UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

RESISTIVITY SECTIONS, UPPER ARKANSAS RIVER BASIN, COLORADO

By

Adel A. R. Zohdy, Lloyd A. Hershey,
Philip A. Emery, and William D. Stanley

OPEN-FILE REPORT

71002

Colorado District
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Prepared by the
U.S. Geological Survey
in cooperation with the
Southeastern Colorado Water Conservancy District
and the
Colorado Division of Water Resources, Colorado State Engineer

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CONTENTS

ILLUSTRATION

RESISTIVITY SECTIONS, UPPER ARKANSAS RIVER BASIN, COLORADO

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INTRODUCTION

A reconnaissance investigation of ground-water resources in the upper Arkansas River basin from Pueblo to Leadville is being made by the U.S. Geological Survey in cooperation with the Southeastern Colorado Water Conservancy District, and the Colorado Division of Water Resources, Colorado State Engineer. As part of the investigation, surface geophysical electrical resistivity surveys were made during the summer and fall of 1970 near Buena Vista and Westcliffe, Colo. (pl. 1).

The resistivity surveys were made to verify a previous gravity survey and to help locate areas where ground-water supplies might be developed. This report presents the results of the surveys in the form of two resistivity sections.

The able assistance of personnel of the Colorado State Engineer, and the friendly cooperation of residents in the area, who permitted access to their land during the surveys is gratefully acknowledged.

METHODS AND PROCEDURES

Vertical electrical soundings (VES) and dipole electrical soundings (DES) were made using the conventional Schlumberger and equatorial electrode arrays (for a description of the field procedure, see Bhattacharya and Patra, 1968; Keller and Frischknecht, 1966; Kunetz, 1966; Zohdy, 1969; Zohdy and others, 1969). The sounding curves (Schlumberger or equatorial apparent resistivity, $\overline{\rho}_s$, $\overline{\rho}_\theta$, versus half the distance between current electrodes, AB/2, or equatorial spacing, $\overline{R}$) were plotted on log-log paper in the field. Interpretation of the VES curves was made by curve-matching procedures using albums of theoretical curves in conjunction with the auxiliary point method and other graphical methods (Compagnie Générale de Géophysique, 1963; Orellana and Mooney, 1966; Rijkswaterstaat, 1969; Zohdy, 1965). The VES curves obtained in these surveys are given in an appendix to this report.

PRELIMINARY FINDINGS

The interpretations of resistivity data shown on the sections have not been checked by test drilling and therefore should only be regarded as generally representative of subsurface conditions.

However, data derived from the surveys agrees with that from a previous evaluation of the thickness of the valley-fill deposits using the gravity method. Resistivity section A-A' (pl. 1), near Buena Vista indicates the thickness of the valley fill to be as much as 4,600 feet. Resistivity section B-B' (pl. 1), south of Westcliffe indicates the thickness of the valley-fill is as much as 6,700 feet. At both localities the resistivity data indicate that the most permeable rock materials occur in the upper 500 to 1,000 feet of valley-fill deposits.

FUTURE STUDIES

The U.S. Geological Survey plans to drill two test holes 1,000 feet deep at locations along the lines of the sections to determine the thickness, grain size, composition, and permeability of the valley-fill deposits, and the chemical quality of water in the deposits. After comparison of existing resistivity sections and the results of the test drilling, additional resistivity surveys can be made to better define the extent, thickness, and permeability of basin alluvium in the upper Arkansas River basin.

