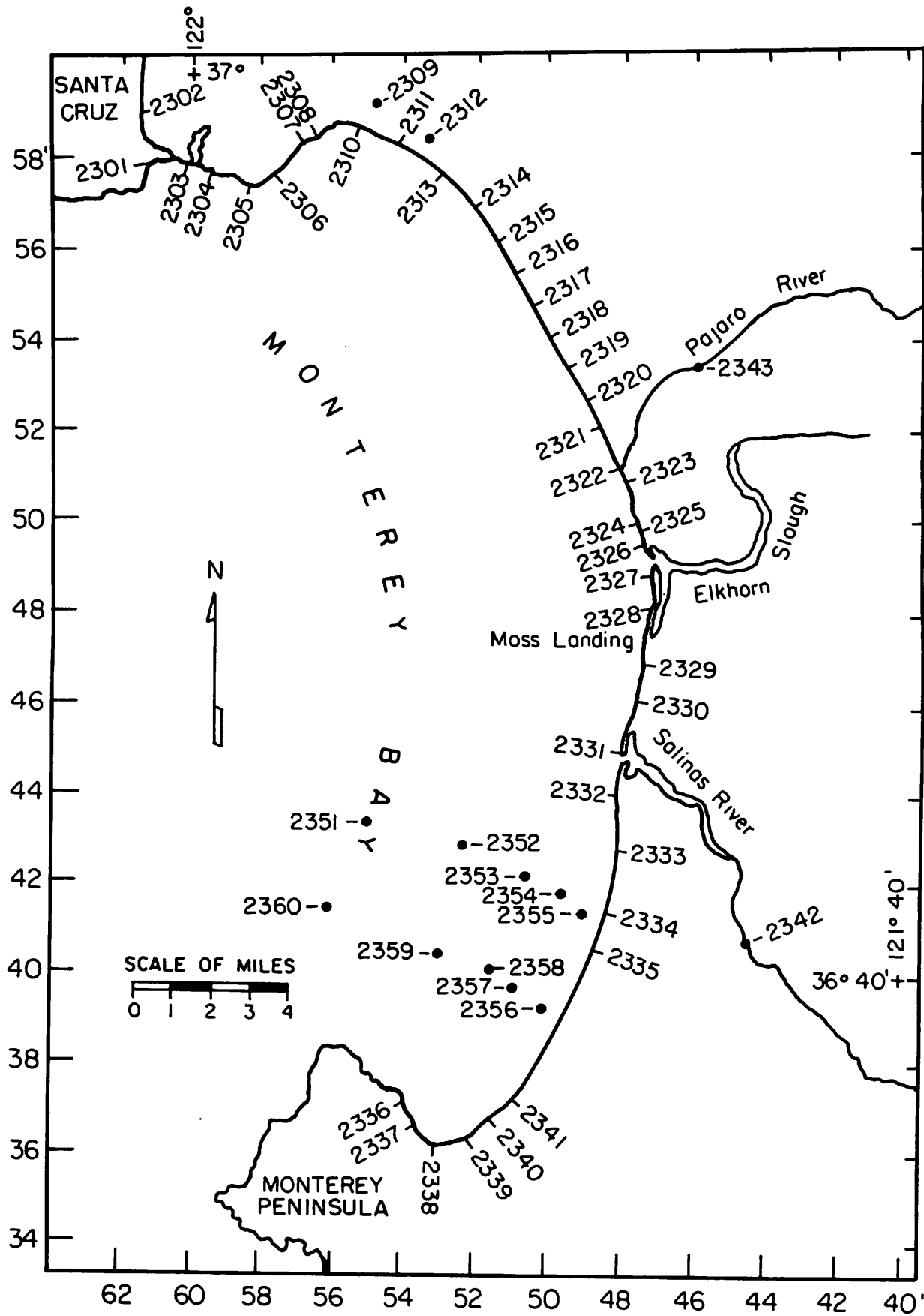


FIG. 1 SAMPLE STATIONS

IDENTIFICATION PROCEDURE

For this report only minerals of the heavy fraction were identified. The grain mounts of the light minerals are available for future study. For each heavy fraction grain mount, individual grains were identified with a Leitz Laborlux polarizing microscope under 28, 80, and 360 power until approximately 100 transparent grains were counted. Opaque grains were identified with oblique reflected light. Alterites (Van Andel, 1958) were considered unidentifiable altered grains. Unknowns were considered unidentifiable transparent grains. Rock fragments were grains of composite mineral composition. Identifications were checked with reference to diagnostic tables in Krumbein and Pettijohn (1938, p. 412-262); Milner (1962, p. 15-207) and by comparison with standard specimens in the University of California, Berkeley, Geological Museum's reference mineral collection. As an additional check on accuracy, some slides were counted in replicate.

DATA SHEETS

Pertinent grain size and mineralogical data for each grain mount are given below. The most common transparent grains are listed left to right in order of persistence (Pettijohn, 1957, p. 516-517). Under opaque mineral listings hematite = hematite plus limonite; and magnetite = magnetite plus ilmenite. Abbreviations used on the data sheets are:

SF = size fraction

mm = millimeters

% = per cent

wt = weight

HM = heavy mineral

no. = number

Size Fraction (SF) in millimeters gives the grain size fraction represented by the graph.

Graph % gives the percent of each mineral shown on the graph considering only transparent grains.

Wt. % of SF/Total Sample is the weight percent of the size fraction with respect to the total weight of the sample.

Wt. % of HM/SF is the weight percent of the heavy mineral fraction of the particular size fraction.

% Transparent Grains is the percent of transparent grains with respect to the total grains counted.

% Opaques is the percent of opaque grains with respect to the total number of grains counted.

% Composite grains and Unknowns is the percent of composite grains (rock fragments) and unknown grains with respect to the total number of grains counted.

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SAMPLE 2301

Wt. % of HM/SF

Location 36° 57.8' 121° 1.6'

