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PRELIMINARY INTERPRETATION OF ELECTRICAL SOUNDING CURVES OBTAINED ACROSS THE SNAKE RIVER PLAIN FROM BLACKFOOT TO ARCO, IDAHO

By Adel A. R. Zohdy and William D. Stanley

Prepared in cooperation with the Idaho Department of Water Administration, Atomic Energy Commission, and Bureau of Reclamation.

Open-file report

1973

This report is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards.

Illustrations

[Figures 1 and 18 in pocket; figures 2-17 follow text]

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During August 1971, the U.S. Geological Survey made 38 d-c resistivity soundings along a profile from Blackfoot to Arco, Idaho. The purpose of the survey was threefold: 1) determine the thickness of the basalt flows of the Snake River Group, which form the main aquifer in the Snake River Plain, 2) determine the nature of the materials underlying the basalt, and 3) estimate the depth to the high-resistivity basement rocks beneath the Snake River Plain.

The locations of the VES (vertical electrical sounding) stations are shown on figure 1. All the soundings were made with the Schlumberger AMNB array with electrode spacings (AB/2) often expanded to 12,000 feet. VES 8, VES 12, VES 24, VES 29, and VES 38 were expanded to larger electrode spacings (up to 58,000 feet) using bilaterial equatorial arrays, and VES 19 was expanded to 68,600 feet using a unilateral equatorial array. VES 15 was expanded to 68,600 feet using a bilateral polar array; and VES 21 was expanded to 32,000 feet using a unilateral polar array. The observed VES curves are shown in figures 2 through 17. The apparent resistivity is plotted on the ordinate axis and the Schlumberger electrode spacing (AB/2 = half distance between current electrodes), the equatorial spacing ($\overline{R}$ = distance from one current electrode to center of potential dipole), and the polar dipole spacing (r = distance between centers of current and potential dipoles) are plotted on the abscissa axis.

Figure 18 shows the geoelectric section obtained from the preliminary interpretation of the VES curves using curve matching procedures (Kalenov, 1957; Orellana and Mooney, 1966). On this section there are five geoelectrical units. The 1,000-3,000 ohm-meter layer is interpreted as dry basalt. The 300-600 ohm-meter layer is interpreted as basalt saturated with fresh water. The 100-200 ohm-meter layer is interpreted as basalt flows intercalated with clayey sedimentary rocks. The 20-40 ohm-meter layer is interpreted as sedimentary rocks and/or rhyolitic ash-flow tuff. The geoelectric basement at the bottom of the section has a high resistivity, about 500 ohm-meters or more, and it may represent Paleozoic rocks.

The deep structural trough on the southeastern part of the profile is filled with materials having a resistivity of about 40 ohm-meters. The depth to the electric basement in that structure is estimated to be at least 20,000 feet. Whether this structural trough represents a caldera or a graben cannot be determined from the available VES data.

References

Kalenov, E.N., 1957, Interpretation of vertical electrical sounding curves [in Russian]: Moscow, Gostoptelkhizdat, 471 p.

Orellana, Ernesto, and Mooney, H. M., 1966, Master tables and curves for vertical electrical sounding over layered structures: Madrid, Interciencia.

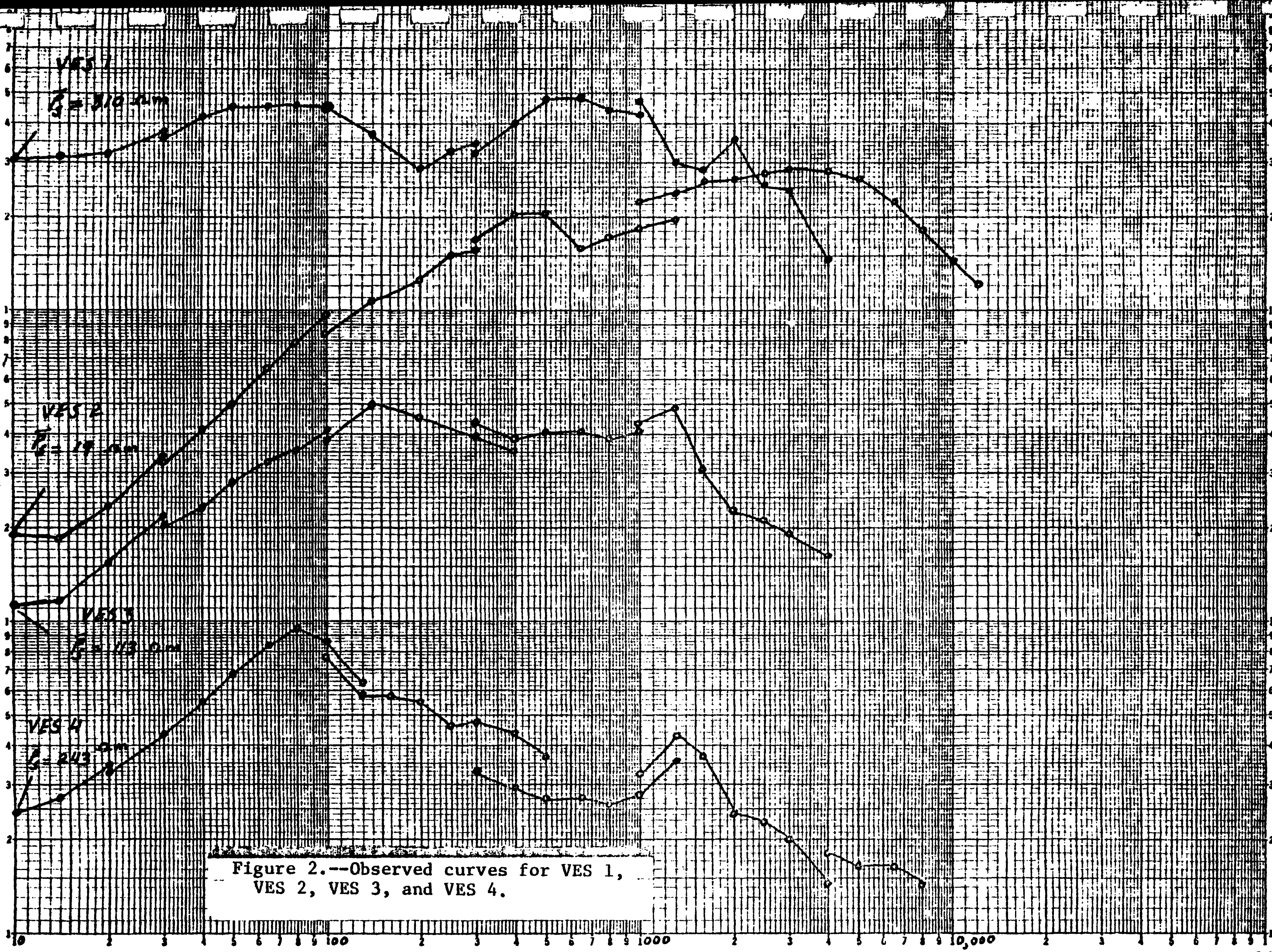


Figure 2.--Observed curves for VES 1, VES 2, VES 3, and VES 4.