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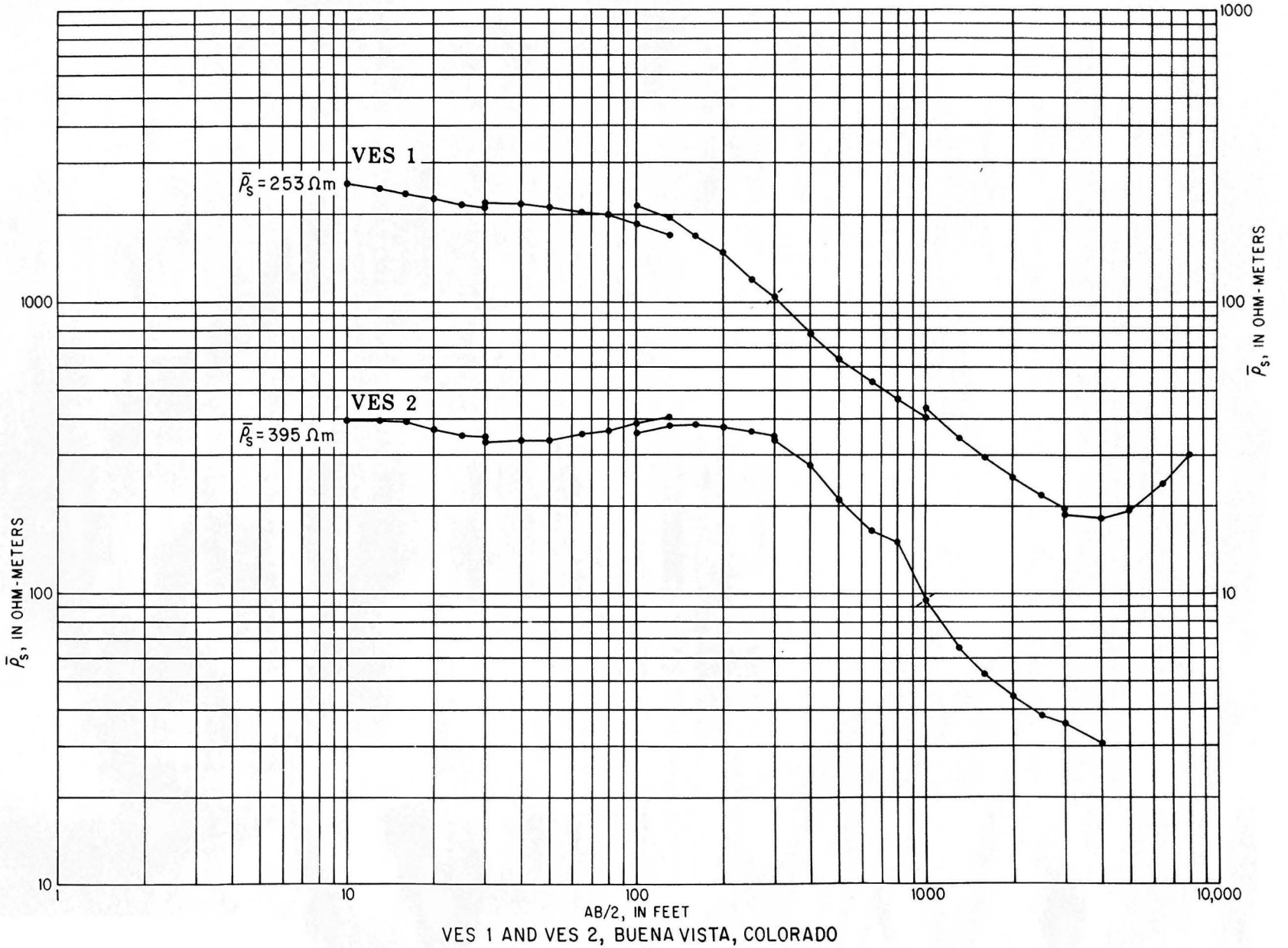
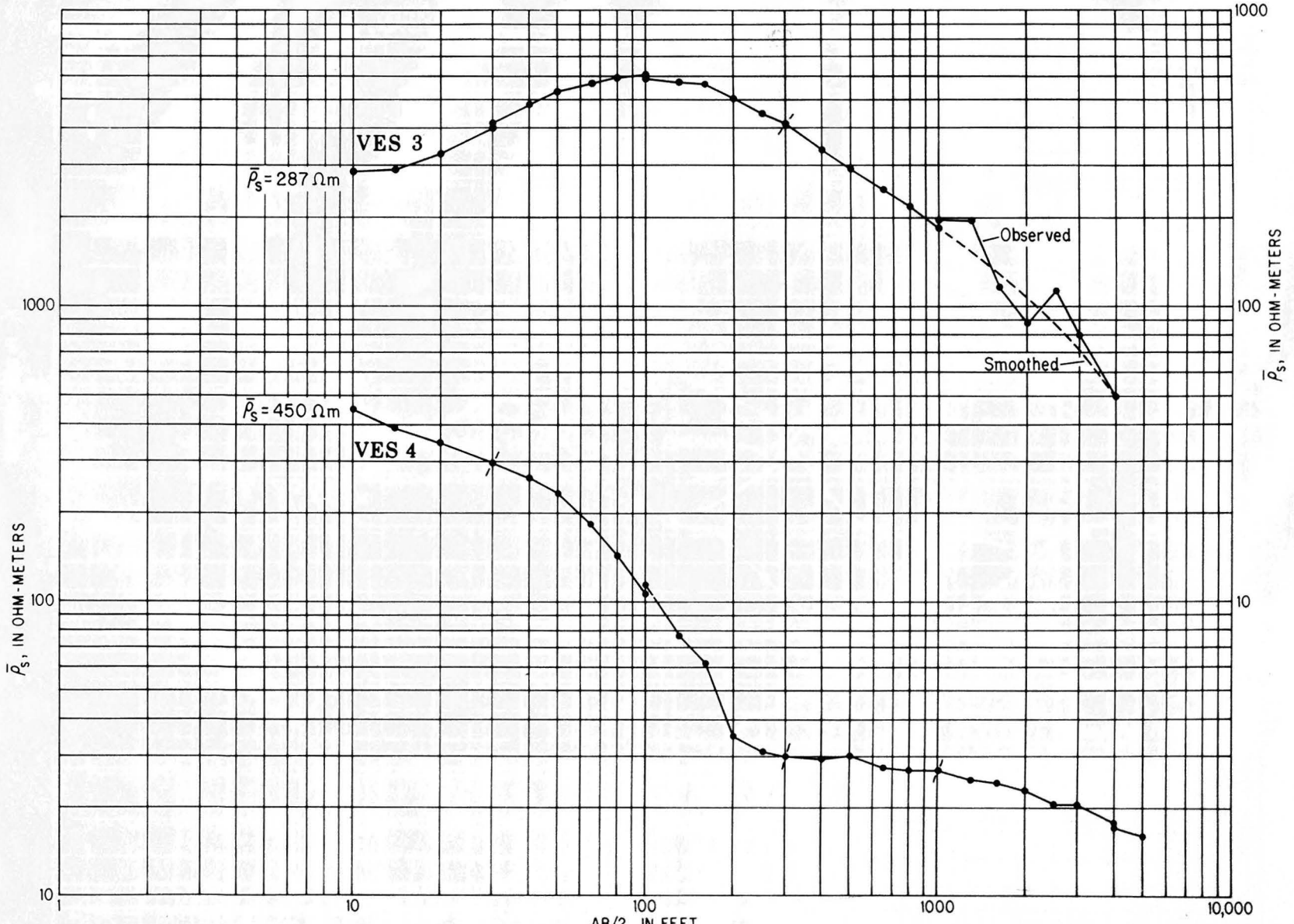
APPENDIX