Total Grains Counted 142

Depth intertidal meters fathoms

% Transparent Grains 70.6

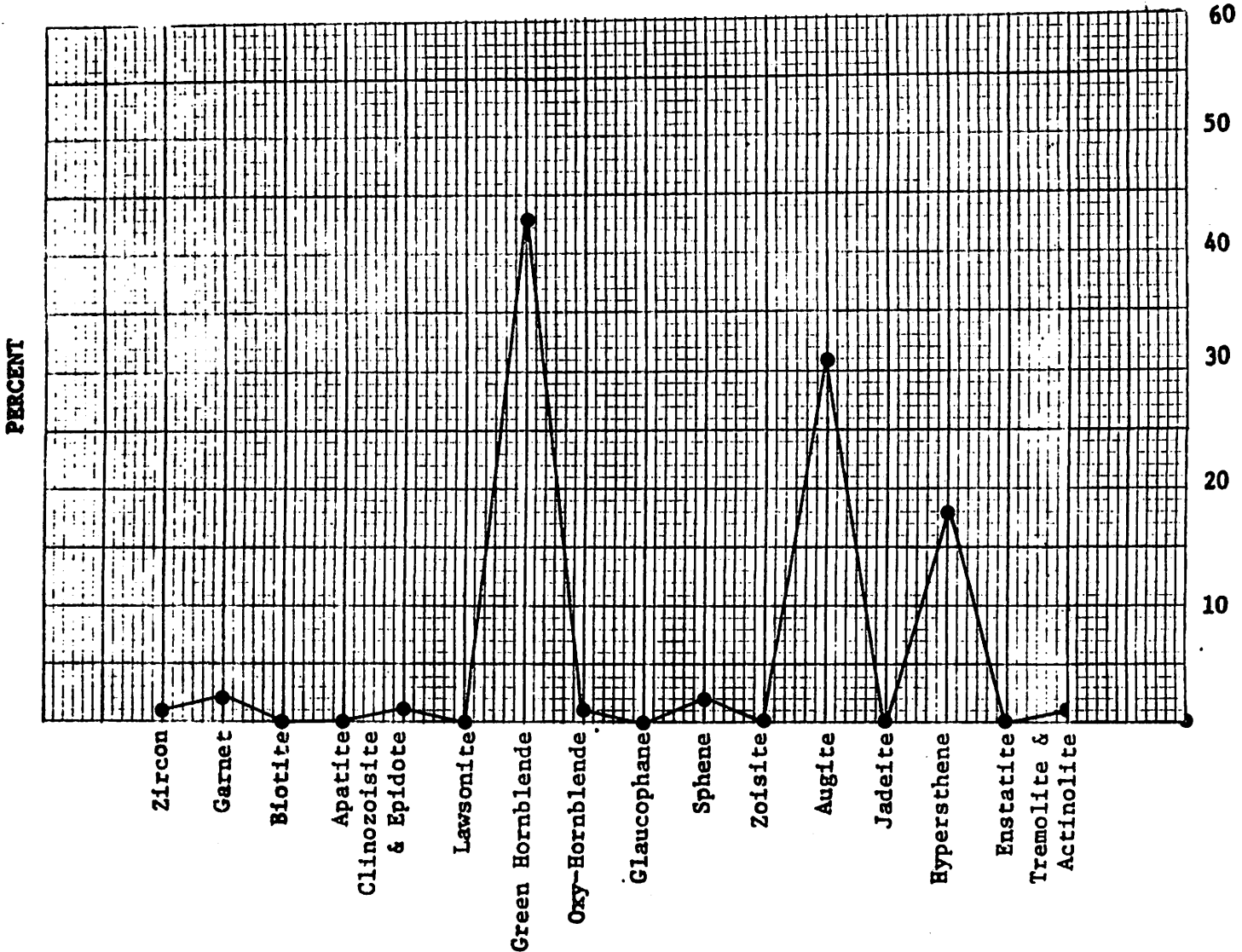
Size Fraction (SF) .074 - .248 mm

% Opaques 29.4

Graph % = Total % of Each Mineral

% Composite Gr. and Unknowns 0

Total % of Transparent Grains
Wt. % of SF/Total Sample



Other Transparent Minerals

Other Opaque Minerals

Mineral No. Grains Counted

Mineral No Grains Counted

Opaques & Alterites 42

Analyst F. Sayles

SAMPLE 2303

Location 36° 57.7' 120° 0.4'

Depth intertidal meters fathoms

Size Fraction (SF) .074 - .248 mm

Graph % = Total % of Each Mineral

Total % of Transparent Grains

Wt. % of SF/Total Sample --

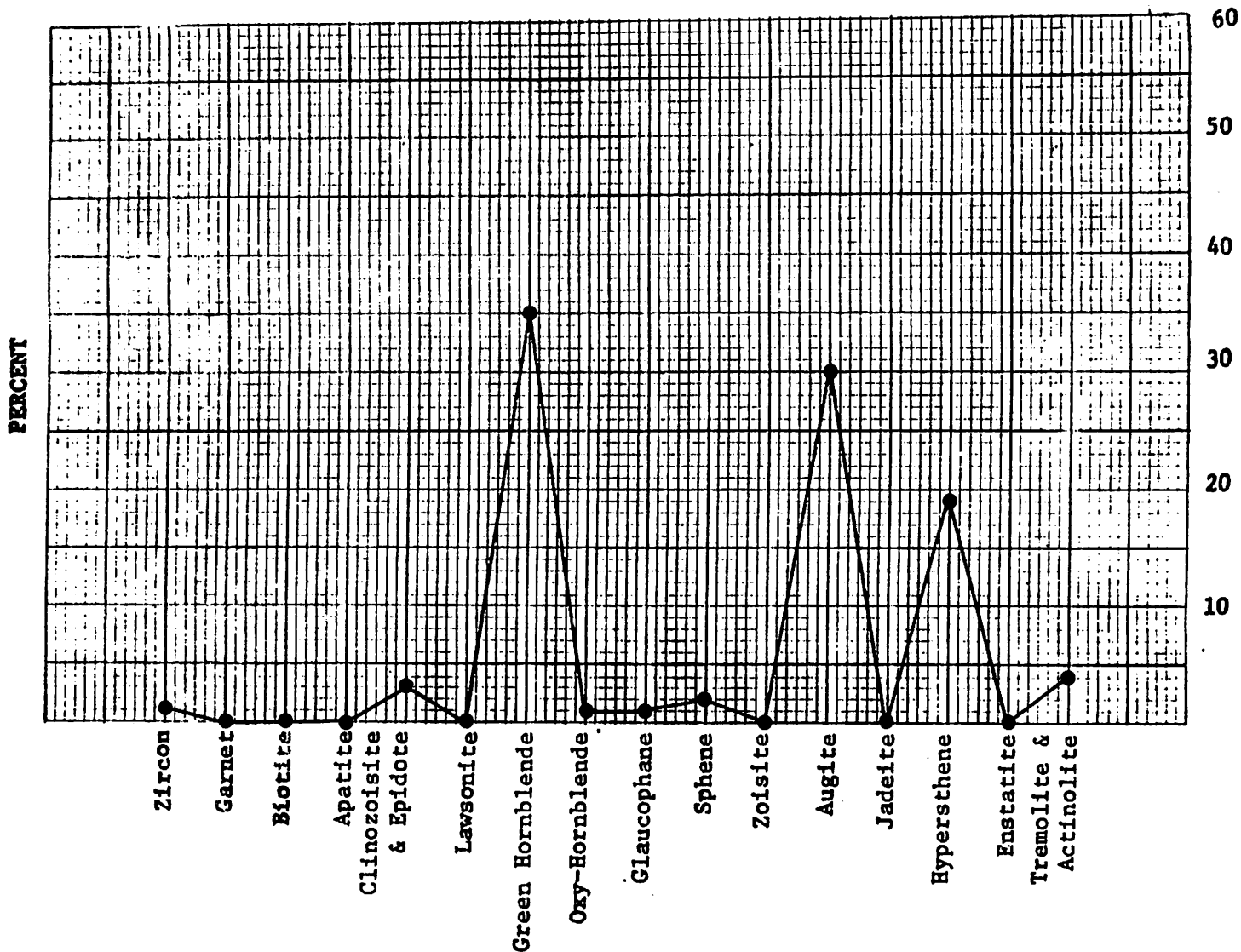
Wt. % of IM/SF --

Total Grains Counted 140

% Transparent Grains 71.4

% Opaques 25.7

% Composite Gr. and Unknowns 2.9



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Unknowns	4
Opaques & Alterites	36