SCHLUMBERGER ELECTRODE SPACING (AB/2), IN FEET

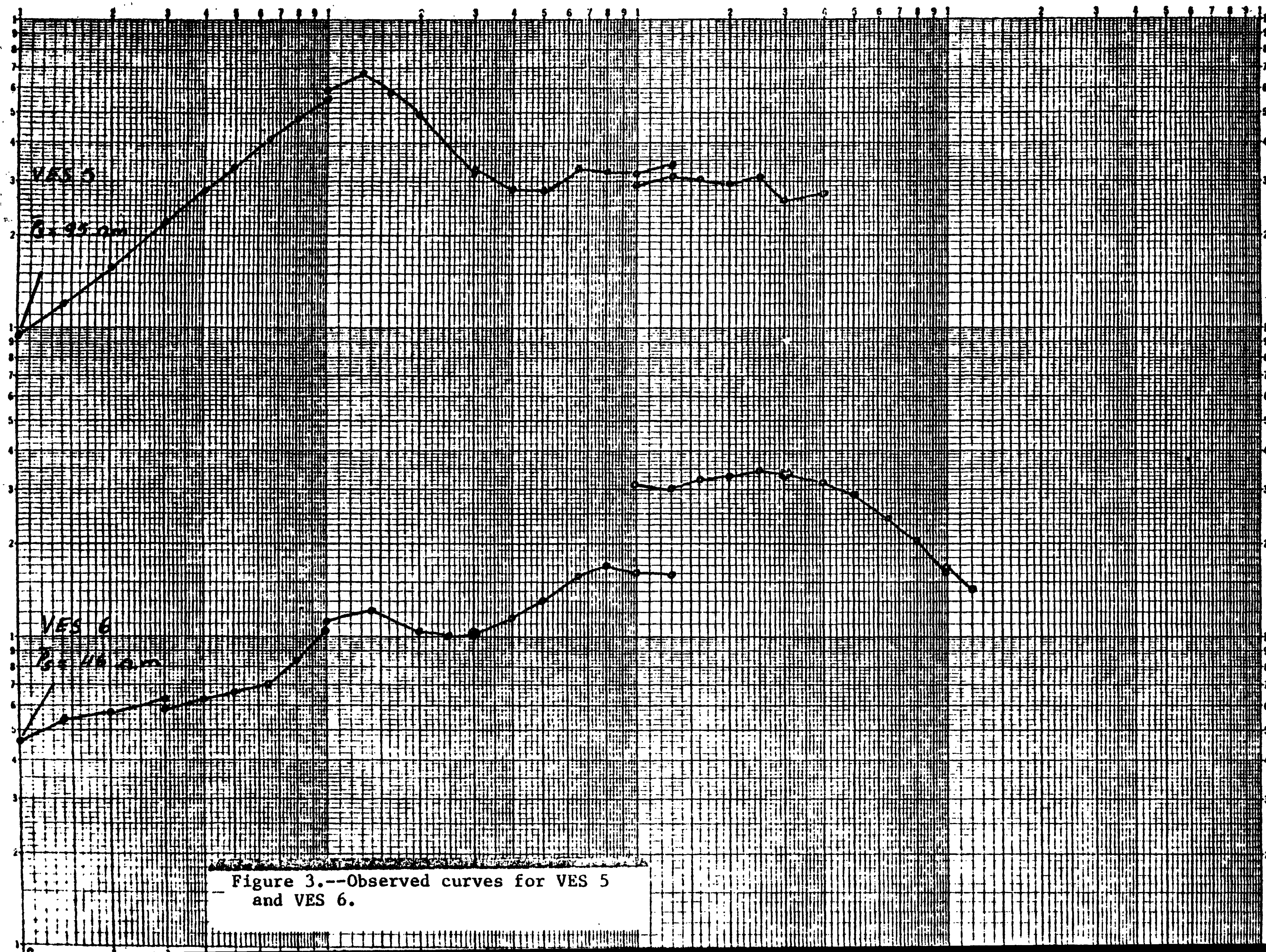


Figure 3.--Observed curves for VES 5 and VES 6.

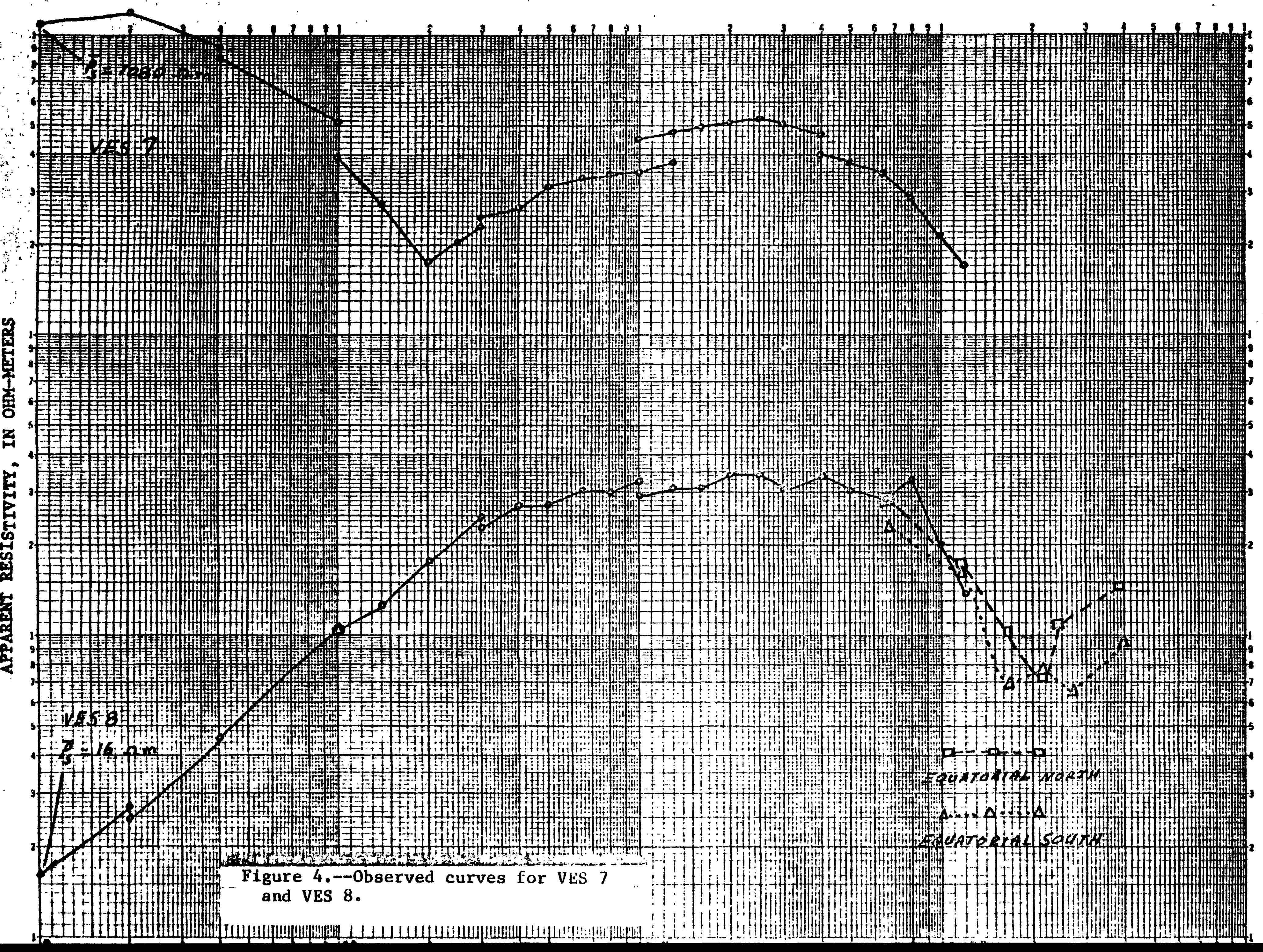


Figure 4.--Observed curves for VES 7 and VES 8.

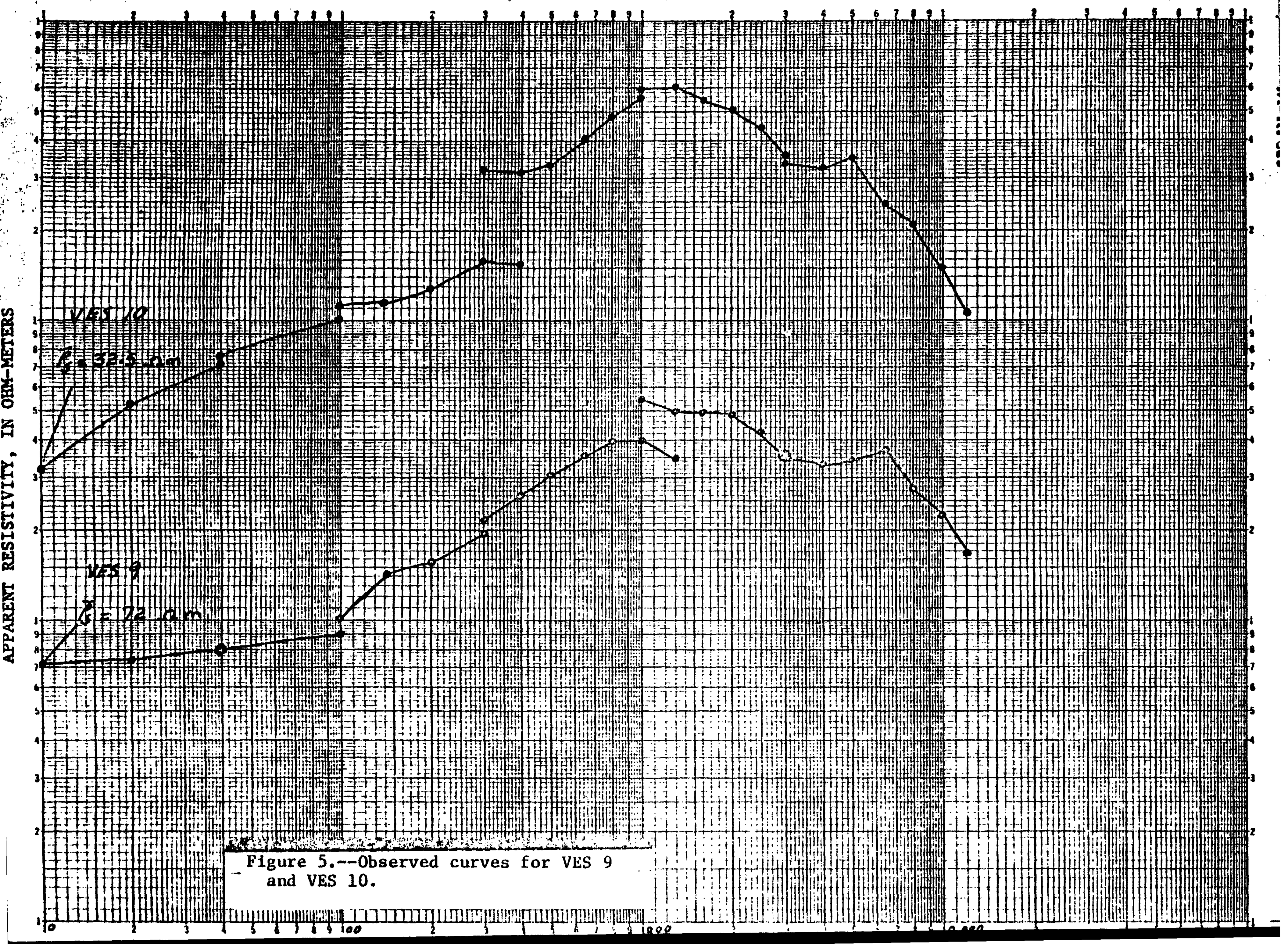


Figure 5.--Observed curves for VES 9 and VES 10.