VES 1 AND VES 2, BUENA VISTA, COLORADO



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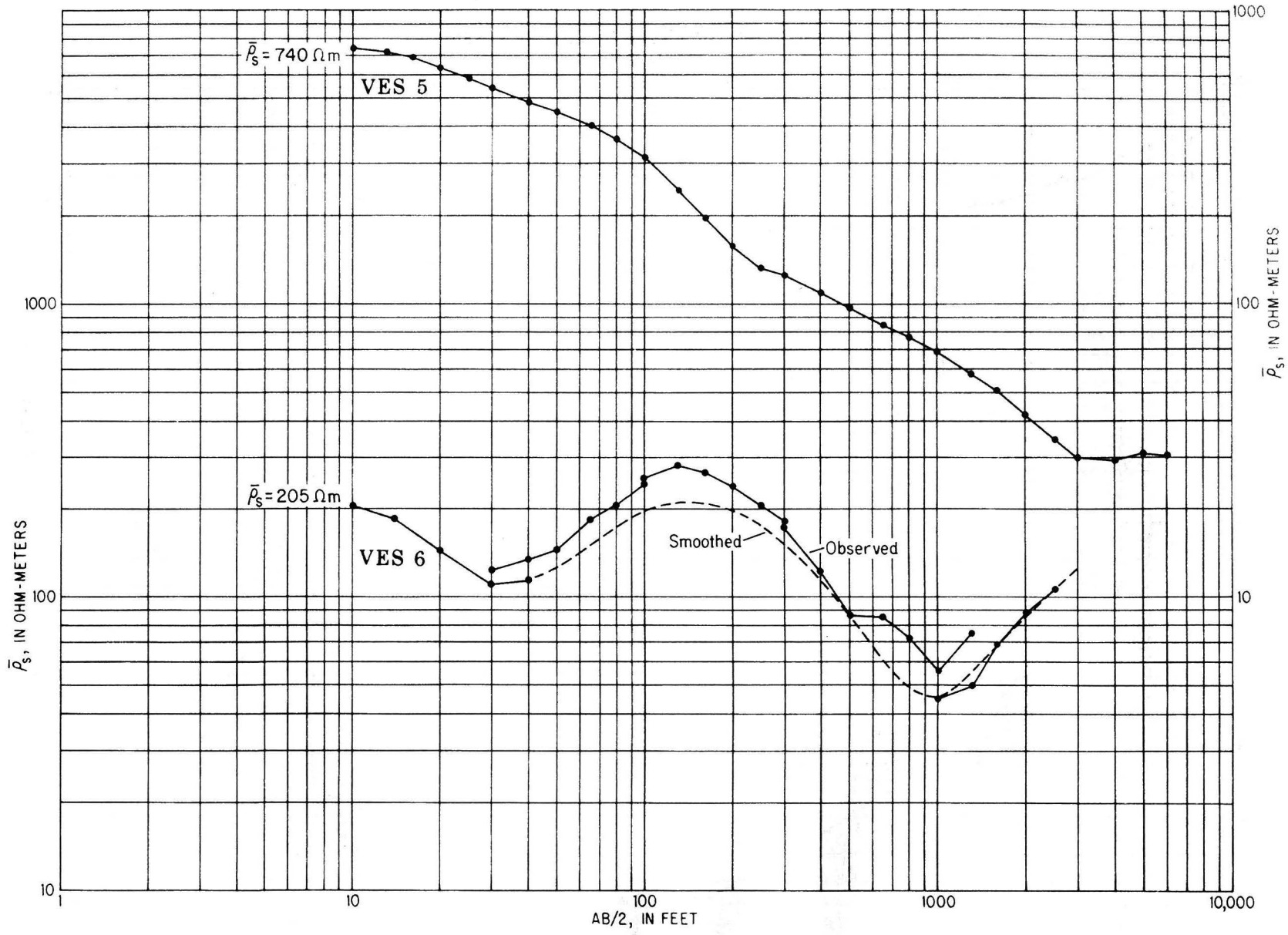