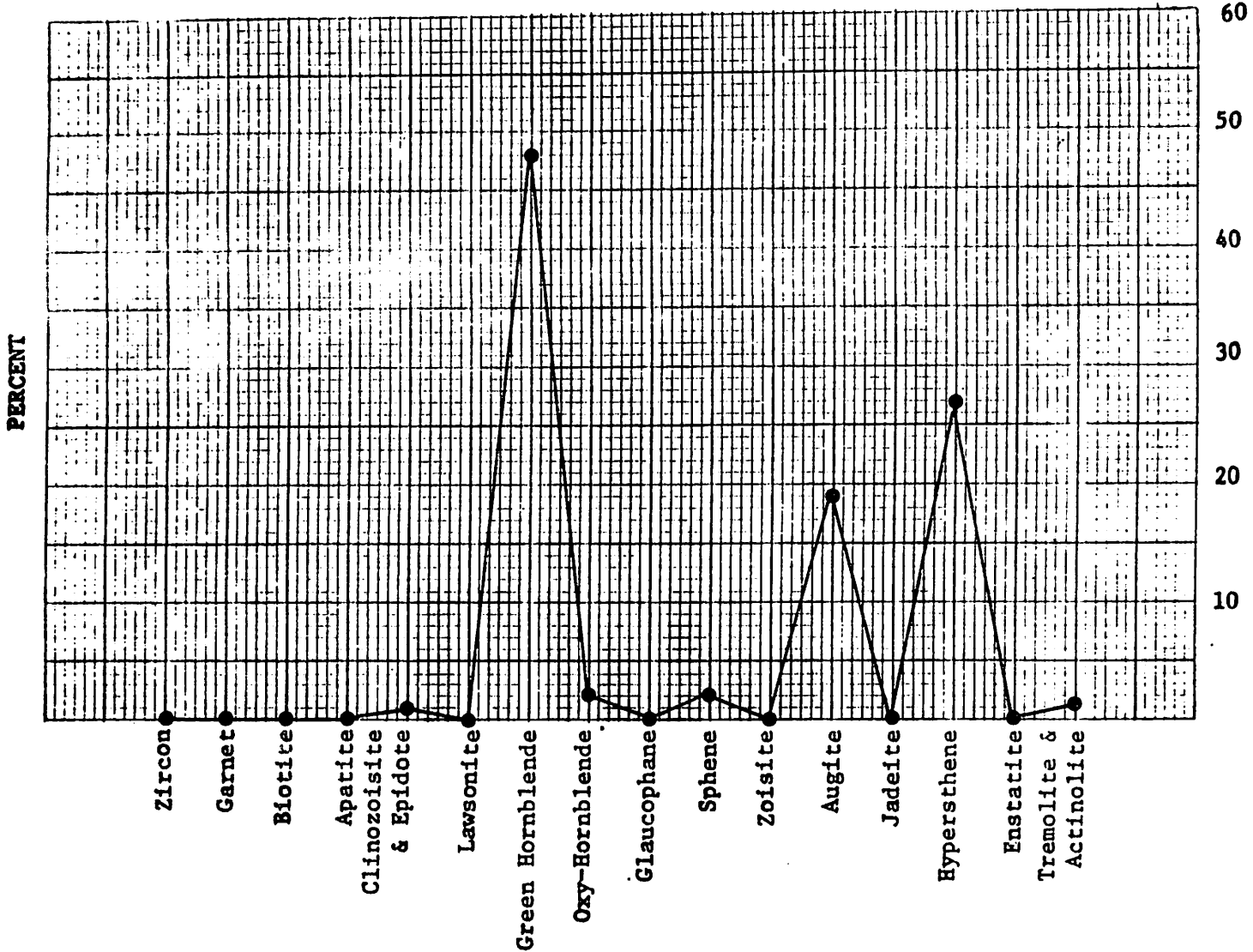
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>

SAMPLE 2312
 Location 36° 58.3' 121° 53.4'
 Depth stream meters _____ fathoms
 Size Fraction (SF) .074 - .248 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF _____
 Total Grains Counted 161
 % Transparent Grains 62.1
 % Opaques _____ 37.9
 % Composite Gr. and Unknowns 0

Total % of Transparent Grains
 Wt. % of SF/Total Sample _____



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Opaque & Alterites	61

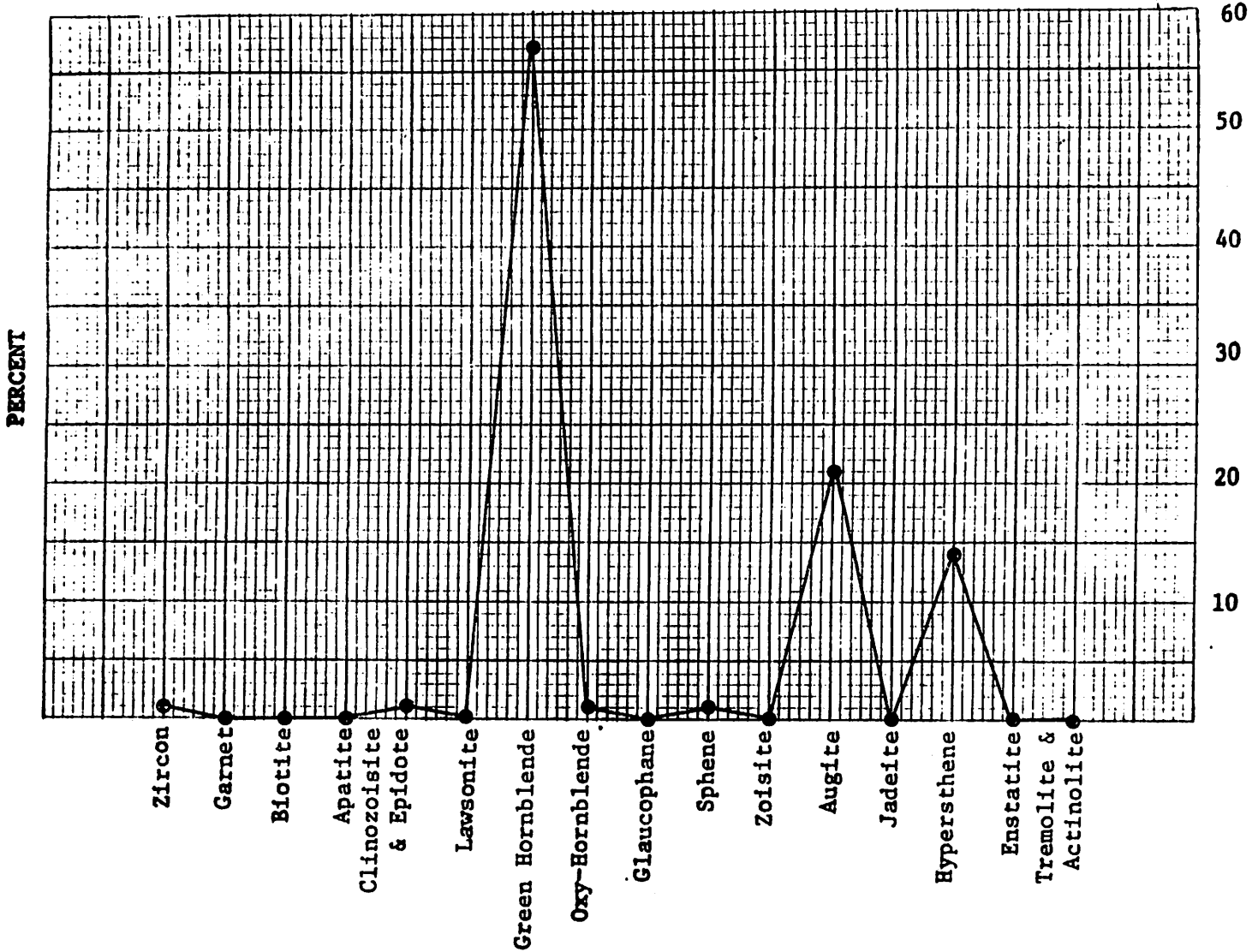
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>

