STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

John W. Katz — *Commissioner*

Geoffrey Haynes — *Deputy Commissioner*

Ross G. Schaff — *State Geologist*

April 1982

This is a preliminary publication of the Alaska Division of Geological and Geophysical Surveys and has not received final editing and review. The author will appreciate candid comments on the accuracy of the data and will welcome suggestions to improve the report.

Alaska Open-file Report 150
PEAT RESOURCE INVENTORY
OF SOUTH-CENTRAL ALASKA,
A DATA REPORT
By
R.W. Huck and S.E. Rawlinson

Prepared by:

Northern Technical Services
750 West 2nd Avenue, Anchorage, Alaska 99501

and

Alaska Department of Natural Resources
Division of Geological and Geophysical Surveys
3001 Porcupine Drive, Anchorage, Alaska 99501
P.O. Box 80007, College, Alaska 99708

Under Contract to:

Alaska Department of Commerce and Economic Development
Division of Energy and Power Development
Mr. Donald R. Markle, Energy Projects Manager
338 Denali Street, Anchorage, Alaska 99501

Prepared for:

U.S. Department of Energy
Division of Fossil Energy
Grant No. DE-FG18-81FC05112

TABLE OF CONTENTS

PREFACE

The State of Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, has produced fifteen Open File maps which show relevant physical data and report peat resource boundaries in part of the Susitna Valley, the Dillingham area, and statewide. Sample number and analytical results given in this report, AOF-150, correspond to sampling sites shown on the Susitna Valley maps, AOF-150A-M, and the Dillingham map, AOF-151; peat resource estimates given in Appendix A of this report are also given on these individual maps, and the state peat resource map, AOF-152.

Peat Resource Inventory of Southcentral Alaska, A Data Report

By Robert W. Huck[1] and S.E. Rawlinson[2]

INTRODUCTION

The importance of peat as a fuel source (as well as feedstock for the production of a large variety of other food and fiber items) is ever increasing on a worldwide scale. Active peat research is underway in the U.S., Europe and, Soviet Union. Major research objectives in the U.S. are directed toward the production of gaseous, liquid, and solid fuel from peat.

Economically promising production of gaseous and liquid fuels has to date been generally associated with the hydrogasification or pyrolysis processes[3]. Solid fuels are produced principally through agglomeration processes usually preceded by a partial oxidation step. The range of heating values produced to date falls between a value of 350 Btu's per cubic foot for gaseous fuels to a maximum of 14,000 Btu's per pound for solid fuels. (Costs of production are highly variable.)

The design of the production processes for peat fuels (or other peat-based production processes) depends upon the character of the resource. Additionally, the physical character of the process feedstock has an especially heavy impact on process economics. Therefore, it is essential to have an accurate definition of resource character to support both the technical and economic integrity of any particular proposed production facility.

---

1. Northern Technical Services, Anchorage, Alaska.

2. DGGS, College, Alaska.

3. Biological processes for the production of fuel from peat are also under active investigation. However, these are currently less promising from an economic standpoint.

Consequently, the U.S. Department of Energy, in concert with the State of Alaska, Department of Commerce and Economic Development and Department of Natural Resources, has been actively assessing the extent of peat occurrences statewide and conducting regional (more site specific), detailed analyses of the potential fuel peat sites in Alaska.

The state's 1980 program was designed to assess the extent of the resource statewide. The 1981 program, addressed herein, was designed to examine in as much detail as possible fuel peat deposits in south-central Alaska.

The results of the 1981 program have been mapped and presented in graphic format by the Alaska Division of Geological and Geophysical Survey (DGGS) in open file reports.

MAPPING

DGGS has produced 15 maps in an open file report format. Seven maps (Appendix A) show peat resource areas and data within parts of the Susitna Valley of south-central Alaska and Dillingham at a scale of 1:15,840; and seven other maps of these areas have been produced at a scale of 1:31,680. The mapping scale for these 14 maps was dictated by the density of ground data points. Further, a small-scale map showing the general distribution of peat statewide was also produced by the DGGS (AOF-152). A complete discussion of the statewide fuel peat resource estimate, as recently modified by Rawlinson and Hardy (1982), is included in Appendix A.

The main body of information presented in the DGGS maps includes:

(1) Core site location and depth of sampling
(2) Peat/mineral soil boundaries
(3) Surface topography
(4) Major surface drainage and other physical features
(5) Partial results of the laboratory analyses inclusive of ash content and heating values, and
(6) An estimate of the total area covered by peat, the total moisture and the ash-free heating value of the total tonnage of moisture, and ash-free peat within the map boundaries in acres, quads*, and tons, respectively.

Relative to item (6) above, some basic assumptions based on average field conditions and laboratory data were required. Experience has shown that field densities of wet peat usually range between 65 and 70 lb./ft^3 with water contents ranging between 70 and 90 percent for peat having an average ash content of about 25 percent. Using an average water content of 85 percent and an assumed in-situ density of 70 lb./ft^3 yields 10 lb.

*Quad = 10^{15} Btu.

of dry peat and ash per cubic foot of in-situ material. Adjusting this result by incorporating a 25 percent ash content by weight results in a moisture and ash-free density of 7.5 lb.(per cubic foot of bone dry peat per cubic foot of in-situ material). For estimating, this value was rounded off to 7 lb./ ft^3.

The average laboratory moisture and ash free (MAF) heating value for the entire Susitna Valley study area was 9732 Btu/lb.

The above background logic was used as the foundation for the "Estimated Peat Resources Bases" shown on each map.

This mapping effort was complemented by a U. S. Geological Survey (USGS) program which overlayed the Rogers Creek and Houston areas previously examined during the 1980 field program. The USGS open-file reports are 81-1301 and 81-1302.