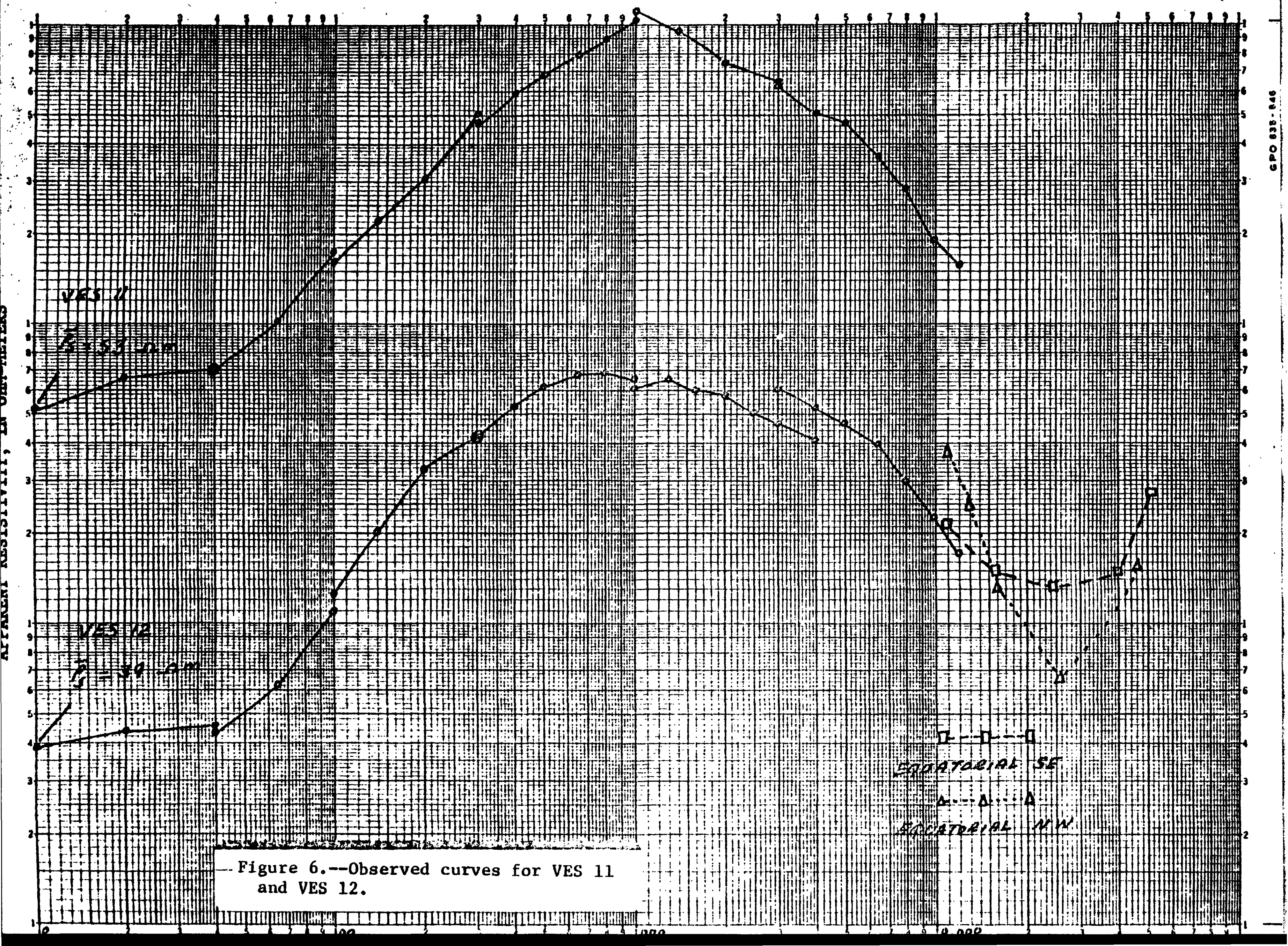


Figure 6.--Observed curves for VES 11 and VES 12.

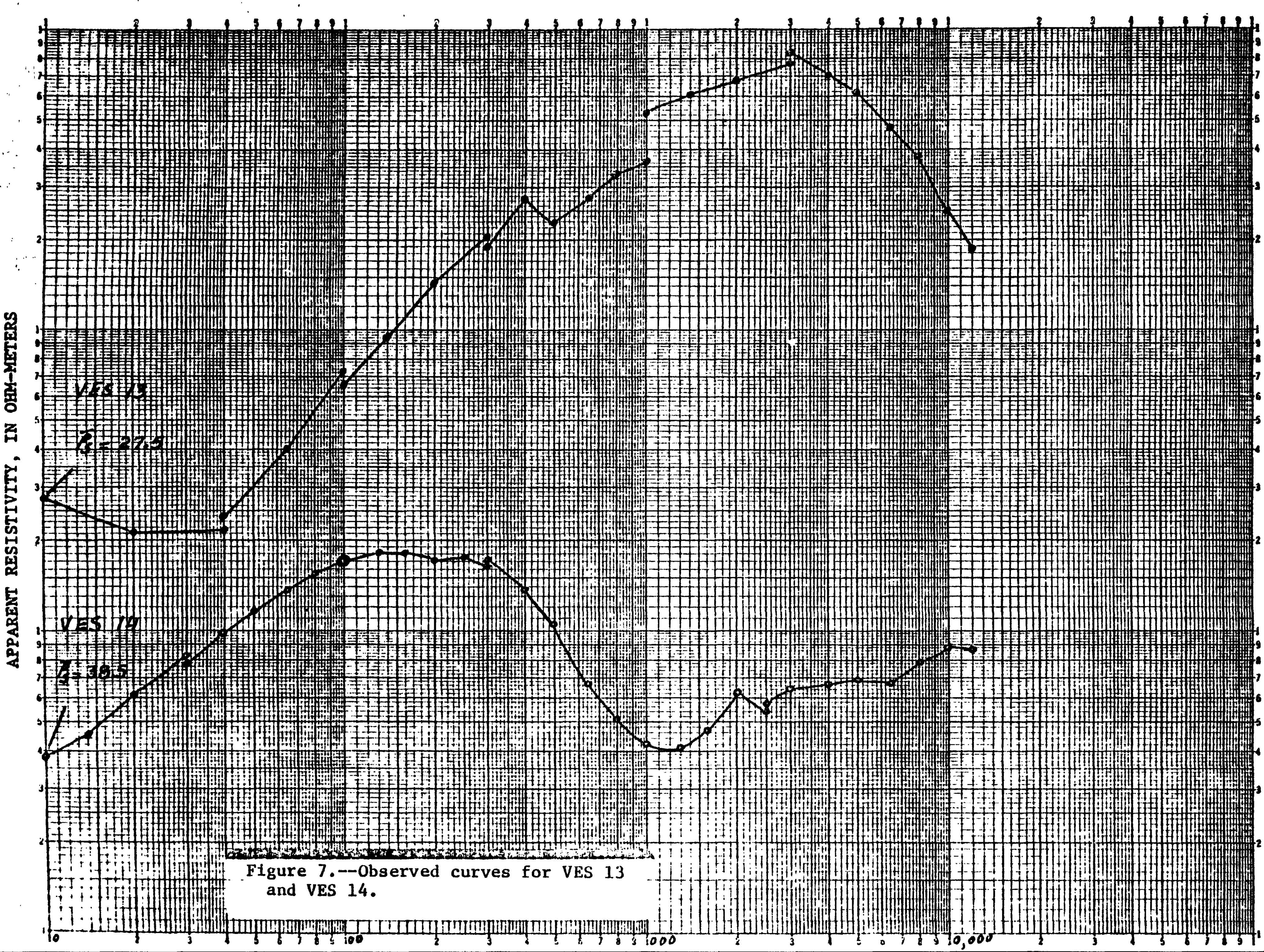
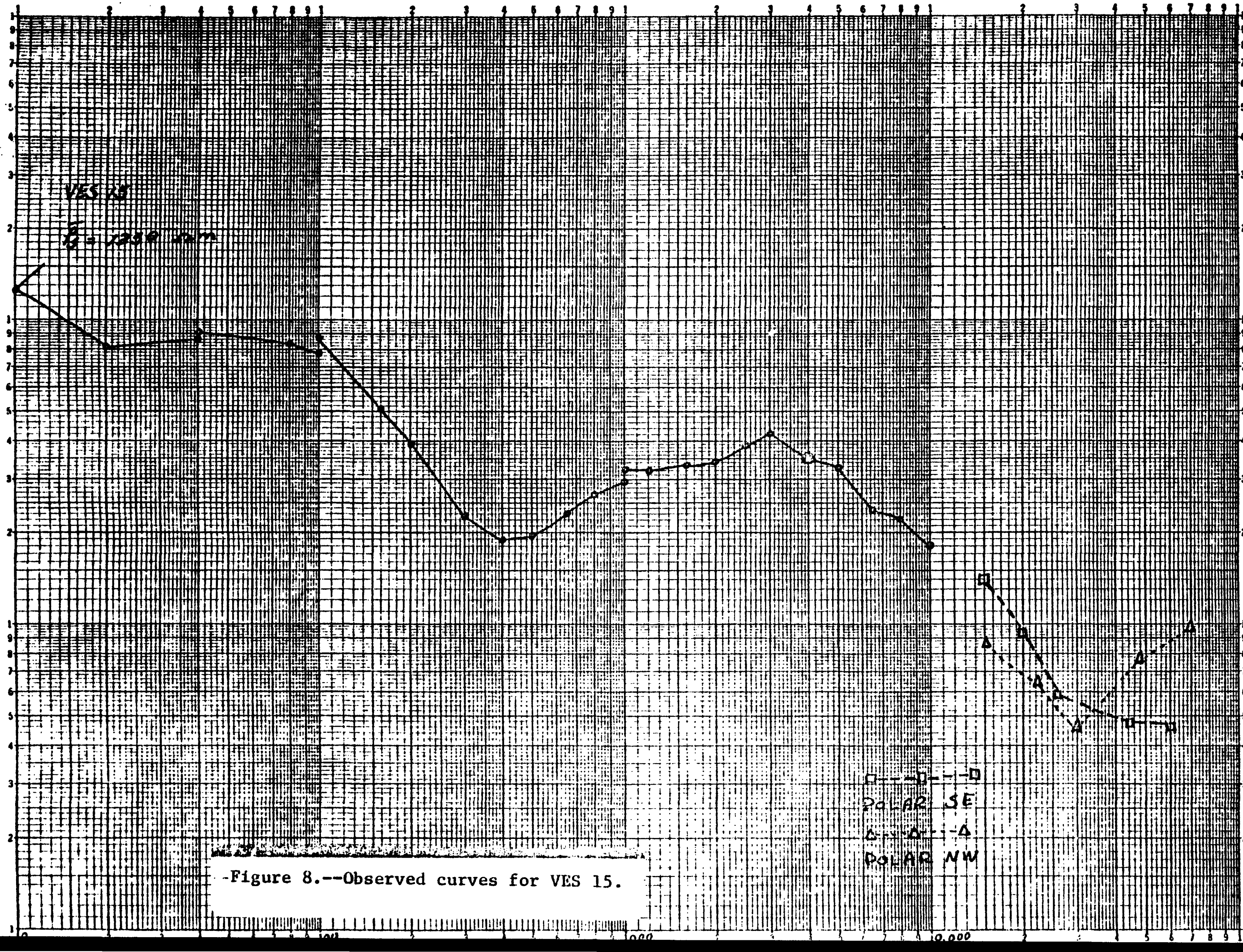