SAMPLE 2317
 Location 36° 54.6' 121° 50.6'
 Depth intertidal meters fathoms
 Size Fraction (SF) .074 - .248 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF
 Total Grains Counted 178
 % Transparent Grains 56.7
 % Opaques 41.6
 % Composite Gr. and Unknowns 2.2

Total % of Transparent Grains
 Wt. % of SF/Total Sample



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Opagues & Alterites	74
Unknowns	4

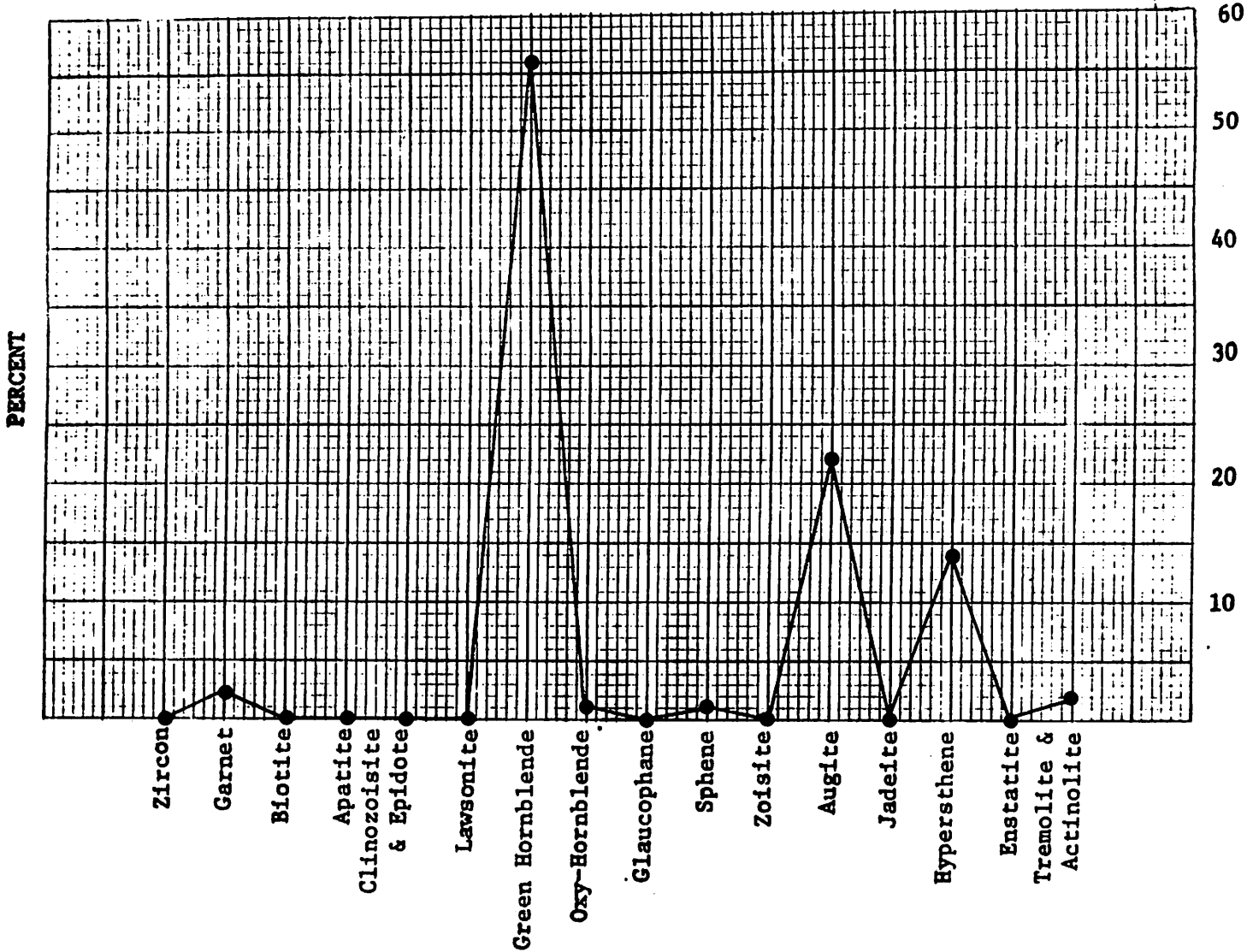
Other Opaque Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>

SAMPLE 2322
 Location 36° 51.2' 121° 47.8'
 Depth intertidal meters fathoms
 Size Fraction (SF) .074 - .248 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF
 Total Grains Counted 142
 % Transparent Grains 70.4
 % Opaques 28.2
 % Composite Gr. and Unknowns 1.4

Total % of Transparent Grains
 Wt. % of SF/Total Sample



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Opaques & Alterites	40
Unknowns	2