Data presentation throughout this report is tied to map numbers associated with the airphotos. These numbers are shown on the Index of Alaska Division of Geological and Geophysical Surveys Open-File Reports 150A-M and Summary of Peat Resources, included in Appendix A. For example, sample 053C-6 was the sixth site cored on airphoto 053-C. Furthermore, references are tied to sample depth. Sample 053C-6-1, 053C-6-3, and 053-C-6-6 indicate airphoto 053-C; the sixth site cored to depths of 1, 3, and 6 ft. respectively. These numbers are shown on "Index of Alaska Division of Geological and Geophysical Surveys Open File Reports 150A-M and Summary of Peat Resources included in Appendix A.

FIELD PROGRAM

The areal extent of the sample areas and their semi-remote nature demanded careful planning of the field program to maximize not only the amount of data acquired but also the level of confidence in that data.

Examination of data derived from the 1980 Phase I work proved that ash content (moisture-free basis) showed an exceptionally strong correlation with heating value. This correlation was the foundation for the field program designs and supported the decision to acquire a preponderance of ash content data.

Because budgetary contraints precluded excessive helicopter use, an all-terrain vehicle was selected as the primary means to access the peat bogs in the Susitna Valley. The ATV was an intermediate size, eight-wheeled recreational unit capable of several hours of operation under excessively wet conditions, thus giving field crews the maximum range essential to cover most of the mapping area in a 1- or 2-day period.

Positioning of the vehicle for sampling operations was conducted using a topolite system in concert with 1:60,000-scale enlarged to 1:15,840-scale, color infrared photography of the sample areas. Further, 1:15,840-scale bluelines of topographic mylar base maps were carried into the field for verification of sample location in the field office at the end of each field day.

Two core-sampling devices were made available at the outset of the program, the Davis sampler and the McCauley sampler. The larger diameter McCauley was chosen so that a more representative sample could be obtained. The Davis was selected for its speed and ease of manual penetration under difficult or dense peat conditions.

Field crews were housed in Willow, which is central to the 2,000 mi^2 sample area to be covered within the Susitna Valley.

The Dillingham field program was comparatively simple. The field crew was flown to Dillingham and operated from within walking distance of the existing road system. The Davis unit was used to acquire all Dillingham samples. Sample location in Dillingham was done totally from air photos.

SAMPLING DETAILS, PROCEDURES AND REPORTING

Terrain anomalies prevented detailed preselection of sampling sites. However, prior to entering the field each day the general area to be sampled was selected using the air photos and bluelines.

Crews were then sent to preselected coring locations or to nearby alternative sites.

Early in the field program it was found that the density of the peat in Susitna Valley precluded manual insertion of the large-diameter McCauley Sampler. Penetration was further stymied by the presence of a layer of volcanic ash occurring at depths between 3 and 6 ft. Consequently, the smaller diameter Davis sampler became the principal core recovery tool.

Davis Sampling

Early field and laboratory data indicated the presence of a 3 in. thick volcanic ash layer at depths between 3 and 6 ft. Because possible contamination of the small diameter (1/2 in.) Davis sample might bias laboratory results, field crews thoroughly washed the sample head of the Davis system following each sample recovery beneath the ash layer. Further, each field sample taken was then examined visually for evidence of contamination prior to being placed in the watertight sample container for shipment to the laboratory.

McCauley/Davis Correlation Tests

A specific correlation program was conducted to compare laboratory results of the samples derived from both the Davis and McCauley samplers.

McCauley samples were acquired at several locations; corresponding Davis samples were taken within 2 to 3 in. horizontally and vertically of the McCauley sites.

The McCauley sampler was inserted to the desired depth and a sample was recovered for analysis. Following this, three Davis samples were recovered from the same depth at 120° intervals within 2 to 3 in. horizontally of the McCauley sample site. The basis for this procedure was the relative volume of sample acquired from the two systems.

Figure B-1 of Appendix B shows a plot of data resulting from this correlation program. The range of Davis data, along with the average of the three points are shown for each McCauley point. A discussion of the data is in a subsequent section of this report.

Old Davis/New Davis Correlation

Throughout the field program, two Davis samplers were used. Because of large variation in ash content, field crews conducted a field correlation with each sampler (Figure B-2).

Field crews made daily logs of their activities. The logs indicated weather conditions and site descriptions, and were used to record any unusual events or observations made during a given field day. Personnel also located and marked sample locations on 1:15,840-scale color infrared photography each day. This resulted in a markedly improved ability to preselect and access sampling sites.

DATA PRESENTATION

The presentation of raw data has been separated into a tabular format and is presented in the tables of Appendix C. Appendix D is attached to present the results of a scanning-electron-microscope examination of selected ash samples from the northern part of the Susitna Valley.

Appendix E contains the graphic presentations of the 1981 laboratory analyses. Further, as appropriate, the 1980 laboratory analyses of Susitna Valley samples have been incorporated with the 1981 data.

Additionally, Appendix F has been prepared to show graphically the spread of statewide data points superimposed on the 1980 and 1981 Susitna Valley data.

DATA DISCUSSION

Ash Content

The strong relationship between ash content and moisture-free heating value, as determined from the 1980 Susitna Valley data was the foundation for the design of the field and laboratory programs.

Because of the relatively strong interdependent relationship of ash content with other variables such as volatile content, oxygen, hydrogen and fixed carbon, special attention was given to early ash content data as they arrived from the laboratory.

Early indications from the laboratory showed a very wide range in ash content data from within a very small (less than 1,000-acre) area. Further, the areas appeared to be geologically and botanically quite uniform in the field and on the color infrared aerial photography. Additionally, there appeared to be no special or unique drainage features. Further examination showeds extreme increases in ash content (up to 100%) occurring at depth between 3 and 6 ft.

Excavation of several small test pits showed a 3- to 4-in. layer of mineral soil occurring at depths between 3 and 6 ft. throughout the Susitna Valley. This layer has been identified as far as 100 mi. south of the study site. The mineral soil layer is of volcanic origin (Appendix D) although it was identified during the 1980 field season using a ground-penetrating radar system as a frost interface.