Figure 7.--Observed curves for VES 13 and VES 14.



-Figure 8.--Observed curves for VES 15.

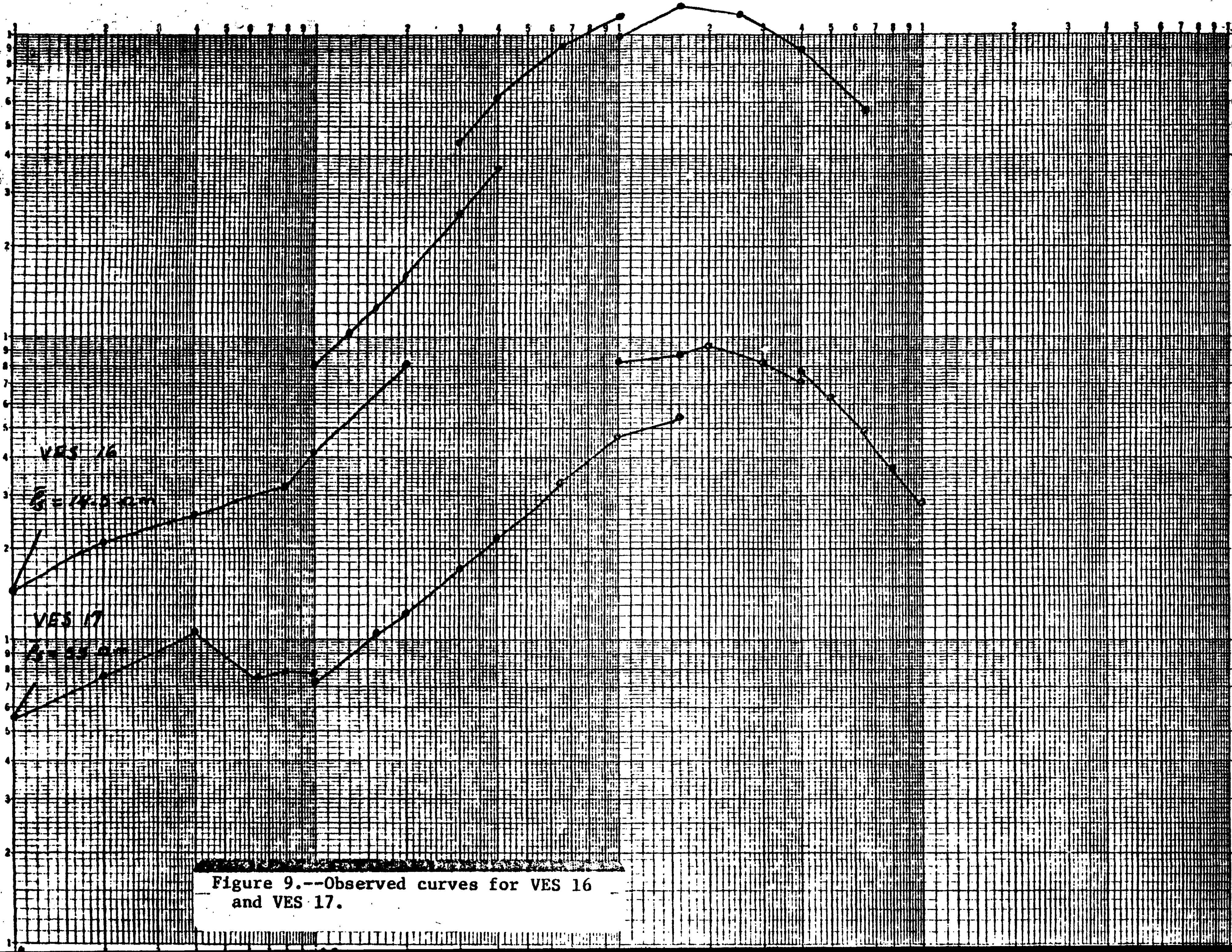


Figure 9.--Observed curves for VES 16 and VES 17.