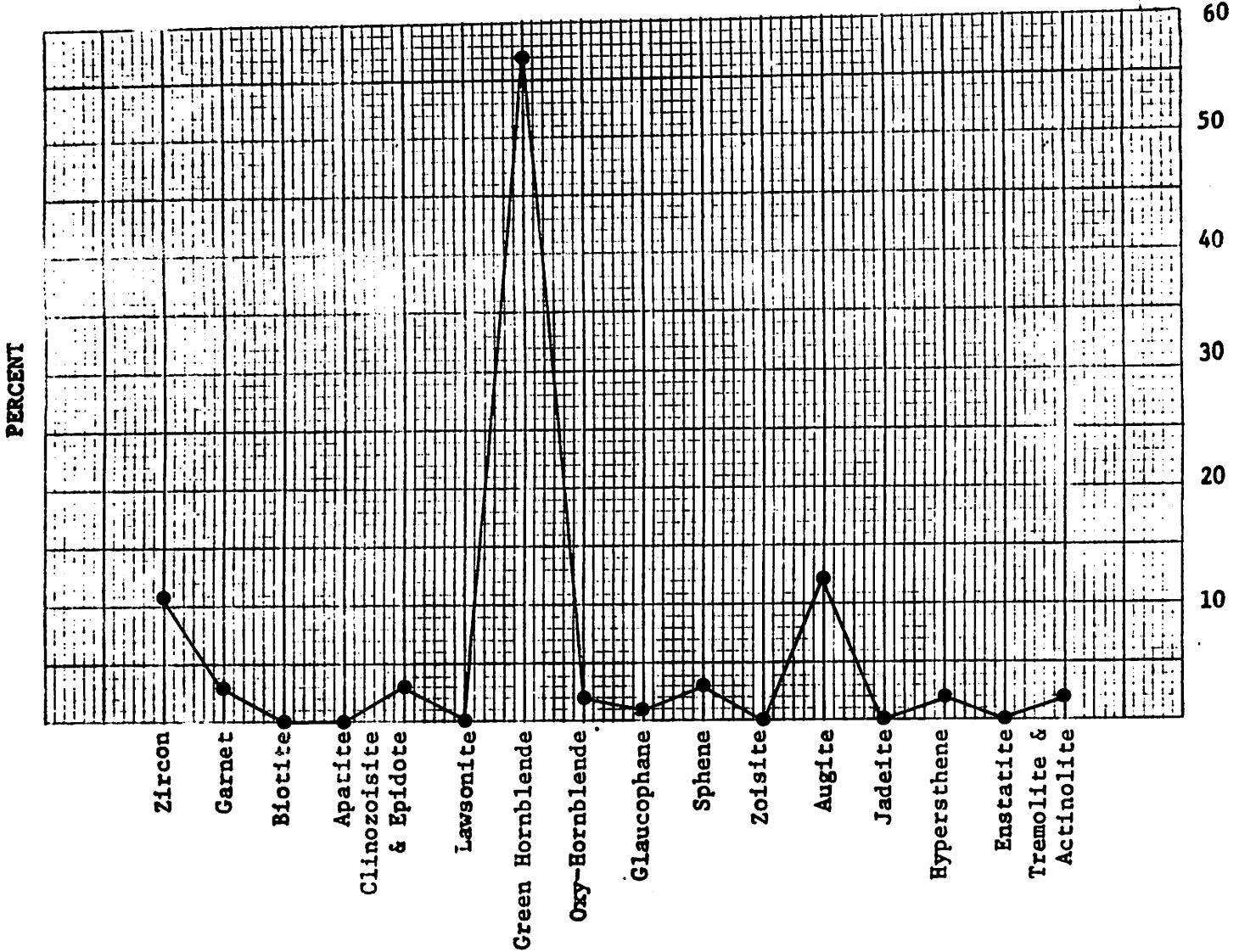
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>

SAMPLE 2342
 Location 36° 40.7' 121° 44.4'
 Depth stream meters _____ fathoms
 Size Fraction (SF) .074 - .248 mm
 Graph % = Total % of Each Mineral

Wt. % of IM/SF _____
 Total Grains Counted 374
 % Transparent Grains 26.7
 % Opaques 72.2
 % Composite Gr. and Unknowns 1.1

Total % of Transparent Grains
 Wt. % of SF/Total Sample _____



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Opagues & Alterites	270
Unknown	4

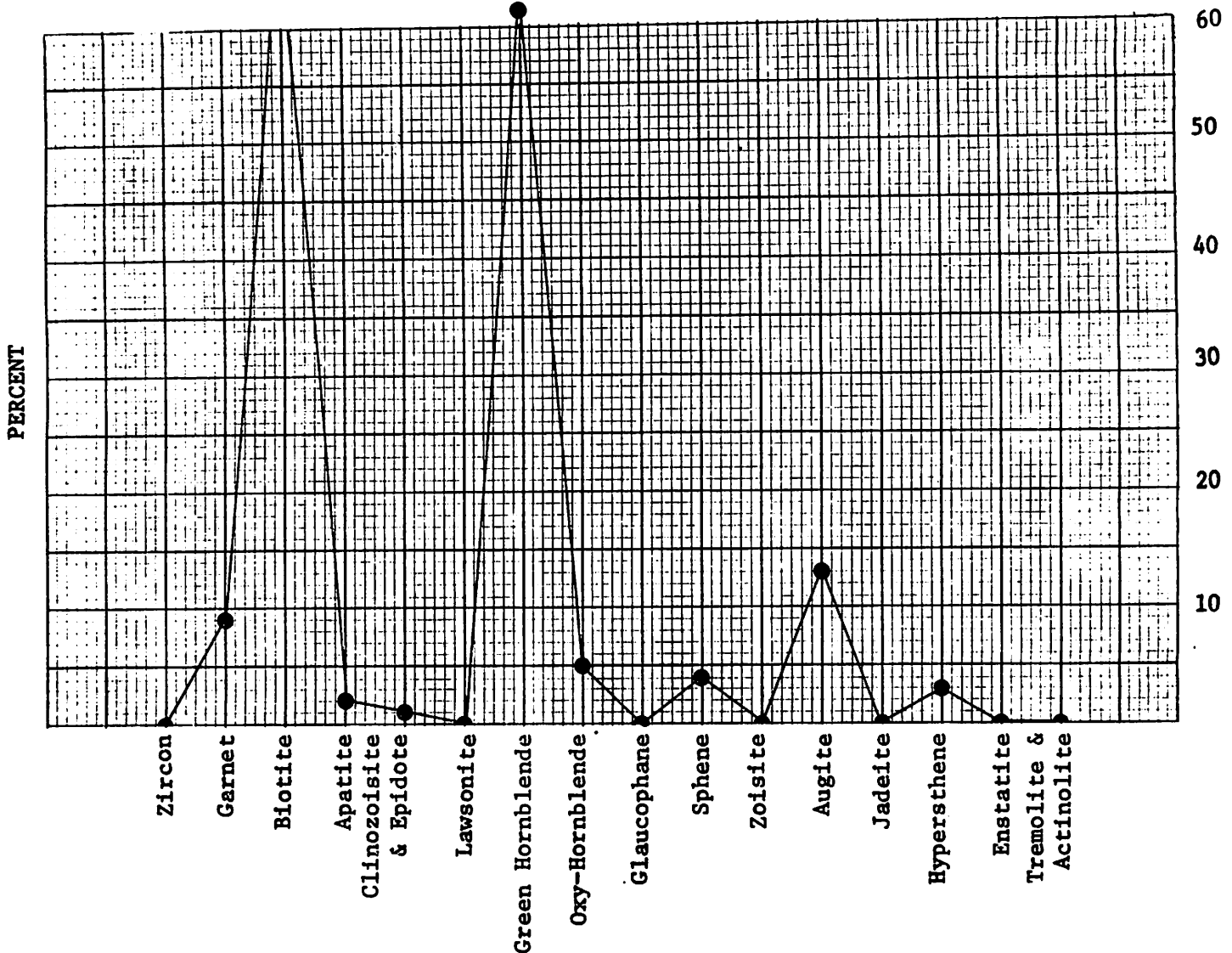
Other Opaque Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>

SAMPLE 2351
 Location 36° 42.5' 121° 54.8'
 Depth 89.2 meters 49 fathoms
 Size Fraction (SF) .062 - .350 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF ---
 Total Grains Counted 222
 % Transparent Grains 45.0
 % Opaques 8.1
 % Composite Gr. and Unknowns 12.6

Total % of Transparent Grains
 Wt. % of SF/Total Sample 2.5



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Detrital Carbonate	1
Unknowns	1
Composites - Alterites	27