The consequence of the ash layer occurrence was twofold. First, the density of the layer precluded passage of the larger diameter McCauley sampler. (USGS personnel were successful in using a smaller diameter McCauley system.) Second, it was felt that the ash may have contaminated the small Davis samples. The latter consideration was reinforced by the wide scatter in the early ash-content data received from the laboratory.

Based on these considerations, a correlation test was conducted to evaluate the contamination scenario. The test consisted of carefully opening a hole through which McCauley samples could be taken without contacting the ash layer. Following this, three Davis samples were taken at each McCauley sample site within a few inches of the site, as described earlier.

Figure B-1 of Appendix B shows the results of the correlation testing program. The raw data from which figure B-1 was derived are listed on table 3 of Appendix C. The excessive scatter from each sample location precludes a definitive, quantitative statement about the degree of sample contamination. However, the preponderance of data points from the Davis sampler lie above the 1:1 slope on the graph. There are 55 data points above the 1:1 slope and 29 below it.

Thus, there is a definite tendency toward increased ash content in the Davis samples, probably due to contamination of the samples from the intermediate ash layer.

Because of the large degree of variation in ash content data the strong correlation between ash content and other physical-chemical properties, and the later recognized erratic nature of the peat deposits, an additional correlation testing program was implemented.

During the study, the original Davis sampler malfunctioned and a new Davis system was used. Due to the highly probable susceptibility of the Davis system to contamination, field crews returned to several previously cored sites to get samples using the new Davis system. These samples were obtained from sites a few inches laterally and at the same depth as the original Davis samples.

Results of the ashing tests are shown in figure B-2; the raw data are presented in table 4 of Appendix C.

The range of scatter shown in figure B-2 and the erratic data distribution indicate no clear correlation. The resource character as exemplified by ash content appears extremely variable.

To ensure that the erratic nature of the ash content was not due to variation in laboratory procedures, ten samples were forwarded to two separate laboratories. These samples were taken from a single representative test pit and thoroughly mixed before shipment to ensure consistency.

Figure B-3 shows graphically the results of the laboratory check the raw data are listed in table 5.

Subsequent laboratory results show that variations of ash content are limited to less than 3 percent; thus large variations in data are not due to differences in laboratory procedures.

The preceding arguments indicate that the ash content of the peat deposits in the Susitna Valley area vary greatly over very short distances.

It should also be noted that there appears to be an anomalie in the ash content data as presented in tables C-1, C-1A and C-6 of Appendix C. The ash contents reported are derived from two separate field efforts. The first field samples were gathered for ash determinations only. Following this work additional samples were recovered from the same sample locations for proximate and ultimate determinations. The highly variable nature of the ash content appears as a distortion in the data. In reality, the data accurately reflects the ash values as well as the especially erratic nature of the resource.

Petrographic and Scanning Electron Microscope Analyses

Soon after discovery of the intermediate layer, it was noted that products of the ash determinations had a distinctly different color, which was dependent on origin. That is, ash from the intermediate layer (after burning) had a decidedly reddish color, whereas ash from the peat-mineral soil interface was usually light yellow to white.

Literature searches and consultations with surficial geologists and volcanologists led to speculation that the intermediate layer was volcanic in origin rather than sedimentary. Consequently, 34 randomly selected peat ash samples were forwarded for petrographic analysis. Further, two special samples, one taken from the intermediate layer and one from the underlying mineral soil, were submitted for both examination under a scanning electron microscope and petrographic analysis.

The mineralogical character of the various ashes are described in concert with the physical nature of these ash samples in Appendix D.

As stated in Appendix D, it appears that the intermediate layer and at least some of the bottom material are of volcanic origin; the intermediate layer contains a significantly higher quantity of amorphous glass fragments.

Proximate and Ultimate Analyses

The results of 81 proximate and ultimate analyses of Susitna

Valley peat (60 from the 1981 program and 21 from the 1980 program) were scatter graphed to determine the relationships between ash content, heating value, and other physical-chemical properties. The 1980 and 1981 data were processed separately. The resulting differences in the empirical relationships are small, usually less than a fraction of 1 percent. Consequently, it was decided to combine the 2 years of data for analysis.

The critical physical-chemical variables included volatile matter, oxygen content, hydrogen content, carbon, fixed carbon, and moisture- and ash-free oxygen content. Sulfur content was generally so low, ranging between 0.18 and 0.65 percent and averaging about 0.30 percent, that it was not plotted. Further, the influence of such low sulfur contents on heating value would be insignificant. The same argument was applied to the nitrogen content when considering its influence on heating value. (Nitrogen values averaged approximately 2 percent for the suite of tests reported.)

The tabulation of the 1981 proximate and ultimate analyses raw data is given on table 6 of Appendix C.

Because of the predominant strength of the ash content data initial scatter graphing was directed toward the determination of empirical relationships between ash content and other variables important to the combustion properties of peat.

These relationships were established by simple curve fitting techniques. The suite of possible relationships selected for curve fitting included the following:

$$y = a + bx$$
$$y = ae^{bx}$$
$$y = ax^{b}$$
$$y = a + {}^{b}/x$$

$$y = {}^{1}/(a + bx)$$
$$y + {}^{x}/(a + bx)$$

Wherein:

a = constant
b = constant
x = ash content or heating value
e = base of the natural logarithms
y = heating value, volatiles, oxygen content, hydrogen content, fixed carbon, oxygen content, and moisture- and ash-free oxygen content, all derived from the proximate and ultimate analyses. (On a moisture-free basis except as otherwise noted.)

The above base relationships were transformed into linear components and curves were fitted by using a simple least-squares technique.