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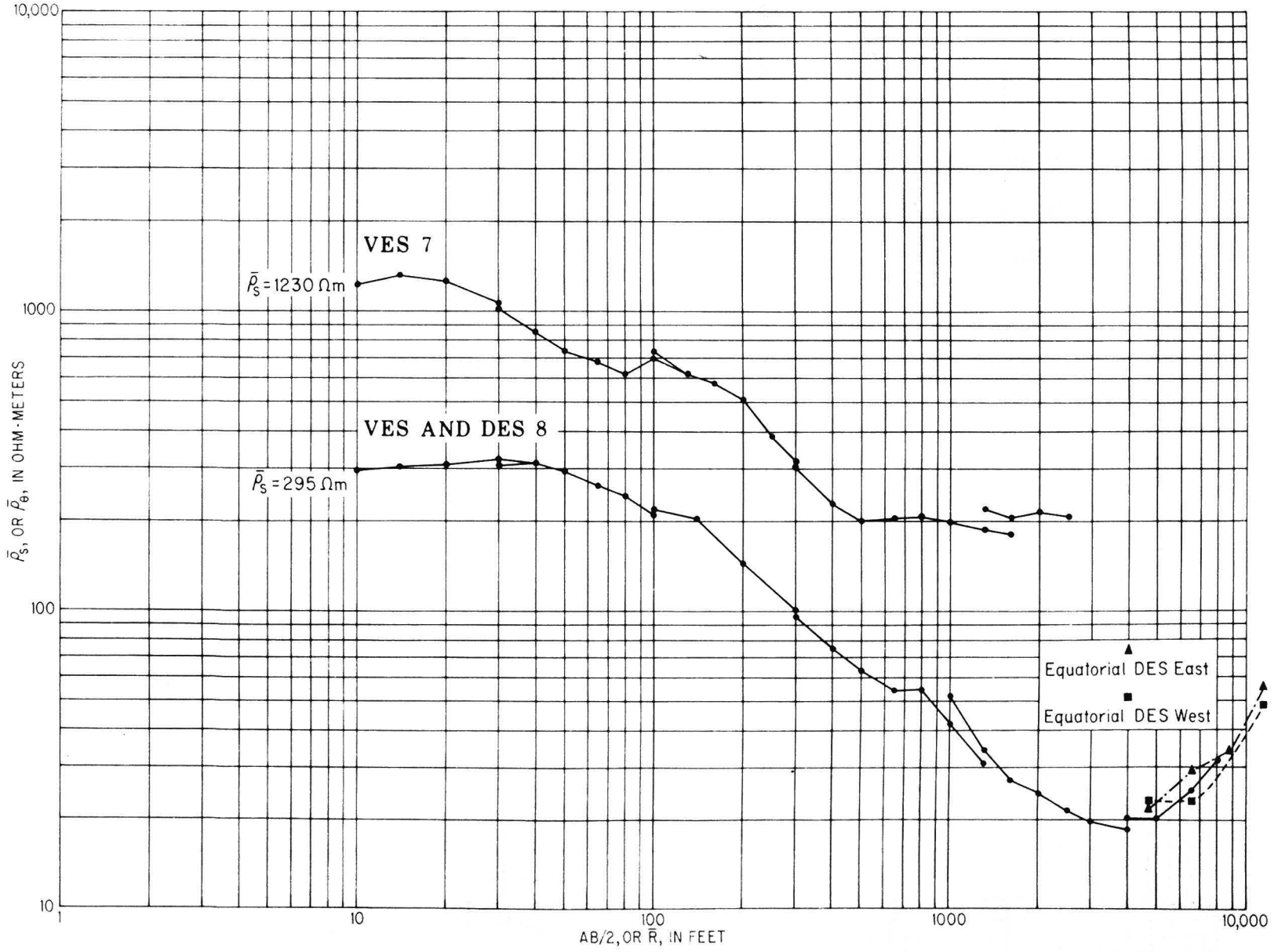
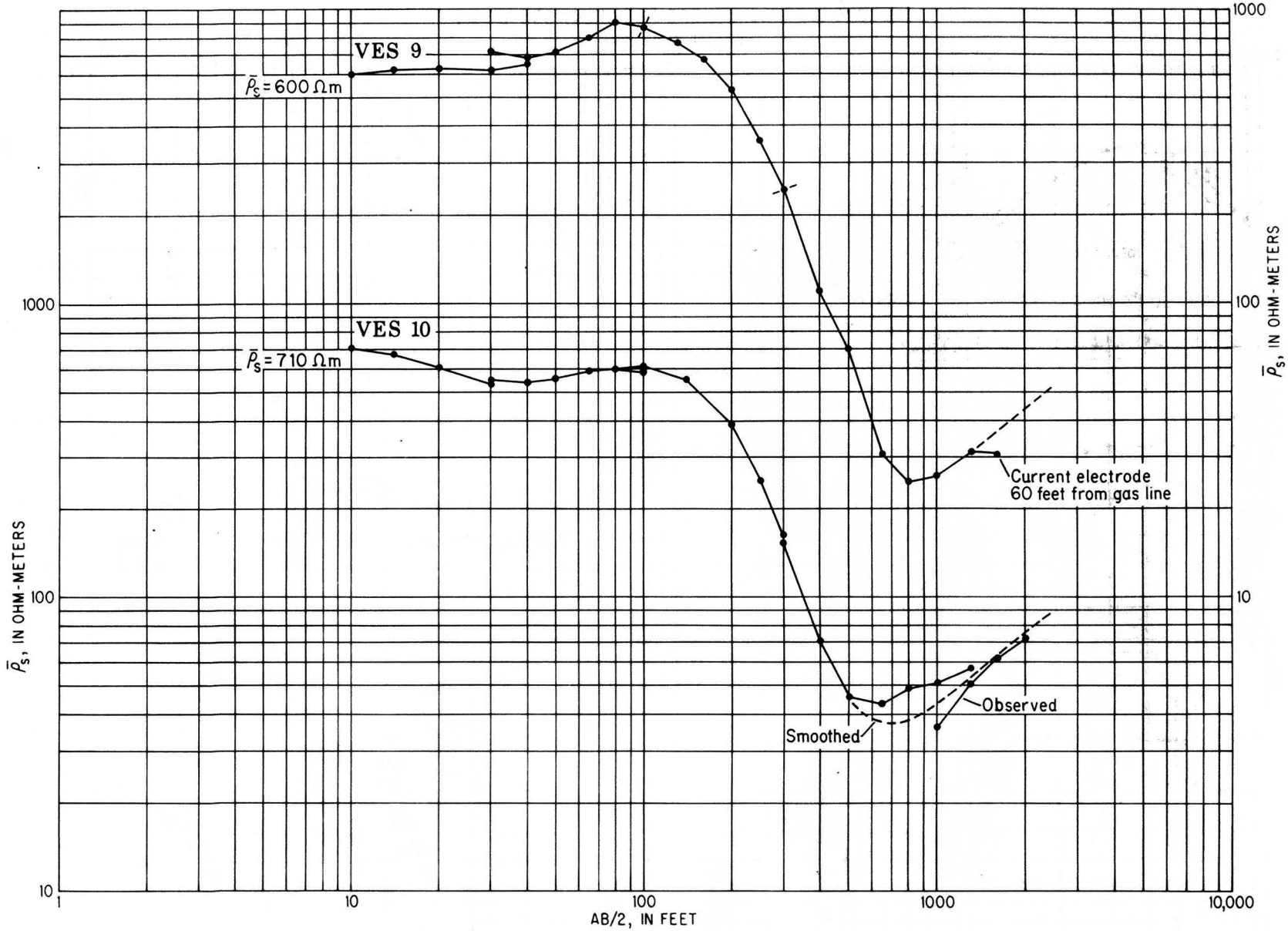
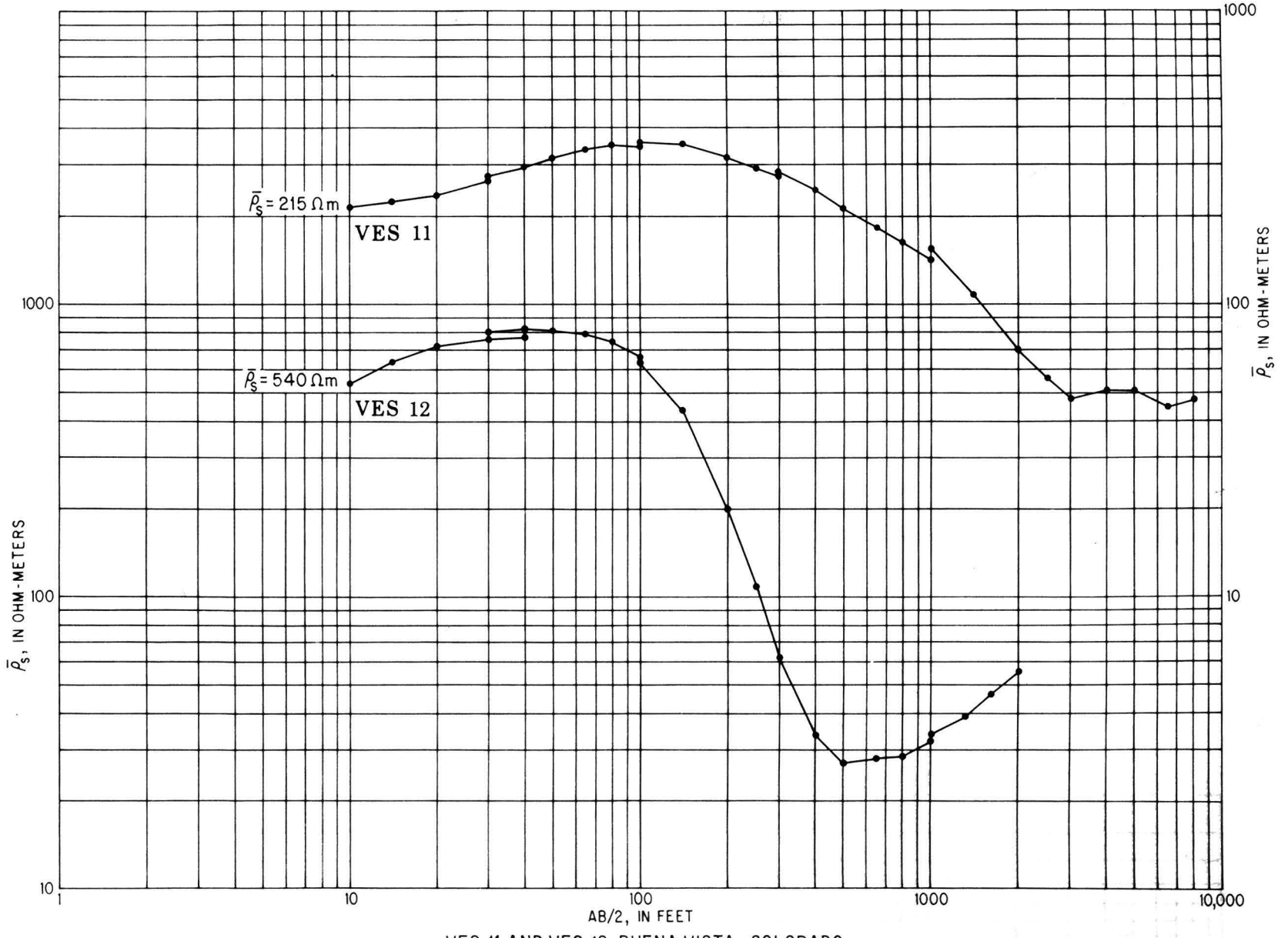