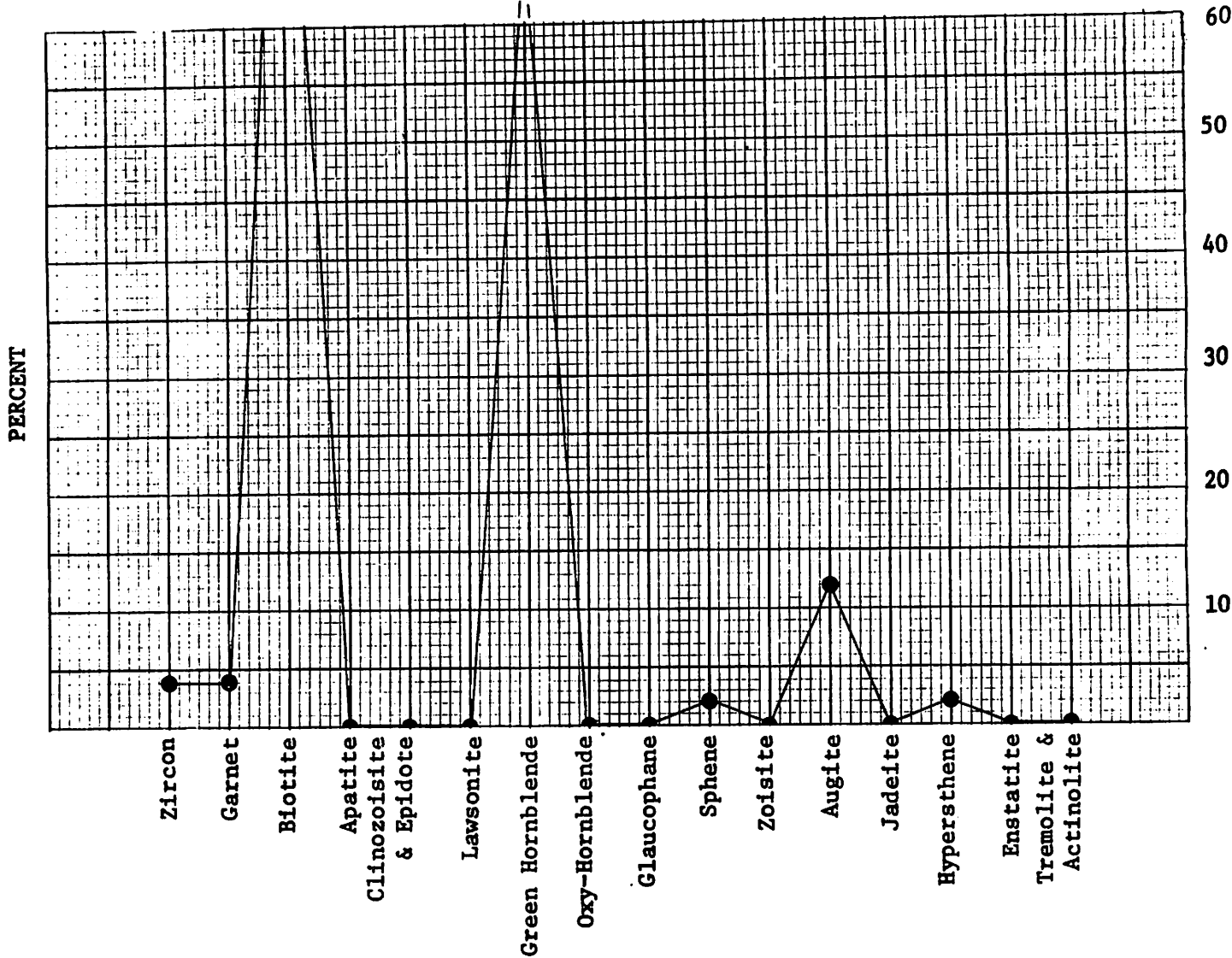
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>
Magnetite Ilmenite	15
Hematite - Goethite	2
Pyrite	1

SAMPLE 2352
 Location 36° 42.5' 121° 52.5'
 Depth 71.0 meters 39 fathoms
 Size Fraction (SF) .062 - .350 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF --
 Total Grains Counted 16.70
 % Transparent Grains 6.0
 % Opaques 0.1
 % Composite Gr. and Unknowns 1.1

Total % of Transparent Grains
 Wt. % of SF/Total Sample 3.3



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Biotite	1550
Unknowns	2
Composites - Alterites	16

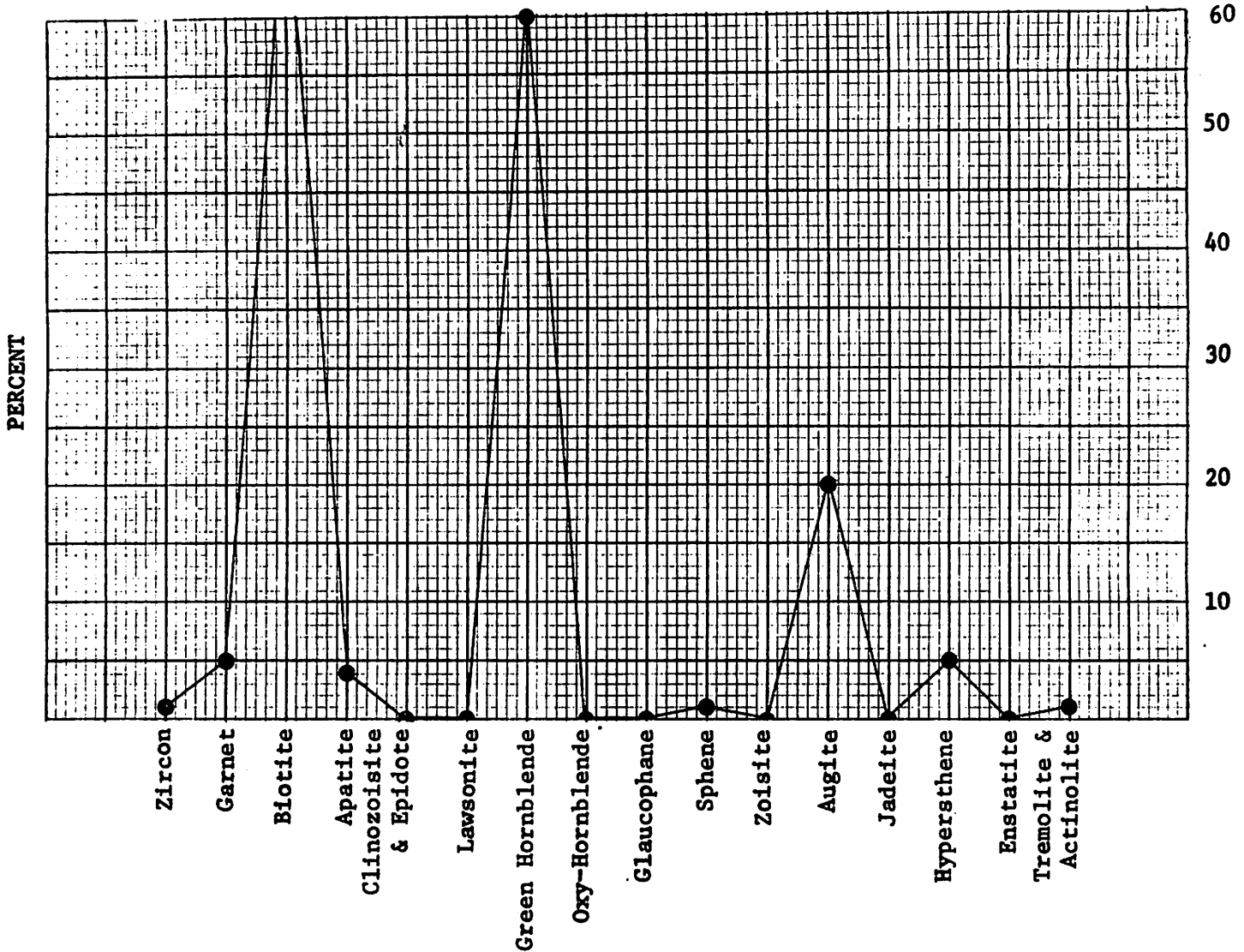
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>
Magnetite - Ilmenite	2