The coefficients a and b and an "index of determination" (Table I), were calculated for each of the following relationships:

(1) heating value vs ash content
(2) volatiles vs ash content
(3) oxygen content vs ash content
(4) hydrogen content vs ash content
(5) fixed carbon vs ash content
(6) hydrogen vs heating value
(7) oxygen vs heating value
(8) ash-free oxygen vs heating value
(9) volatiles vs carbon 1981 data (note no index of determination was made for this plot)

Those relationships showing the strongest "index of determination", i.e., the best fit of data to a particular curve, were then selected and plotted. The graphic presentation of the data used and the resulting curve fits are given in figures E-1 through E-8 as of Appendix E. Figure E-9 (volatiles vs carbon, 1981 data) was generated separately from these analyses.

Table I shows the individual relations, the constants a and b, and the indexes of determination for each relationship.

As noted on table I, the weakest relationship appears to be that between moisture- and ash-free oxygen and heating value. However, the range of values is relatively narrow even though the statistical correlation is weak.

For each curve shown, the correlation between ash content and the variable chosen is clear. Further, assumptions relating the average values for sulfur and nitrogen taken in concert with figure E-9 allow a single point determination for both a proximate and ultimate analysis based on ash content alone.

For example, assume that a field sample analysis results in an ash content determination at 25 percent.

From figure E-1, the heating value is 7400 Btu/lb.
From figure E-2, volatiles are 55 percent
From figure E-3, oxygen is 27 percent
From figure E-4, hydrogen is 4.8 percent
From figure E-5, fixed carbon is 21 percent
From figures E-2 and E-9, carbon is 44 percent
From averages, sulfur is 0.3 perceent
From averages, nitrogen is 2.0 percent

Such an analysis could provide a sufficient level of accuracy for a preliminary facility design and cost study for a variety of peat processes.

Proximate and Ultimate Analyses, Statewide

The generally large range of data shown on the graphs of Appendix E encouraged a closer examination of the previously acquired data from the 1980 statewide program. Consequently, data from this earlier program were superimposed on the Appendix E graphs to examine probable quantitative correlations.

The resulting data plots indicated quite strong correlation between the Susitna Valley data and the 1980 data acquired at Dillingham, Kenai, King Salmon, and Kodiak. These exploration sites represent a 160,000 mi^2 area in south-central Alaska. The superpositions of the 1980 statewide data on the 1981 Susitna Valley data plots of Appendix E are shown in Appendix F. These 1980 statewide data points are superimposed directly on the Appendix E curves and are presented as figures F-1 through F-8.

The close correlation of data over this exceptionally large area is encouraging. First, the single ash content point determination for preliminary proximate and ultimate analyses could make relatively detailed resource data available at only minimal cost at remote sites throughout south-central Alaska.

Second, if detailed analyses are required from any location in this vast area, they may be obtained through very low cost ash determinations and reinforced by only minimal expenditures for the higher cost proximate and ultimate analyses. Third, field explorations in any other region of the state could be greatly abbreviated if such strong correlations can be established for other regions.

APPENDIX A

Detailed Map References and Estimate of Alaska Statewide Fuel Peat Resources

FY82 PEAT RESOURCE MAPS
DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

AOF 150A - Peat-resource map, south-central Talkeetna B-1 Quadrangle, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150B - Peat-resource map, southwestern Talkeetna B-1 Quadrangle, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150C - Peat-resource map, north-central Talkeetna A-1 Quadrangle, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150D - Peat-resource map, northwestern Talkeetna A-1 Quadrangle, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150E - Peat-resource map, southeastern Talkeetna A-1 and southwestern Talkeetna Mountains A-6 Quadrangles, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150F - Peat-resource map, south-central Talkeetna A-1 Quadrangle, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150G - Peat-resource map, southwestern Talkeetna A-1 Quadrangle, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150H - Peat-resource map, Western Anchorage D-8 Quadrangle, Alaska, scale 1:31,680, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150I - Peat-resource map, Tyonek D-1 Quadrangle, Alaska, scale 1:31,680, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150J - Peat-resource map, Anchorage C-8 Quadrangle, Alaska, scale 1:31,680, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150K - Peat-resource map, Tyonek C-1 Quadrangle, Alaska, scale 1:31,680, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150L - Peat-resource map, Anchorage B-8 Quadrangle, Alaska, scale 1:31,680, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 150M - Peat-resource map, Tyonek B-1 Quadrangle, Alaska, scale 1:31,680, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 151 - Peat-resource map, southwestern Dillingham A-7 Quadrangle, Alaska, scale 1:15,840, Rawlinson, S.E., Huck, R.W., and Hardy, S.B.

AOF 152 - Peat-resource map of Alaska, scale 1:2,500,000, Rawlinson, S.E., Huck, R.W., and Hardy S.B.

ALASKA STATEWIDE FUEL PEAT RESOURCE ESTIMATE

Alaska has a total area of 365 million acres, much of which includes massive peat deposits. Initial estimates of potential fuel-grade peat in the state have ranged from 27 million acres to over 100 million acres. Up to 741 quads* of potential peat derived energy have been estimated to be available from peat resources in Alaska. Using the soils maps of the Soil Conservation Service, Rawlinson and Hardy (1982) compiled data showing significant differences in the energy-resource estimates derived during previous preliminary studies based principally on a large variety of map resources and on limited field data acquisition.

The earliest evaluation of Alaska peatlands was conducted by Dachnowski-Stokes (1941). The initial estimates of the U.S. Department of Energy (DOE) (1979) showed Alaska to include 27 million acres of unfrozen peat. This land mass represented 741 quads of energy, assuming peat deposits with an average depth of 7 ft., a moisture content of 35 percent, a heating value of 6,000 Btu/lb, and a bulk density of 15 $lb/ft.^3$. The 741 quads of energy represents 51 percent of the 1,443 quads of energy estimated by the DOE to be potentially available from peat resources nationwide. Northern Technical Services and Ekono, Inc. (1980), in a report to the Alaska Division of Energy and Power Development, estimated the probable fuel peat occurrences to exceed 100 million acres statewide, with 5.5 million acres of the Kenai Peninsula and Susitna Valley areas showing the higher probability of occurrence of fuel peat deposits.