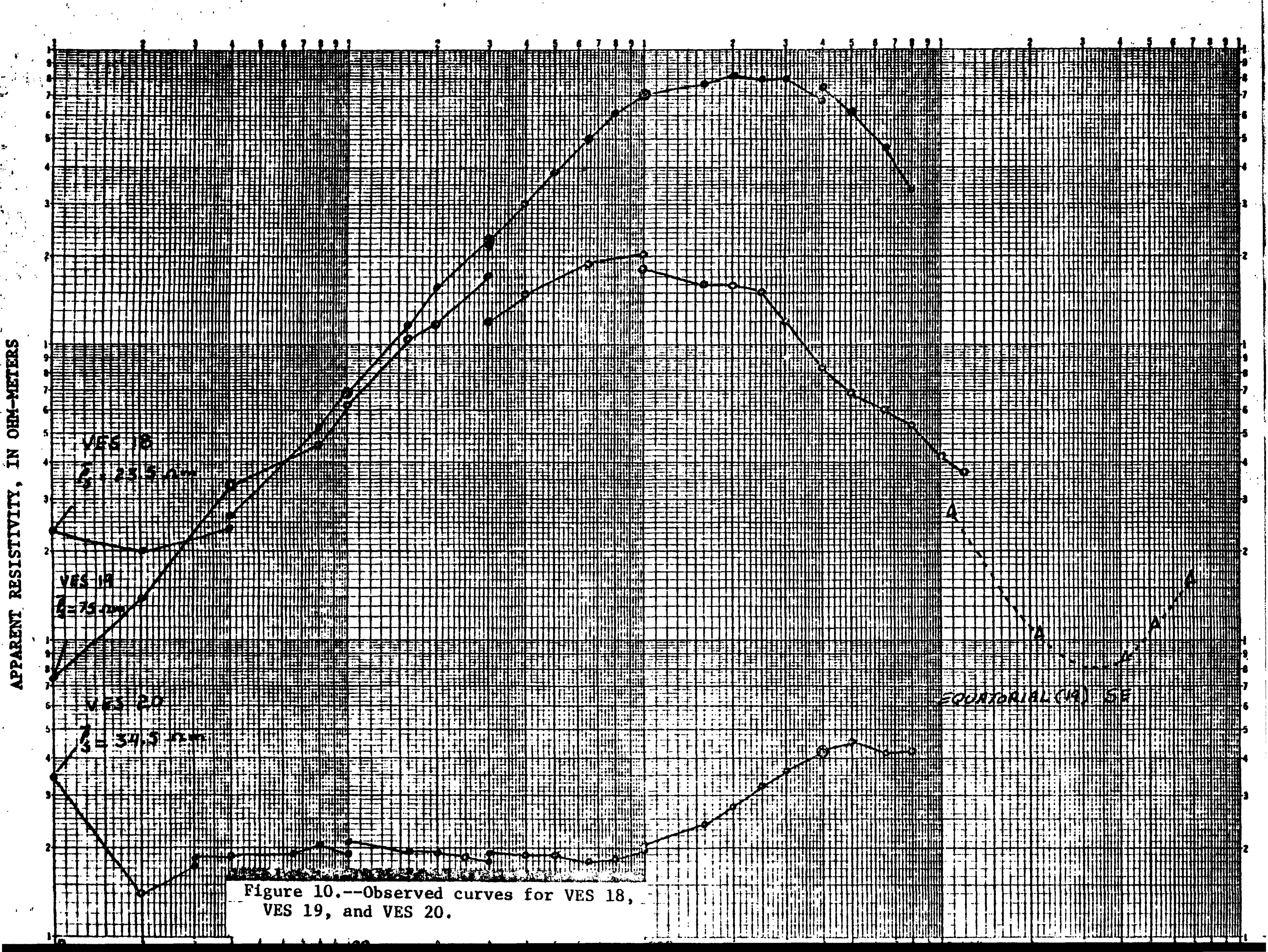


Figure 10.--Observed curves for VES 18, VES 19, and VES 20.

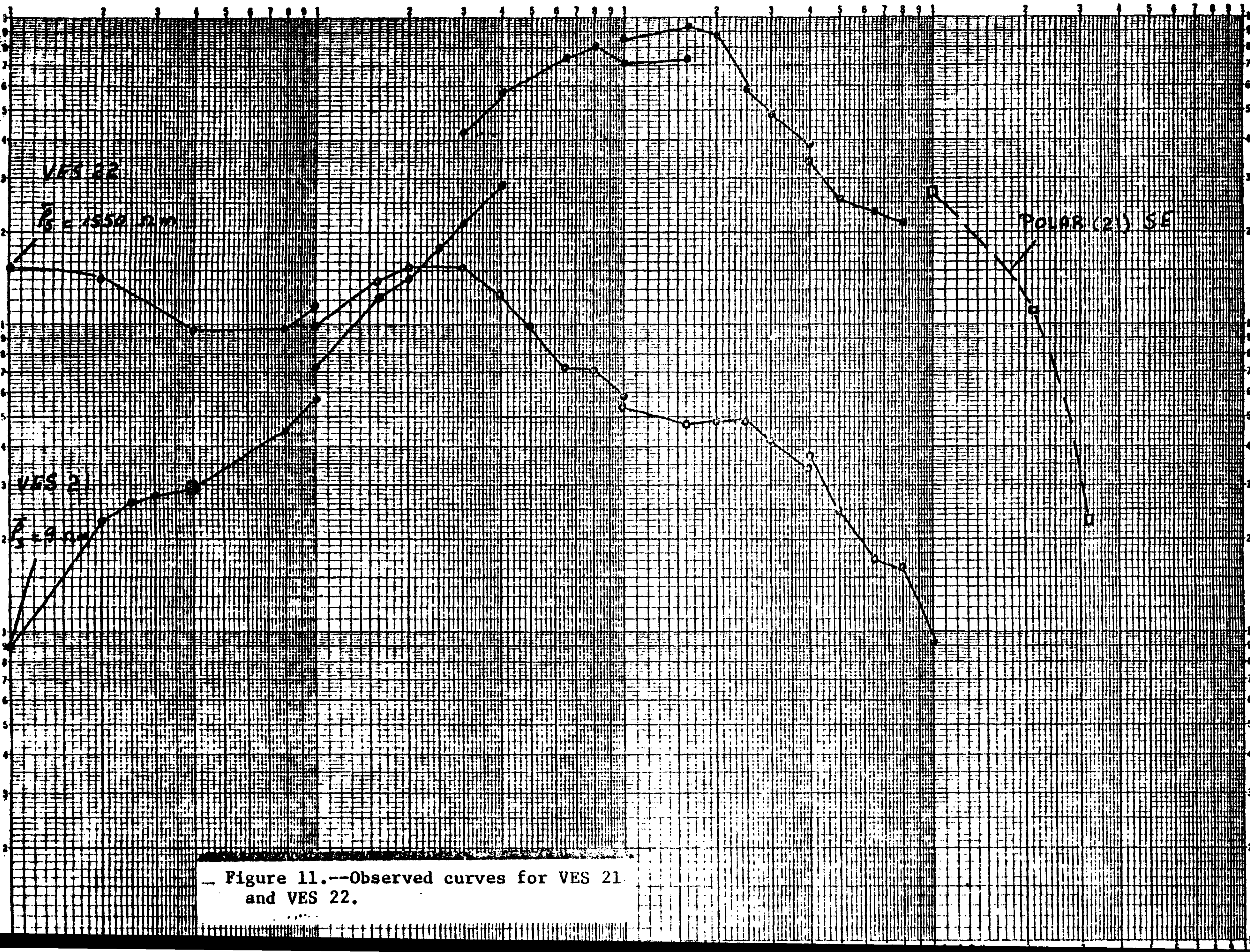


Figure 11.--Observed curves for VES 21 and VES 22.

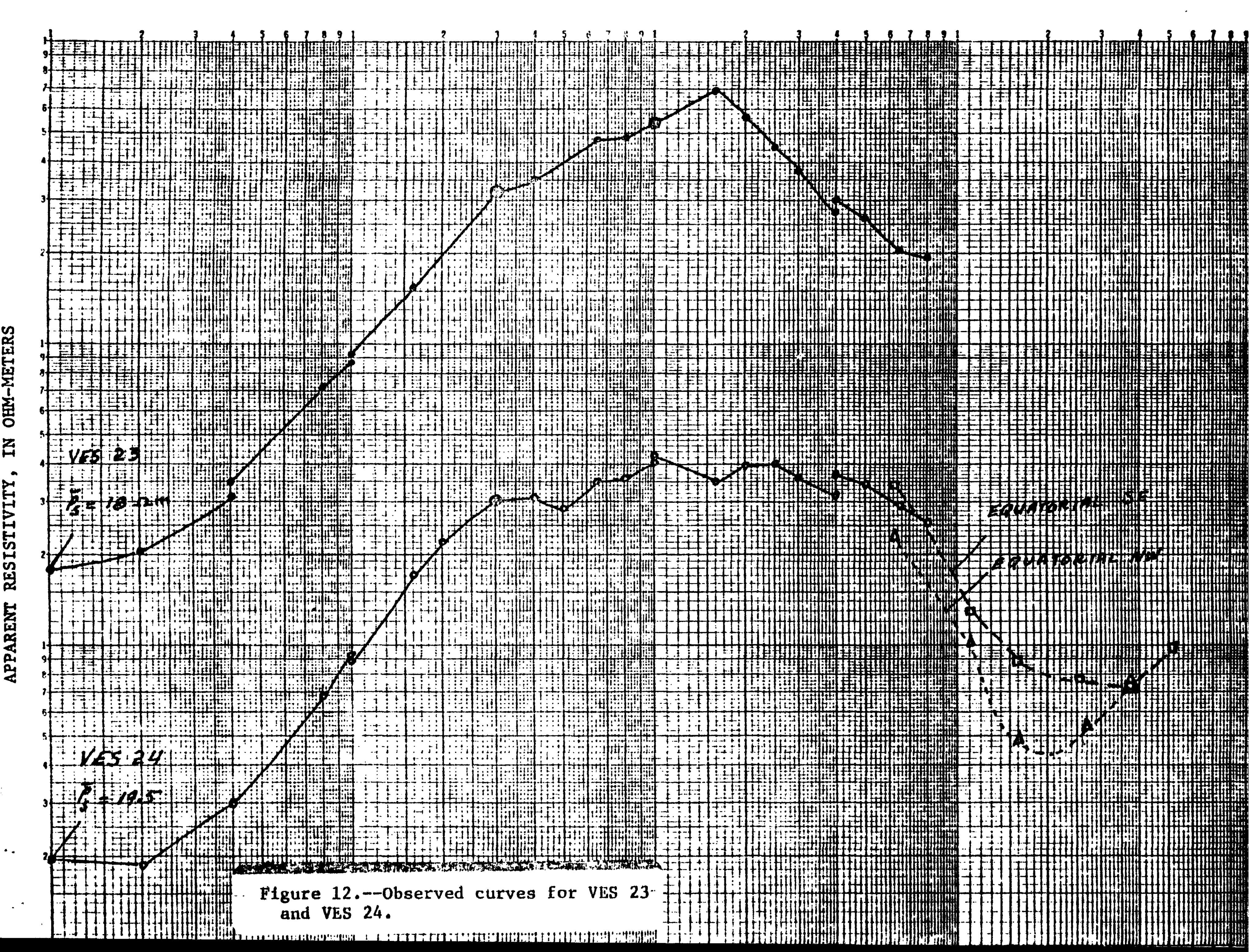


Figure 12.--Observed curves for VES 23 and VES 24.