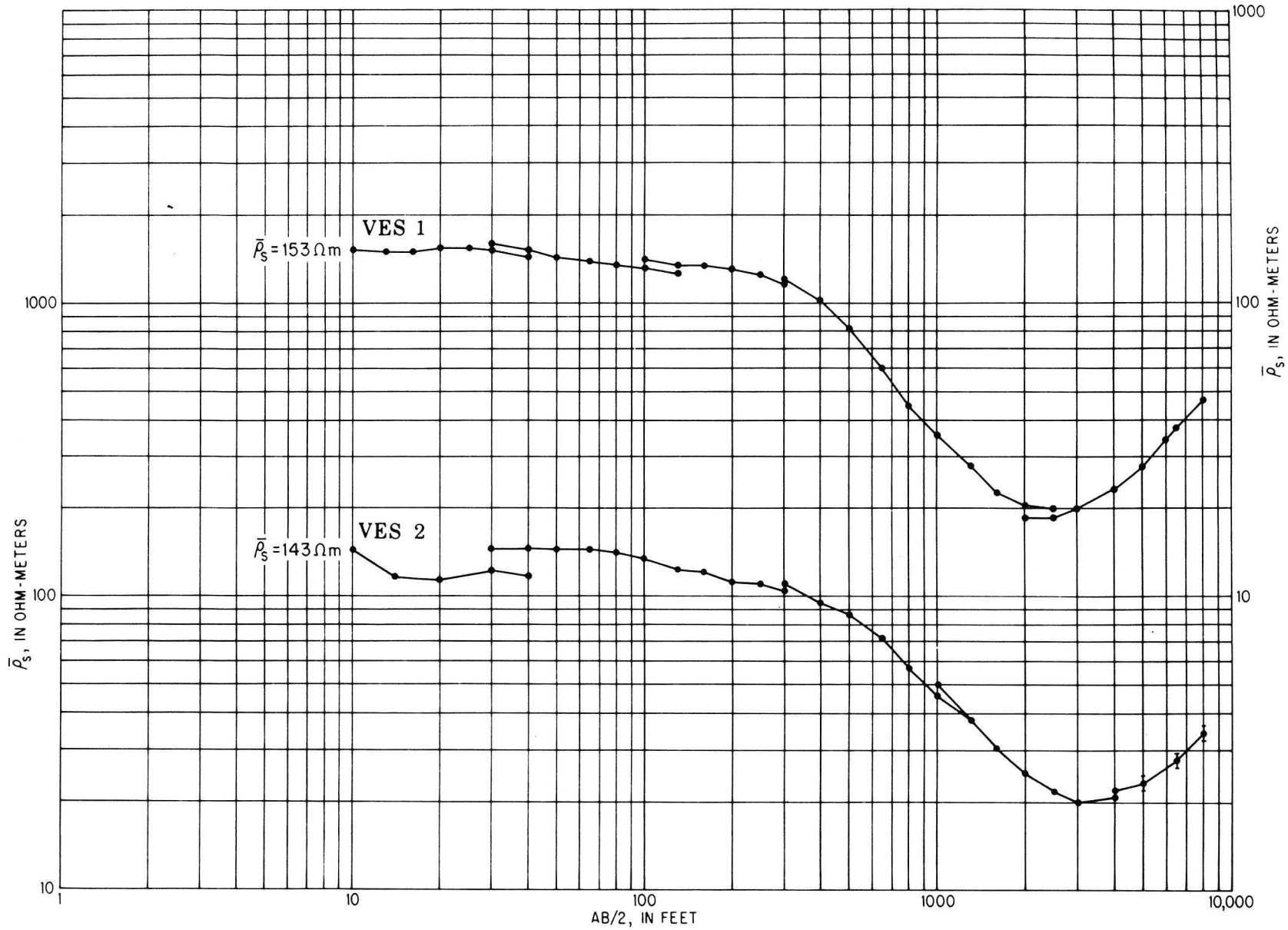
VES 7, VES AND DES 8, BUENA VISTA, COLORADO