Rawlinson and Hardy (1982) indicated total area of peatlands in Alaska to equal approximately 25 million acres, of which 5 million acres are considered to be unfrozen fuel-grade peat.

*Quad = 10^{15} Btu.

Assuming a moisture- and ash-free bulk density of 7 lb/ft.^{3}, a depth of 5 ft., and a heating value of 8,300 Btu/lb, they estimated the unfrozen fuel-grade peat in Alaska to have an energy value of approximately 63 quads. They speculated that if the frozen peat deposits contain the same proportion (56 percent), of fuel-grade peat to non fuel peat as the unfrozen peat deposits, the total acres of fuel-grade peat will equal approximately 14 million acres, representing a potential of 180 quads of energy.

Dachnowski-Stokes, A.P., 1941, Peat resources in Alaska, U.S. Department of Agriculture Tech. Bull. 769, 84 p.

Northern Technical Services and Ekono, Inc., 1980, Peat resource estimation in Alaska, final report, Vol. 1: Division of Energy and Power Development, Anchorage.

Rawlinson, S.E. and Hardy, S.B., (1982), Peat resource map of Alaska: Alaska Division of Geological and Geophysical Surveys Open-file Report 152, scaled 1:2,500,000.

U.S. Department of Energy, 1979, Peat prospectus, U.S. DOE, Washington, D.C.

ALASKA PEAT RESOURCE ESTIMATE[1]

Acres of peat	25,525,400
Acres of unfrozen peat	8,961,550
Acres of frozen peat	16,563,850

Acres of unfrozen fuel-grade peat[2]	4,998,750
Quads of energy[3] of unfrozen fuel-grade peat	63

Fifty-six percent of unfrozen peat in this study is fuel grade. Speculating 56 percent of frozen peat in this study to be fuel grade:

Acres of fuel-grade peat 4,998,750 + 9,275,750	= 14,264,500
Quads of energy of fuel-grade peat	180

1. Rawlinson, S.E., and Hardy, S.B. (1982), Peat resource map of Alaska: Alaska Division of Geological and Geophysical Surveys Open-file Report 152, scaled 1:2,500,000.

2. Peat greater than 5 ft deep and considered to have 8300 Btu/lb

3. 10^{15} Btu, using values of 7 lb/ft^3 bulk density and 8300 Btu/lb.