SAMPLE 2353
 Location 36° 41.9' 121° 50.8'
 Depth 52.8 meters 29 fathoms
 Size Fraction (SF) .062 - .350 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF --
 Total Grains Counted 361
 % Transparent Grains 27.7
 % Opaques 1.7
 % Composite Gr. and Unknowns 36.3

Total % of Transparent Grains
 Wt. % of SF/Total Sample 15.0



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Detrital Carbonate	3
Unknowns	1
Composites - Alterites	130

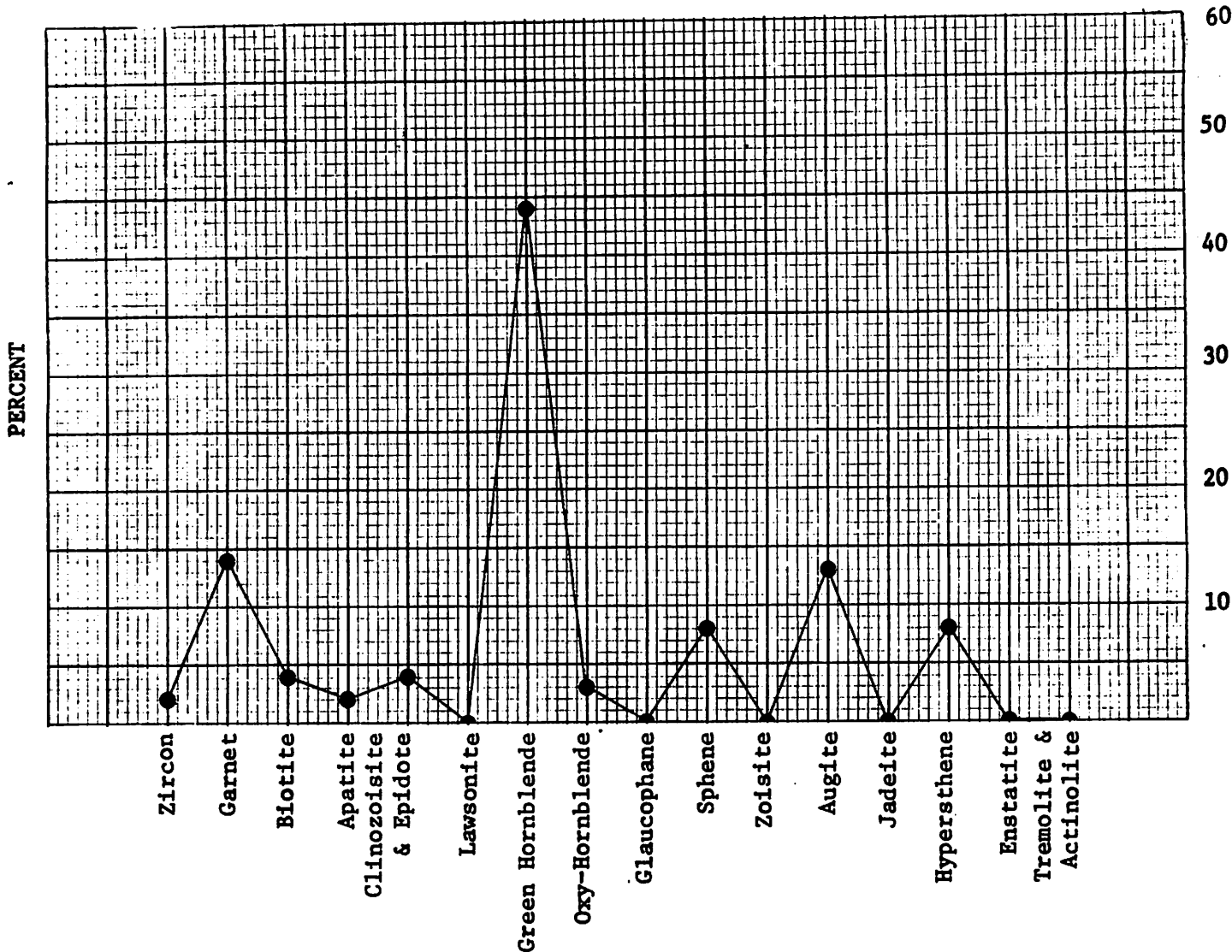
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>
Magnetite - Ilmenite	4
Hematite - Goethite	1
Pyrite	1

SAMPLE 2355
 Location 36° 41.0' 121° 49.5'
 Depth 21.8 meters 12 fathoms
 Size Fraction (SF) .062 - .350 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF ---
 Total Grains Counted 165
 % Transparent Grains 60.6
 % Opaques 21.2
 % Composite Gr. and Unknowns 16.4

Total % of Transparent Grains
 Wt. % of SF/Total Sample 98.1



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Rutile	1
Unknowns	1
Composites - Alterites	26