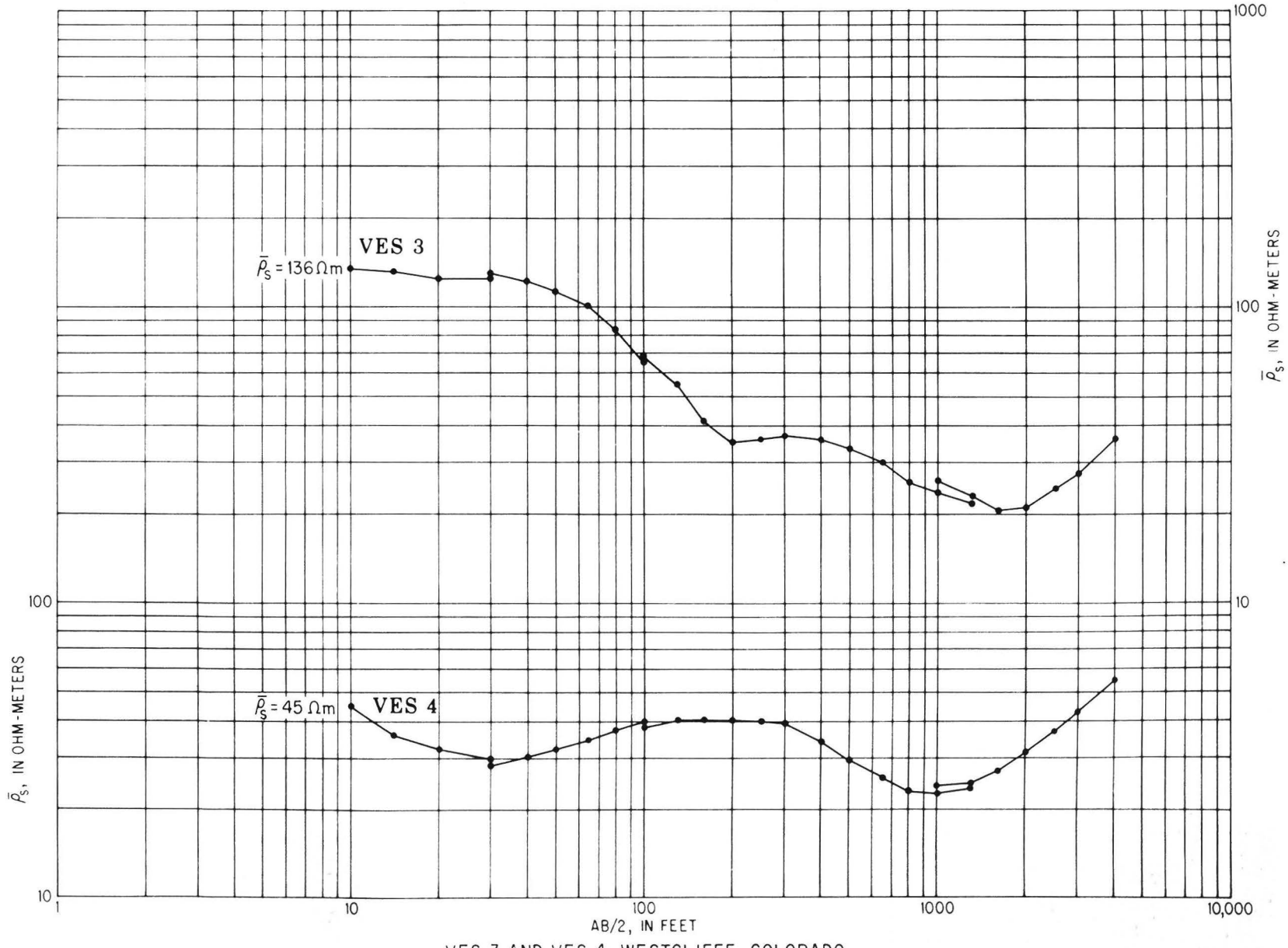
VES 9 AND VES 10, BUENA VISTA, COLORADO



VES 11 AND VES 12, BUENA VISTA, COLORADO



VES 1 AND VES 2, WESTCLIFFE, COLORADO