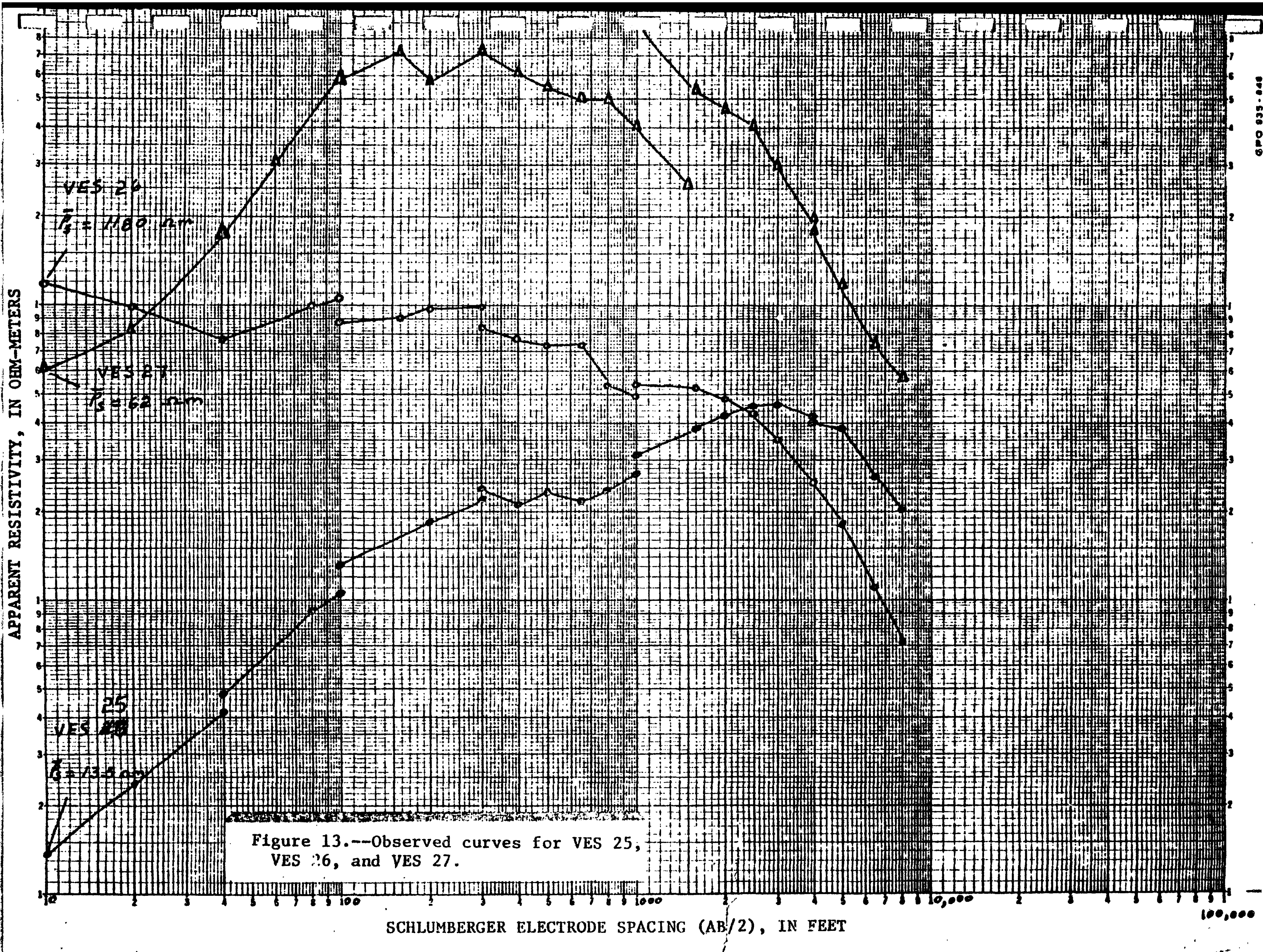


Figure 13.--Observed curves for VES 25, VES 26, and VES 27.

APPARENT RESISTIVITY, IN OHM-METERS

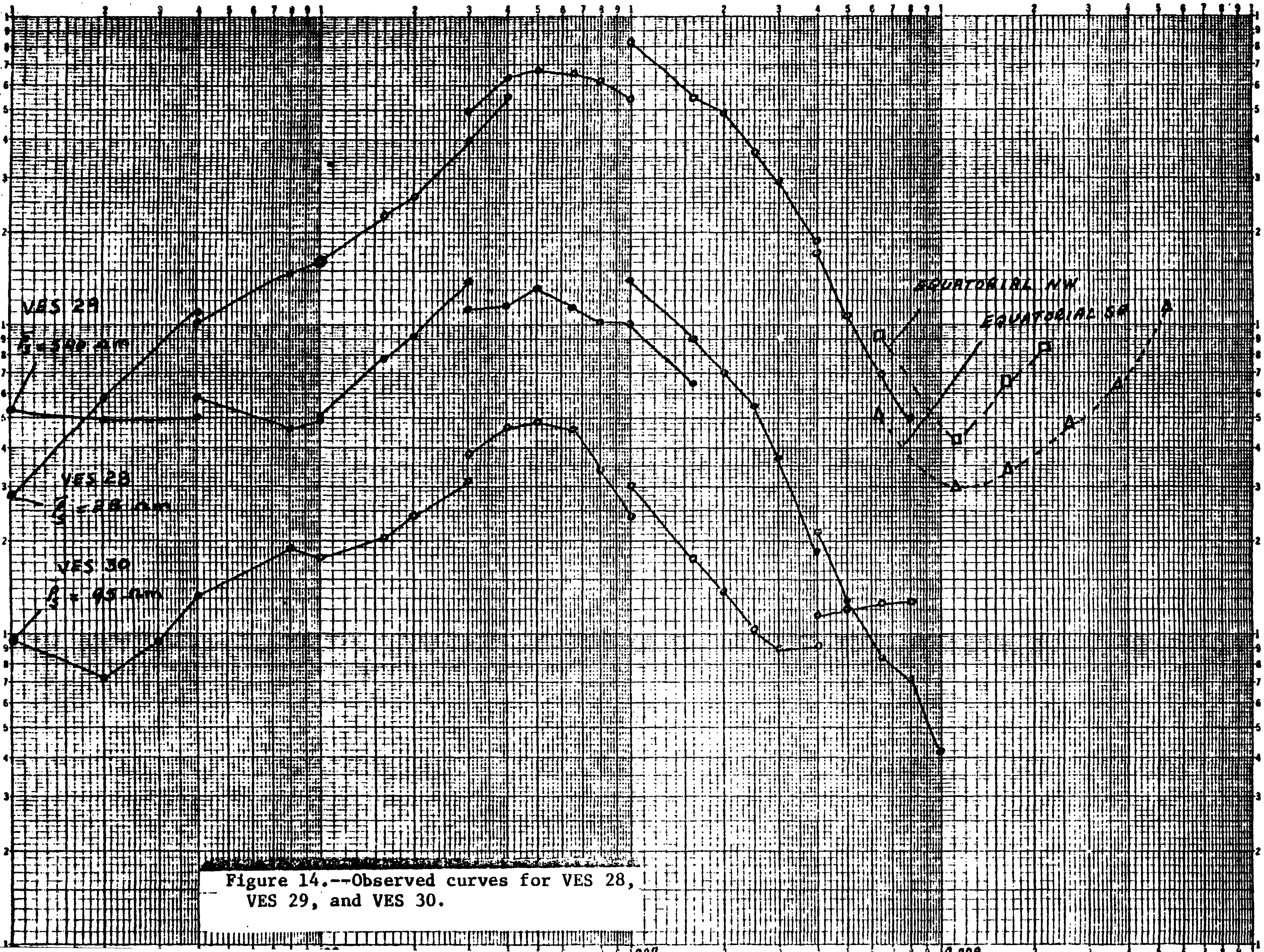


Figure 14.--Observed curves for VES 28, VES 29, and VES 30.