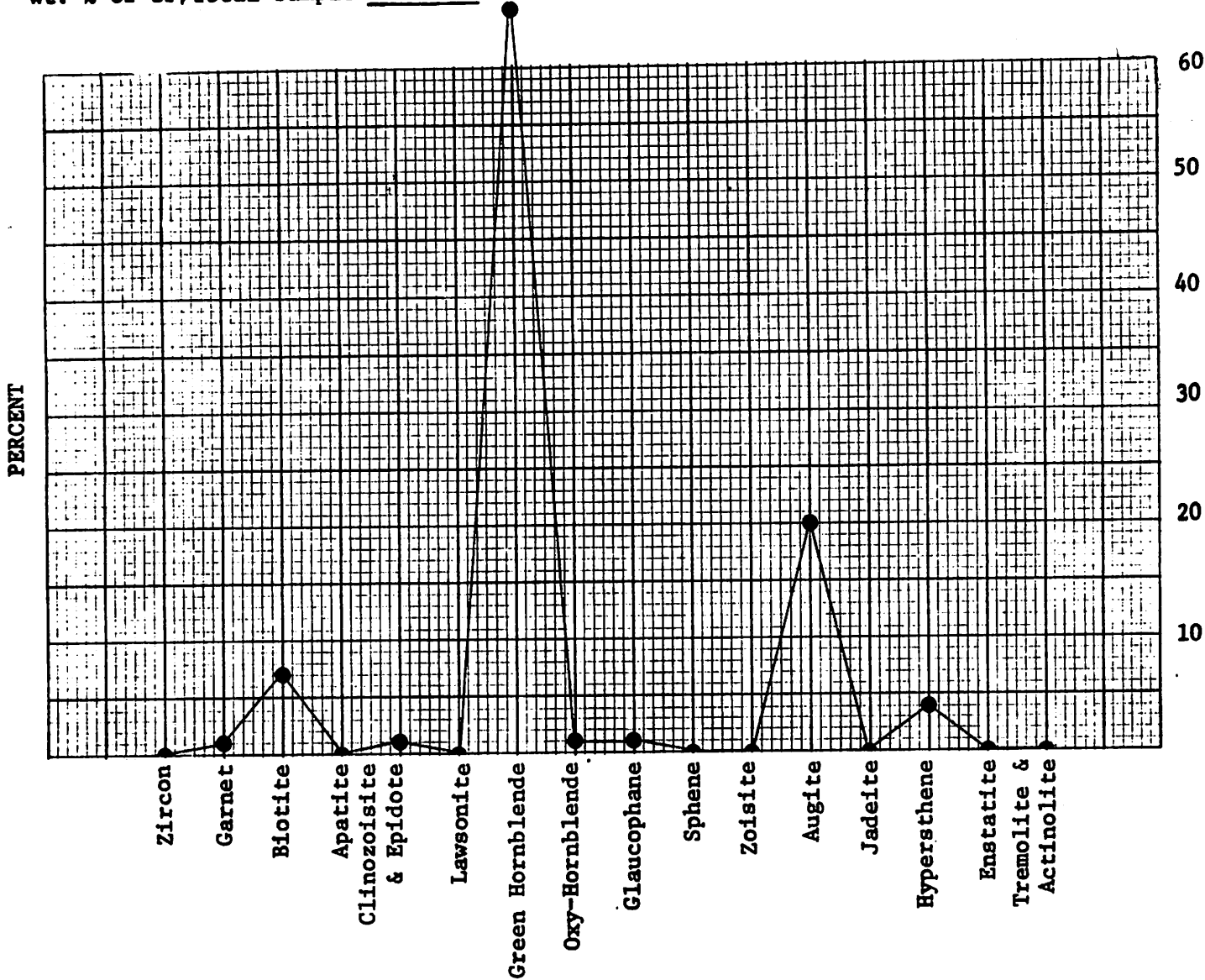
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>
Hematite - Goethite	34
Picotite	1

SAMPLE 2358
 Location 36° 39.7' 121° 51.7'
 Depth 54.6 meters 30 fathoms
 Size Fraction (SF) .062 - .350 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF ---
 Total Grains Counted 167
 % Transparent Grains 59.9
 % Opaques 3.0
 % Composite Gr. and Unknowns 32.9

Total % of Transparent Grains
 Wt. % of SF/Total Sample 92.4



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
Composites - Alterites	55

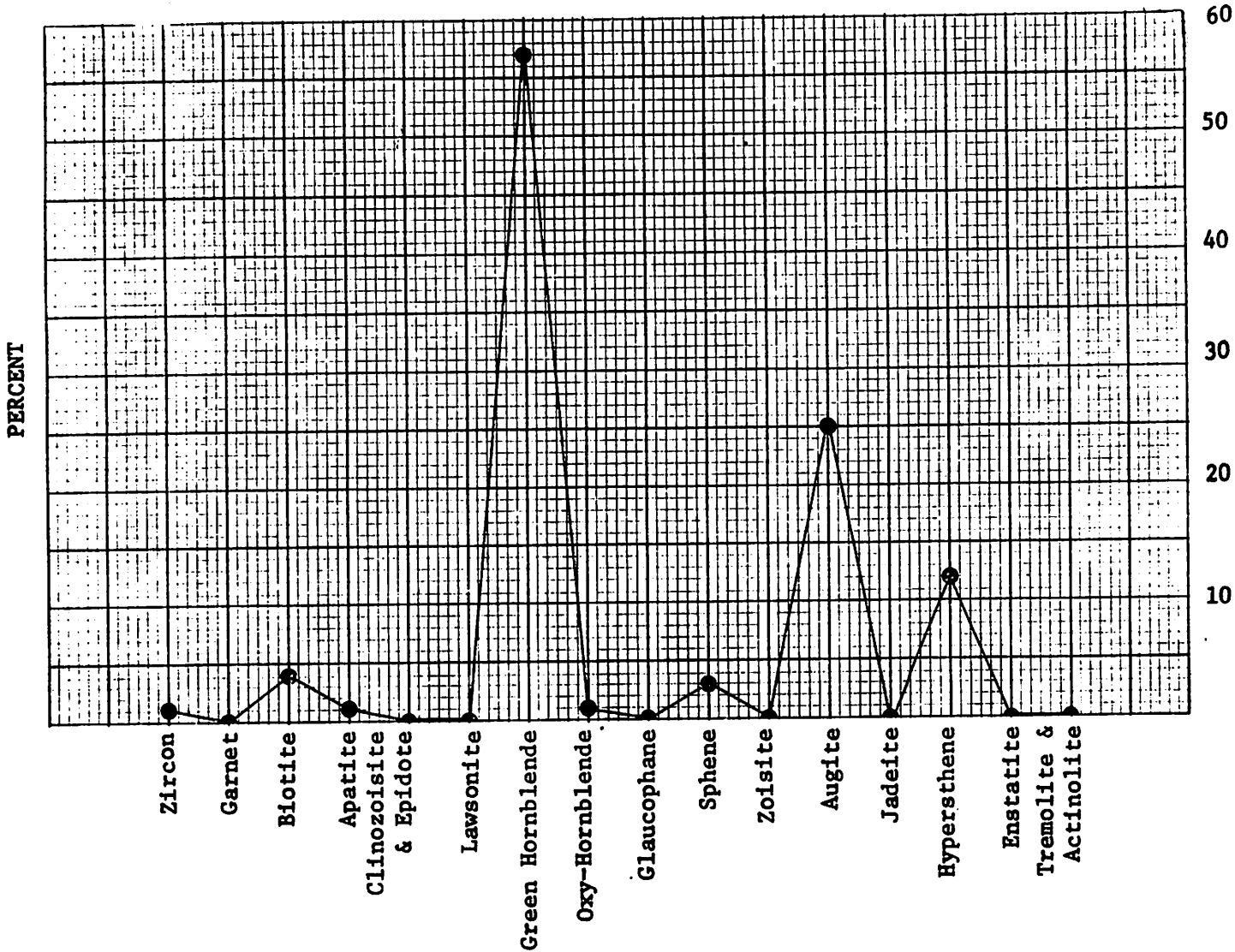
Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>
Magnetite - Ilmenite	5
_____	_____
_____	_____
_____	_____
_____	_____

SAMPLE 2360
 Location 36° 41.2' 121° 55.5'
 Depth 91.0 meters 50 fathoms
 Size Fraction (SF) .062 - .350 mm
 Graph % = Total % of Each Mineral

Wt. % of HM/SF ---
 Total Grains Counted 179
 % Transparent Grains 55.9
 % Opaques 9.5
 % Composite Gr. and Unknowns 32.4

Total % of Transparent Grains
 Wt. % of SF/Total Sample 64.9



Other Transparent Minerals

<u>Mineral</u>	<u>No. Grains Counted</u>
Composites - Alterites	58

Other Opaque Minerals

<u>Mineral</u>	<u>No Grains Counted</u>
Magnetite - Ilmenite	16
Hematite - Goethite	1