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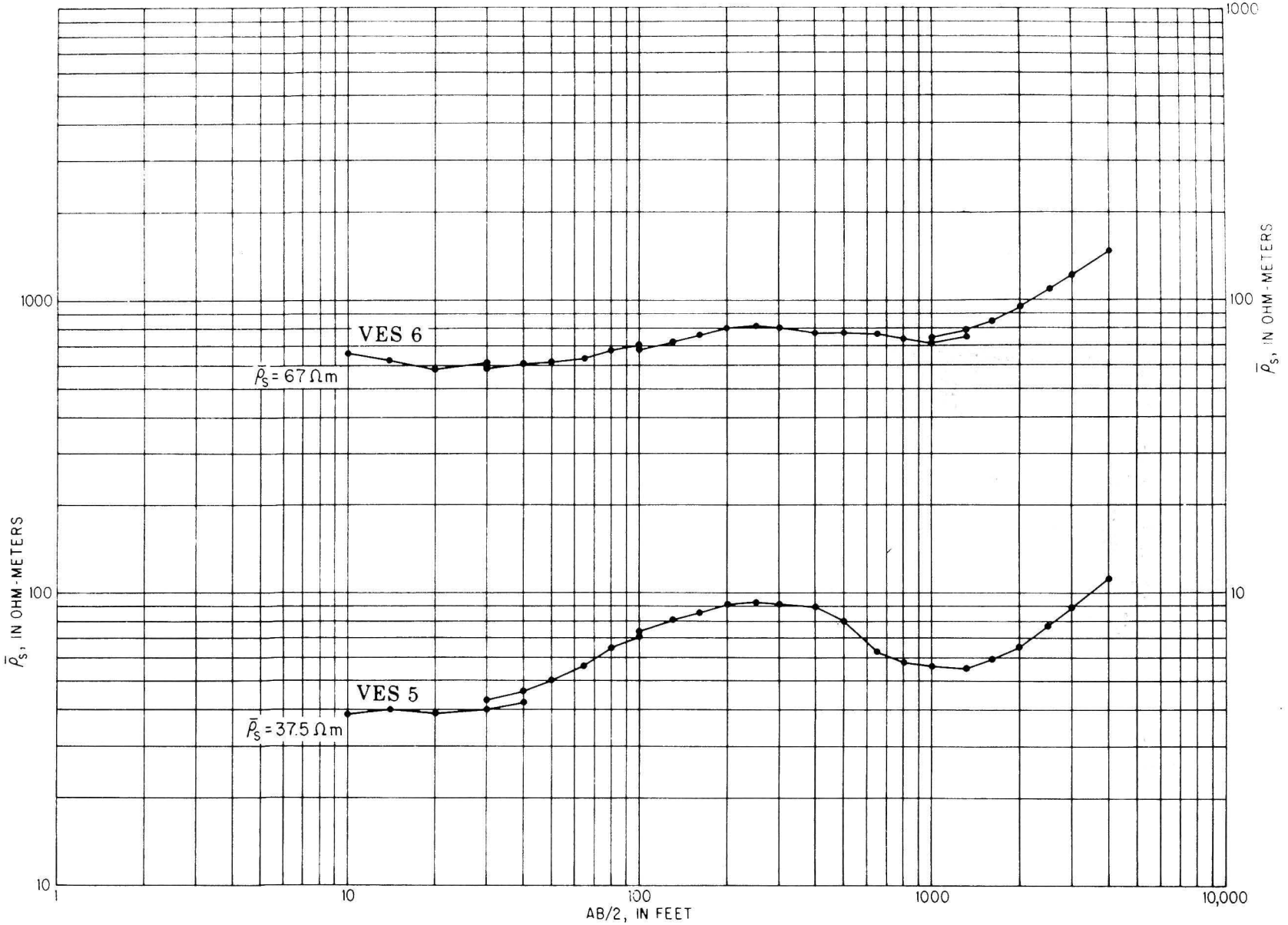

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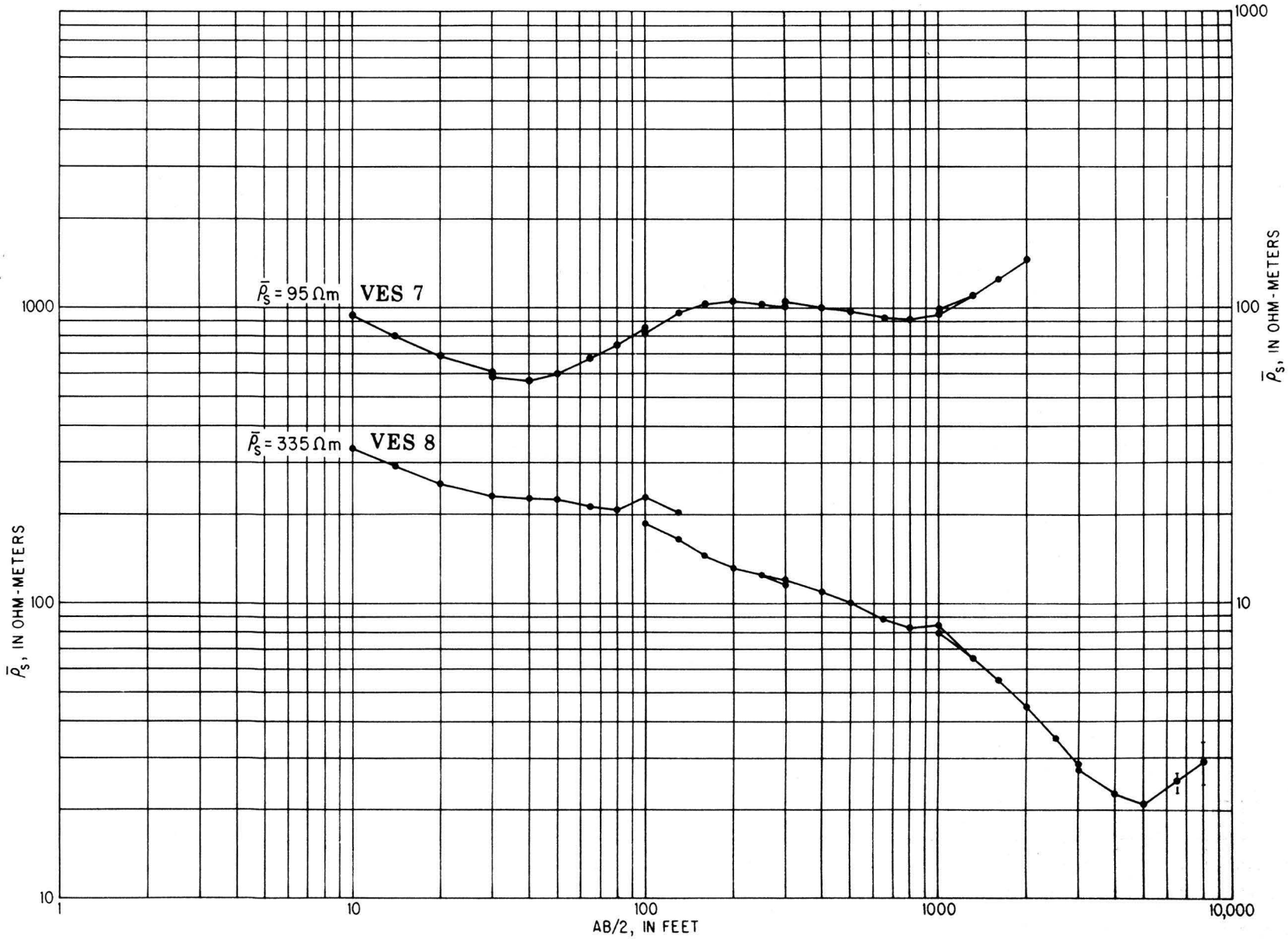