APPENDIX B

Comparison Data Plots, Ash Content

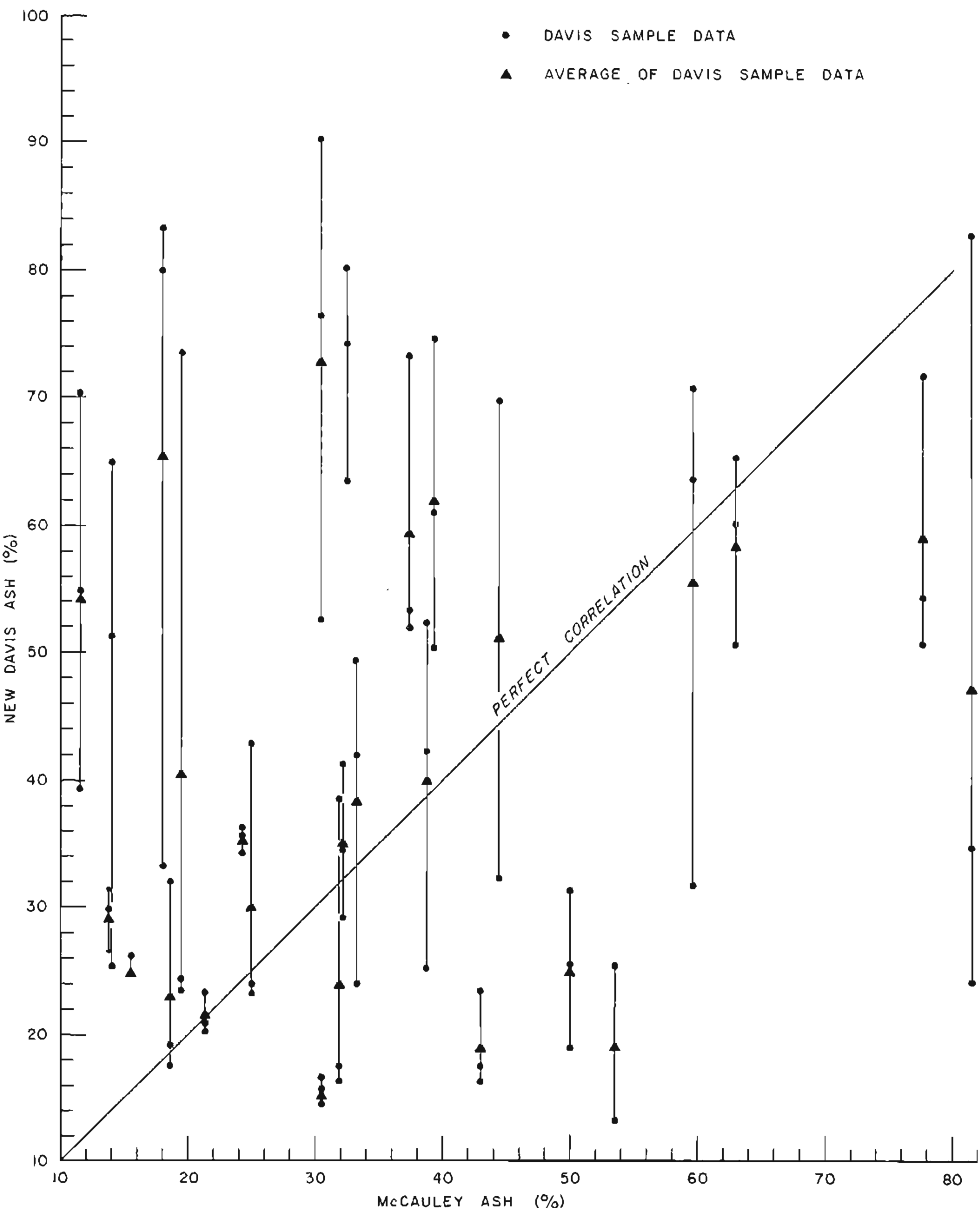


FIGURE B-1
DAVIS vs. McCAULEY SAMPLES

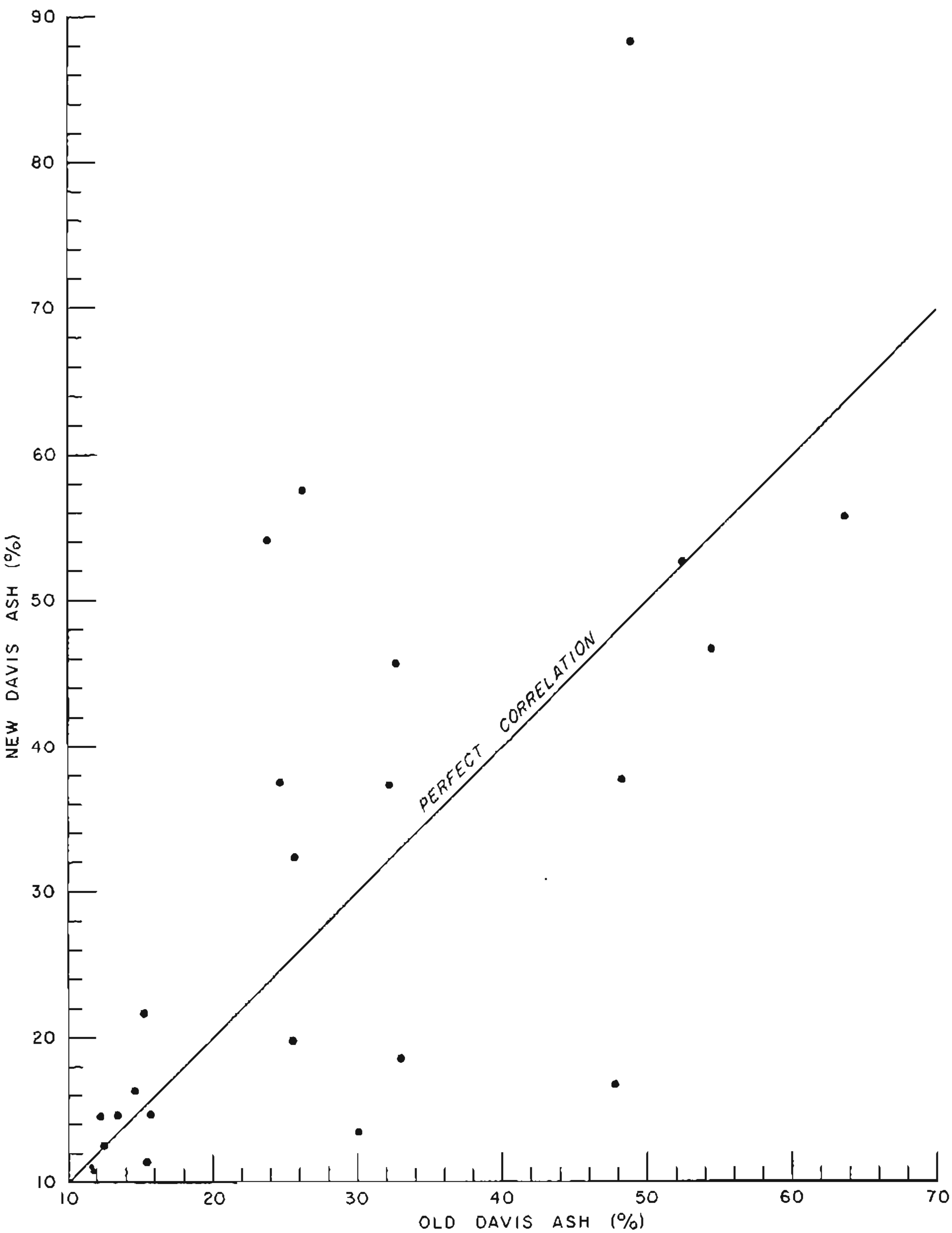


FIGURE B-2

NEW DAVIS vs. OLD DAVIS SAMPLES

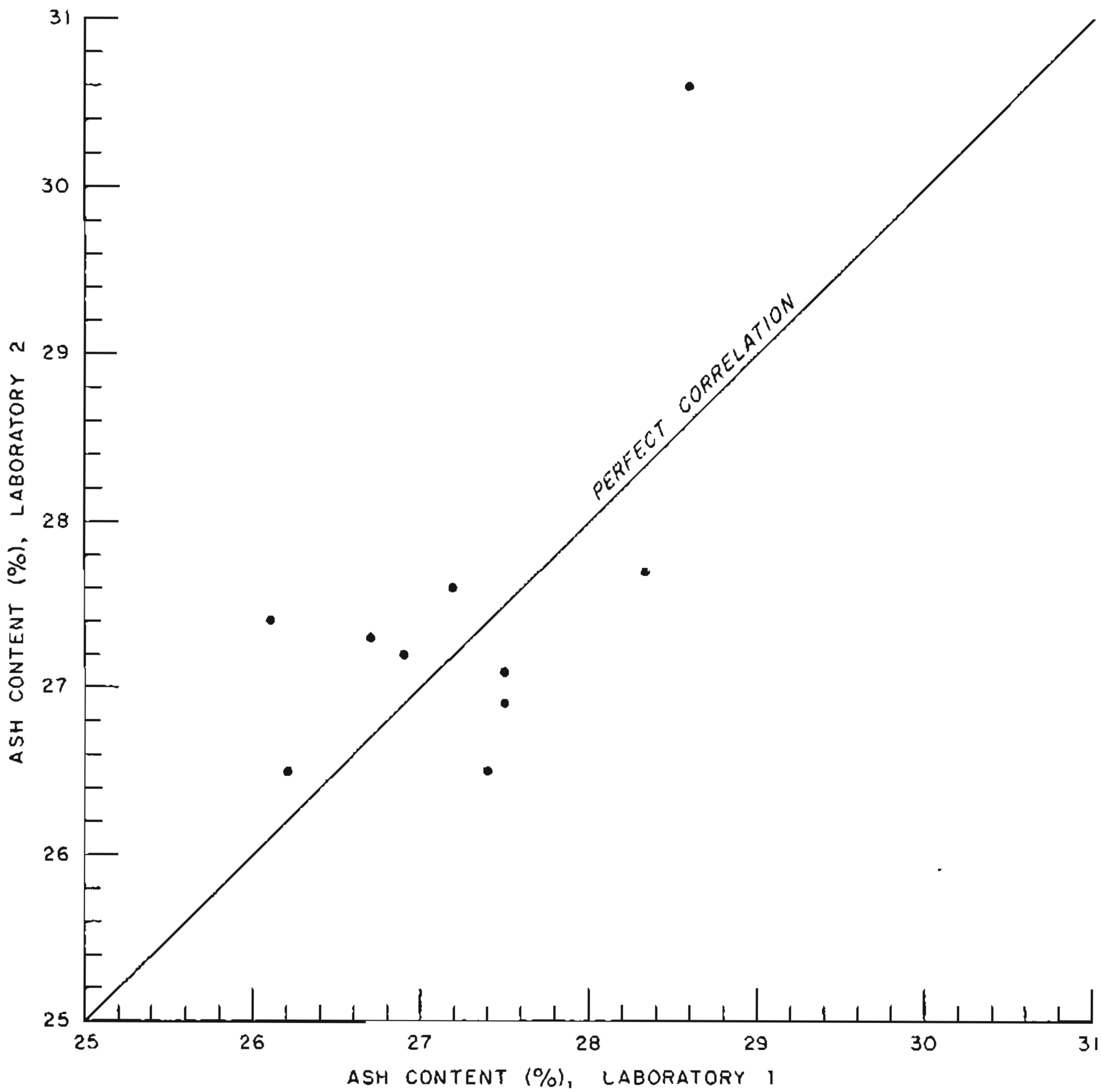


FIGURE B-3

LABORATORY COMPARISON DATA

APPENDIX C

Tables

TABLE C-1

ASH CONTENT DATA, SUSITNA VALLEY

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
053-1-1	26.47	053 A1-7	17.33	053 B5-6	80.28	053 C6-8	69.46	053 D5-6	36.76
053-1-3	22.22	053 A1-9	73.91	053 B5-9	27.90	053 CF-1	16.50	053 D5-9	45.45
053-1-5		053 A1-10	77.08	053 B5-11	20.83	053 CF-3	39.60	053 D5-10	70.83
053-2-1	20.58	053 A2-1	13.33	053 B6-1	24.61	053 CF-6	72.96	053 D6-1	27.39
053-2-5	34.09	053 A2-3	16.50	043 B6-3	24.32	053 CF-9	71.51	053 D6-3	52.80
053-2-8	55.90	053 A2-6	18.75	053 B6-6	40.00	053 CF-12	45.30	053 D6-6	37.25
053-3-1		053 A2-9	7.50	053 B6-9	64.28	053 C8-1	18.84	053 D6-9	58.26
053-3-3	25.00	053 A2-12	27.85	053 B7-1	20.63	053 C8-3	13.26	053 DF-1	11.47
053-3-5	75.73	053 A2-15	34.00	053 B7-3	45.45	053 C8-6	48.60	053 DF-3	33.33
053-4-1	62.50	053 A2-17	99.13	053 B7-6	16.66	053 C8-10	42.00	053-D7-6	89.35
053-4-3	91.71	053 A3-1	18.9	053 B7-9	58.33	053 C9-1	9.30	053 D8-1	22.72