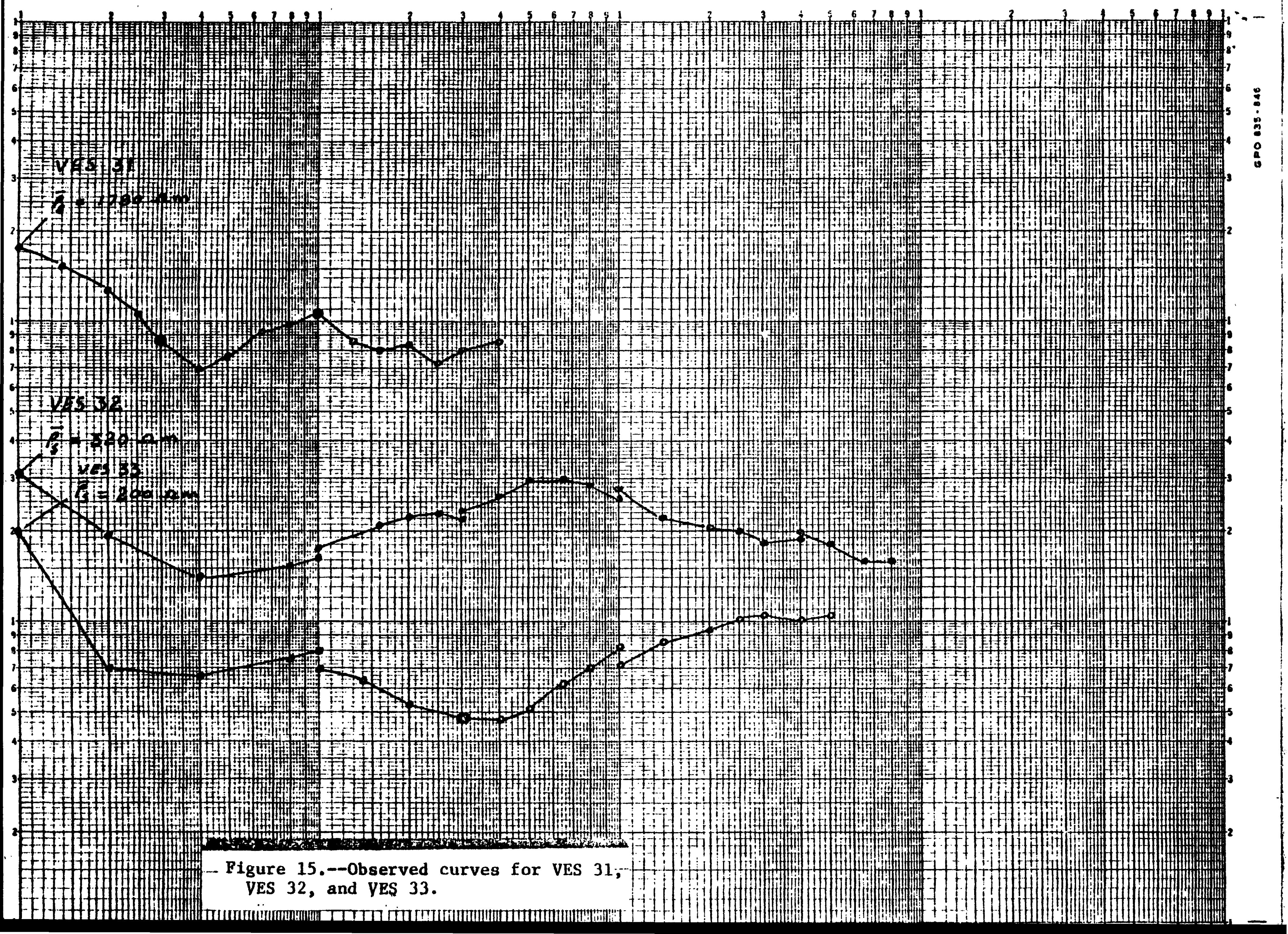


Figure 15.--Observed curves for VES 31, VES 32, and VES 33.

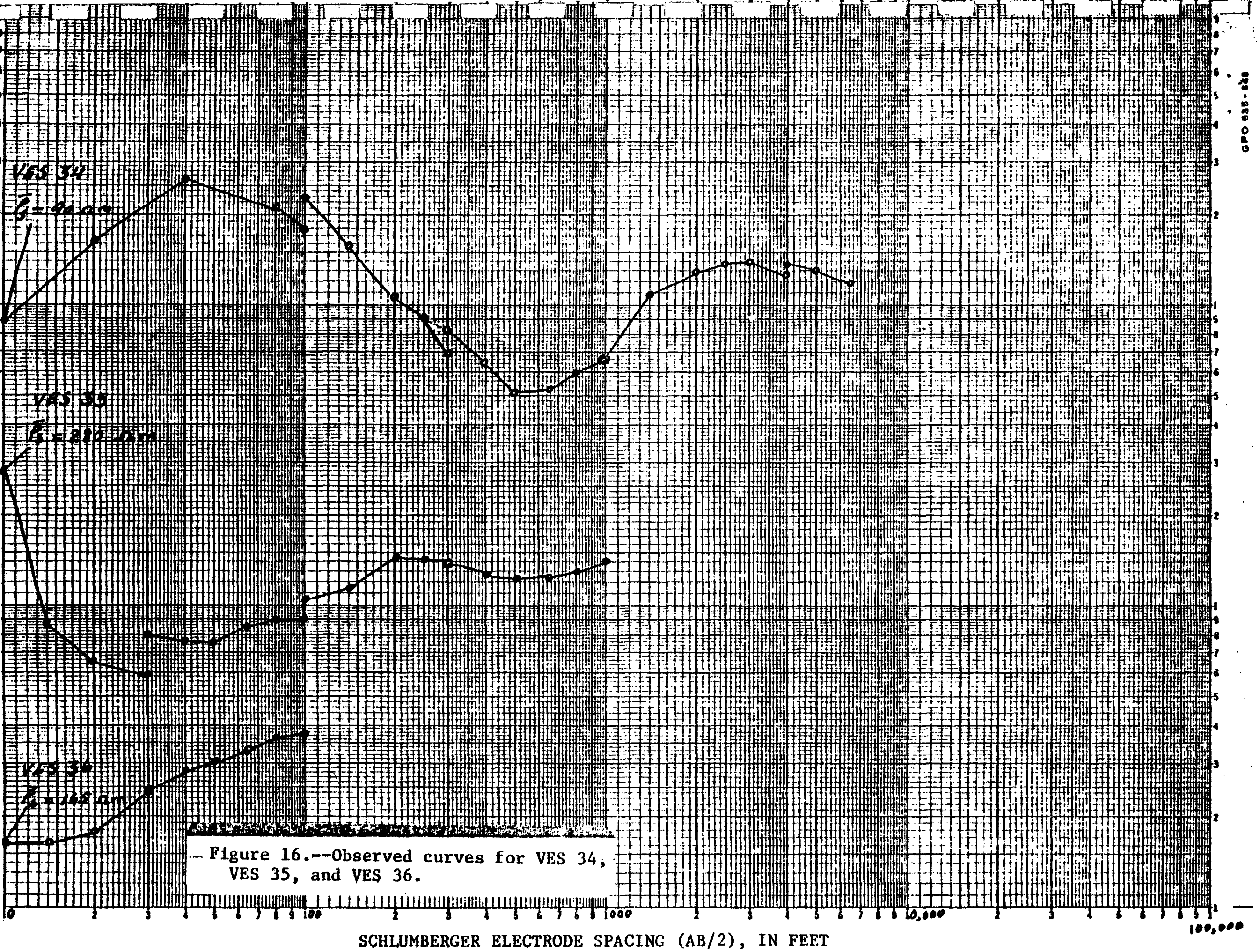


Figure 16.--Observed curves for VES 34, VES 35, and VES 36.