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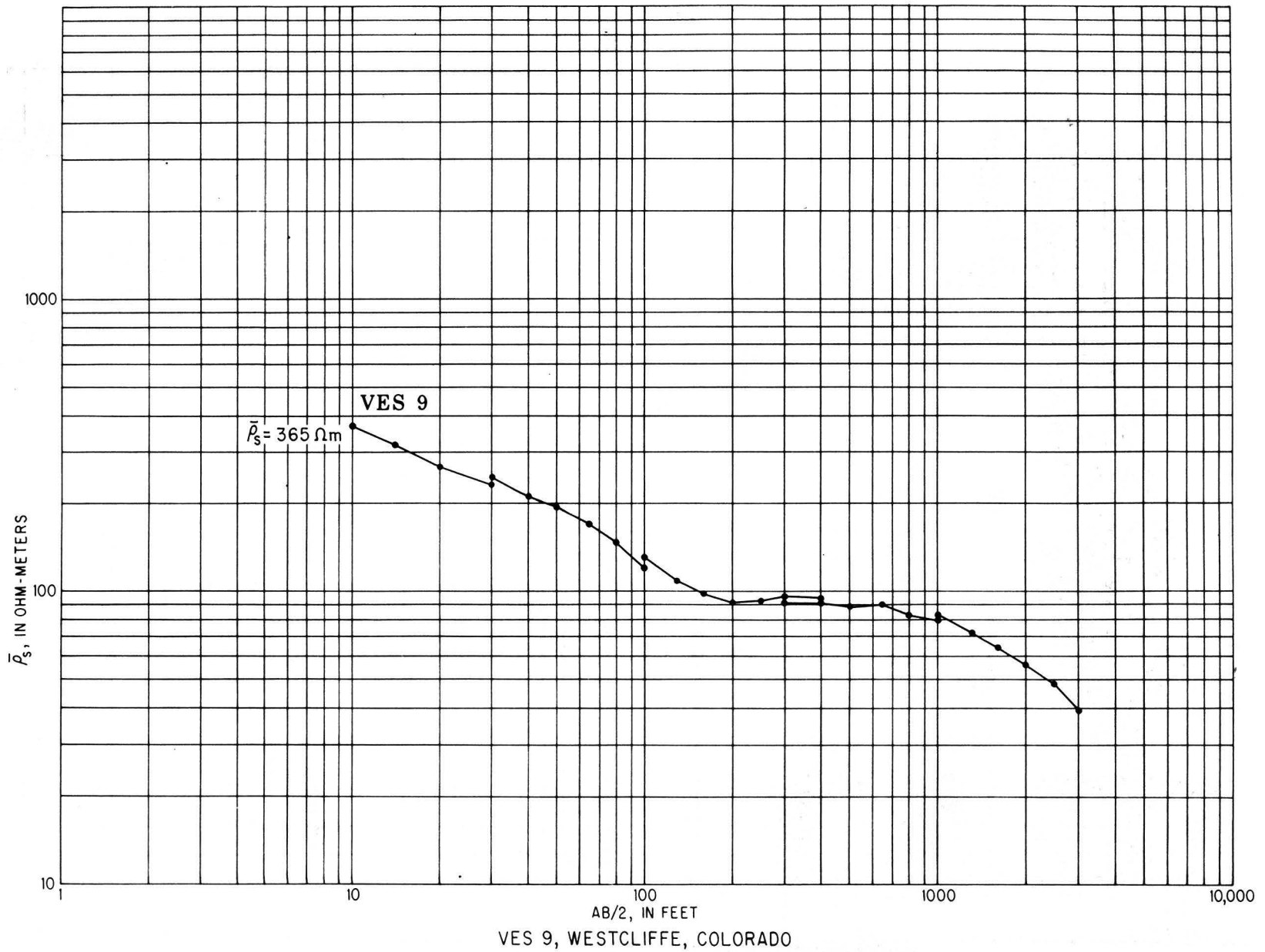

VES 9, WESTCLIFFE, COLORADO