053-5-1	23.52	053 A3-3	23.70	053 B7-11	97.93	053 C9-3	25.00	053 D8-3	56.08
053-5-3	38.57	053 A3-5	37.50	053 C1-1	25.00	053 C9-6	41.18	053 D8-6	58.62
052-5-5	80.37	053 A3-9	59.50	053 C1-3	31.70	053 C9-8	72.67	053 D8-10	49.55
053-6-1	55.10	053 A3-10	45.38	053 C1-4	43.29	053 D1-1	15.71	053 D9-1	18.18
053 6-4	89.34	053 B1-1	21.73	053 C2-3	18.33	053 D1-3	27.20	053 D9-3	24.07
053-7-1	20.68	053 B1-3	20.00	053 C2-6	28.97	053 D1-6	18.33	053 D9-6	46.04
053-7-6	85.49	053 B1-4	94.96	053 C2-8	78.57	053 D1-9	82.14	053 D10-1	19.51
		053 B1-5	62.00						
053-8-3	30.76	053 B2-3	18.00	053 C3-1	26.66	053 D1-10	44.23	053 D10-3	15.66
053-8-5		053 B2-6	80.47	053 C3-3	25.60	053 D2-1	27.18	053 D10-4	38.46
053-9-3	37.17	053 B2-7	39.36	053 C3-5	77.66	053 D2-3	29.12	053 D11-1	21.10
053-9-5	26.70	053 B3-1	19.11	053 C4-1	11.10	053 D2-6	72.57	053 D11-3	34.57
053-8-7	45.29	053 B3-3	18.75	053 C4-3	27.69	053 D2-8	81.71	053 D11-6	35.29
053-9-10	92.30	053 B3-5	87.94	053 C4-6	52.80	053 D3-1	14.28	053 D11-9	63.53
053-10-4	96.03	053 B3-7	33.65	053 C4-9	78.57	053 D3-3	29.62	053 D12-1	73.25
053-11-3	39.13	053 A3-10	98.18	053 C5-1	36.00	053 D3-6	72.68	053 D12-3	84.61
053-11-6	19.41	053 B4-1	8.69	053 C5-3	41.17	053 D3-9	50.38	053 D12-4	98.31
053-11-8	57.62	053 B4-3	38.60	053 C5-6	68.54	053 D4-1	14.44	053 D13-1	14.28