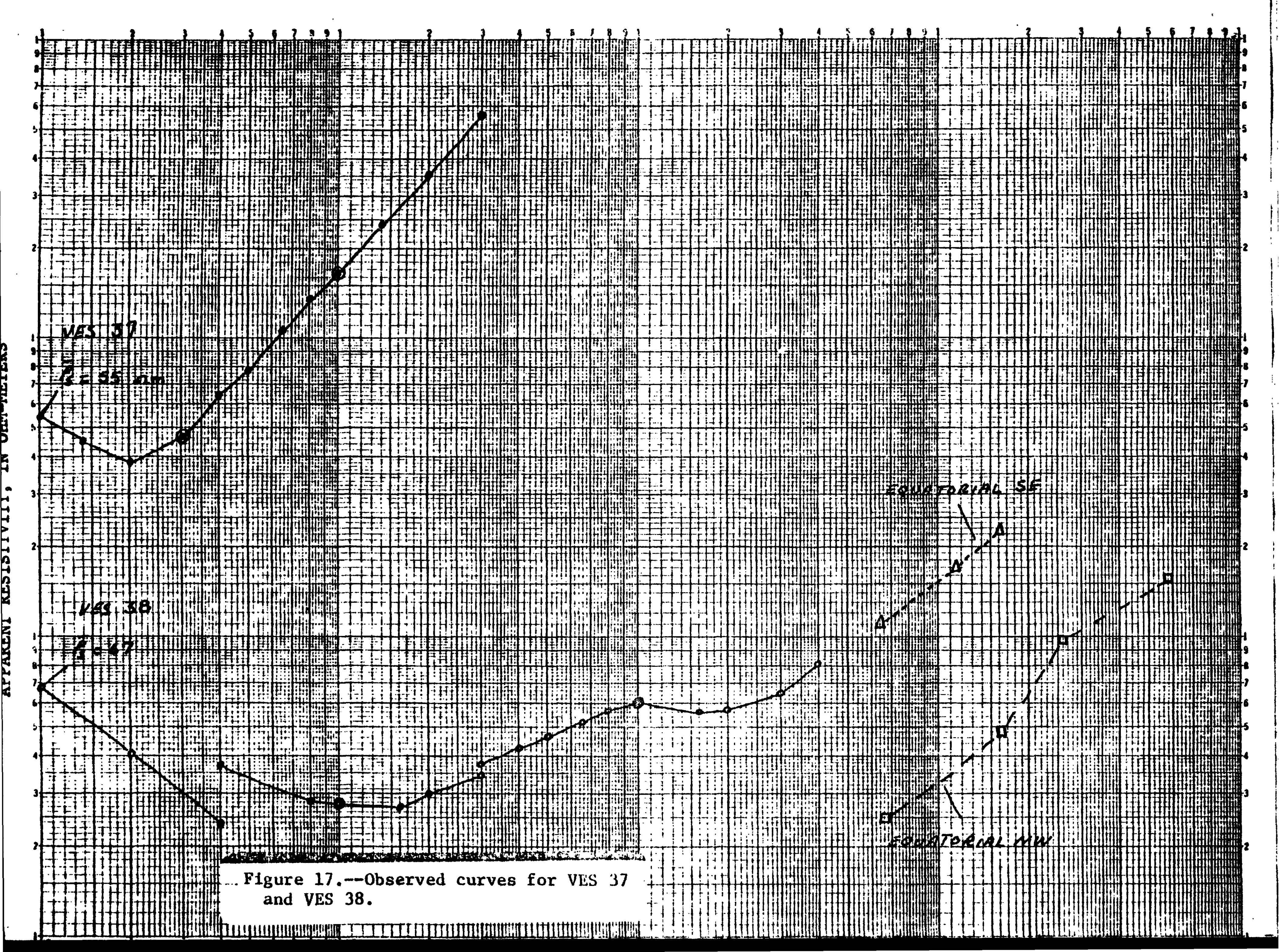


Figure 17.--Observed curves for VES 37 and VES 38.

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Figure 18.--Geoelectric section across the Snake River Plain, from Blackfoot to Arco, Idaho. Solid triangles and numbers designate location and number of VES stations. Solid circles above certain station numbers designate deep soundings made with equatorial or polar arrays.

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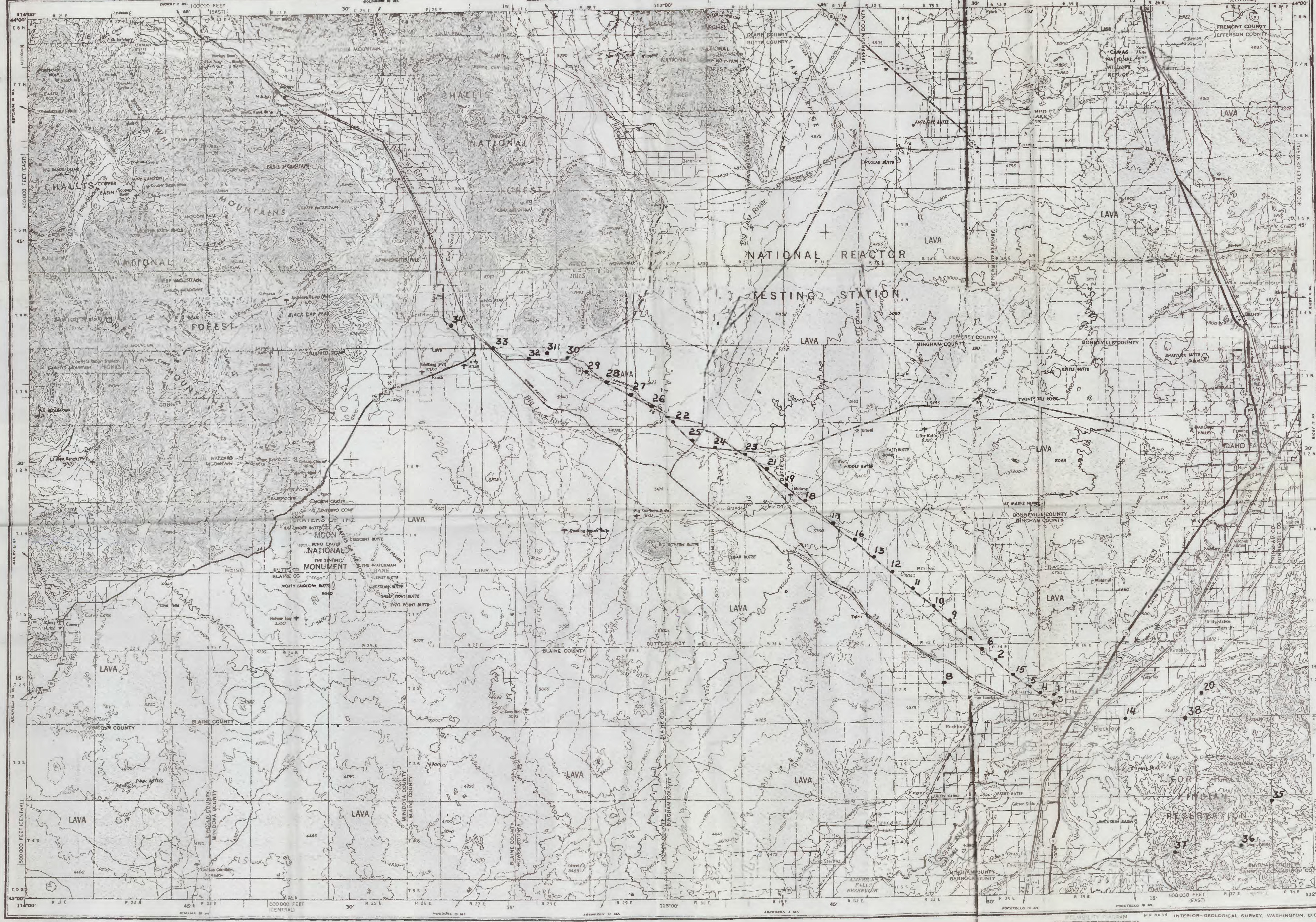

Base from U.S. Geological Survey, 1955-62

Prepared by the Army Map Service (ASSX), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1955 by photogrammetric methods and from USGS quadrangles, 1:24,000, 1:62,500 and 1:125,000, 1925-51. Planimetric detail revised by photo-planimetric methods. Horizontal and vertical control by USGS, USC&GS, and CE. Photography field annotated 1954-55. Limited revision by U.S. Geological Survey, 1962.

100,000-foot grids based on Idaho coordinate system, central and East zones

10,000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

LEGEND
ROAD DATA 1955 PARTIALLY REVISED 1962
Figures in red denote approximate distances in miles between stars

POPULATED PLACES
Over 500,000 — LOS ANGELES
100,000 to 500,000 — OMAHA
25,000 to 100,000 — GALVESTON
5,000 to 25,000 — Laramie
1,000 to 5,000 — Grand Coulee
Less than 1,000 — Sun Valley

RAILROADS — Single track; Double or Multiple
Standard gauge
Narrow gauge

BOUNDARIES
International
State
County
Park or reservation

ROADS
Hard surface, heavy duty
More than two lanes wide
Two lanes wide; Federal route marker
Hard surface, medium duty
More than two lanes wide
Two lanes wide; State, Interstate route markers
Improved light duty
Unimproved dirt
Trail

Landplane airport
Landing area
Seaplane airport
Seaplane anchorage
Woods-brushwood
Approximate road alinement

Landmarks: School; Church; Other
Horizontal control point
Spot elevation in feet
Marsh or swamp
Intermittent or dry stream
Power line

Scale 1:250,000
20 Statute Miles
30 Kilometers
15 Nautical Miles

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

Figure 1.--Index map showing location and number of vertical electrical sounding stations, Idaho Falls quadrangle, Idaho.

LOCATION DIAGRAM FOR NK 12-1

RELIABILITY DIAGRAM

TOWNSHIP OR RANGE LINE
LAND GRANT BOUNDARY

SECTIONIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

MN 8634 INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1963

IDAHO FALLS, IDAHO
1955
LIMITED REVISION 1962

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