TABLE C-1
ASH CONTENT DATA, SUSITNA VALLEY
(Continued)

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
053-12-3	73.04	053 B4-5	31.57	053 C5-9	79.62	053 D4-3	34.73	053 D13-3	17.00
053 A1-1	23.07	053 B4-9	37.33	053 C6-1	40.00	053 D4-7	29.77	053 D13-6	57.40
053 A1-3	12.50	053 B5-1	31.37	053 C6-3	26.50	053 D5-1	16.00	053 D13-9	39.18
053 A1-5	53.12	053 B5-3	16.66	053 C6-6	43.63	053 D5-3	26.66	053 D13-12	33.30
053 D14-1	12.30	053 E3-1	27.82	051 B14-8	88.18	157-8-11		157-16-9	84.49
053 D14-3	12.50	053 E3-3	78.65	051 B15-1	10.52	157-9-1		157-16-10	25.25
053 D14-6	13.51	053 E3-6	27.53	051 B15-3	23.37	157-9-3		157-17-1	29.41
053 D14-9	56.66	053 E3-9	40.98	051 B15-6	21.42	157-9-4		157-17-3	26.82
053 D14-12	21.31	053 E4-1	42.15	051 B15-9	20.90	157-9-6		157-17-6	40.78
053 D14-15	81.03	053 E4-3	71.27	051 B15-11	55.82	157-10-1		157-17-9	34.28
053 D15-1	13.40	053 E4-6	41.00	051 B16-1	23.95	157-10-1		157-17-10	36.47
053 D15-3	27.77	053 E5-1	24.27	051 B16-3		157-10-6		157-18-1	23.62
053 D15-6	48.45	053 E5-3	15.38	051 B16-6	54.80	157-11-1		157-18-3	24.08
053 D15-9	29.14	053-E5-6	77.84	051-B17-1	46.87	157-11-3		157-18-6	27.97
053 D15-12	56.81	053 E5-9	30.23	051 B17-3		157-11-6		157-18-9	44.89
053 D16-1	19.35	053 E5-12	46.80	051 B17-6	24.74	157-12-1		157-18-10	60.07
053 D16-3	61.11	053 E5-15	88.93	051 B17-8	45.25	157-12-3		157-19-1	42.86
053 D16-6	51.44	053 E6-1	20.61	157-4-1	35.56	157-12-6		157-19-3	49.47
053 D17-1	17.39	053 E6-3	16.85	157-4-3	44.92	157-12-8		157-19-6	71.27
053 D17-3	27.48	053 E6-6	24.76	157-4-6	96.58	157-13-1	25.22	157-20-1	22.37
053 D17-6	22.05	053 E6-9	20.45	157-5-1	40.00	157-13-3	50.00	157-20-3	42.95
053 D17-9	50.71	053 E6-12	21.66	051-5-3	46.30	157-13-6	80.62	157-20-6	70.97
053 D18-1	17.33	053 E6-13	91.21	051-5-6	36.60	157-13-9	78.50	157-21-1	31.25
053 D18-3	15.23	051 B12-1	25.00	051-5-9	40.00	157-14-1	12.76	157-21-3	61.92
053 D18-6	33.46	051 B12-3	44.26	051-5-10	91.73	157-14-3	35.21	157-21-6	27.58
053 D18-9	29.27	051 B12-6	63.38	157-6-1	28.89	157-14-6	31.35	157-21-9	29.00
053 D18-10	72.09	051 B12-8	61.71	157-6-3	14.81	157-14-9	54.90	157-21-10	80.61
053 D19-1	19.35	051 B12-9	88.00	157-6-6	28.26	157-14-10	37.11	157-22-1	22.87
053 D19-3	19.23	051 B13-1	36.48	157-6-7	41.07	157-15-1	30.46	157-22-3	12.50

TABLE C-1

ASH CONTENT DATA, SUSITNA VALLEY

(Continued)

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
053 D19-6	71.34	051 B13-3	52.08	157-7-5	20.00	157-15-3	57.52	157-22-6	36.25
053 D19-8	72.97	051 B13-6	14.63	157-7-6	28.75	157-15-6	65.00	157-22-9	57.33
053 E1-1	88.25	051 B13-9	25.32	157-7-8	94.95	157-15-9	37.27	157-22-10	81.87
053 E1-3	83.87	051 B13-11	82.77	157-8-1	13.68	157-15-12	93.71	157-23-1	5.55
053 E2-1	18.14	051 B14-1	29.24	157-8-3	18.66	157-16-1	30.04	157-23-3	28.00
053 E2-3	20.89	051 B14-3	26.08	157-8-6	74.21	157-16-3	15.86	157-23-6	19.04
053 E2-5	21.31	051 B14-6	55.83	157-8-9	35.79	157-16-6	23.67	157-23-9	12.08
157-23-12	47.57	159-2-1	15.90	159-7-18	26.13	177-12-3		177-23-3	21.28
157-23-14	66.25	159-2-3	40.57	159-7-21	CLAY	177-12-6		177-23-6	29.34
157-24-1	29.05	159-2-6	29.03	177-1-3		177-12-9		177-23-9	10.06
157-24-3	68.98	159-2-9	8.82	177-1-6		177-12-11		177-23-12	81.97
157-24-6	38.32	159-2-12	17.64	177-1-8		177-13-3		177-24-3	49.44
157-24-7	60.73	159-2-15	98.97	177-2-3		177-13-6		177-24-6	25.68
157-25-1	33.58	159-3-1	14.28	177-3-3		177-13-9		177-24-9	79.31
157-25-3	63.58	159-3-3	26.44	177-3-6		177-14-3		177-24-11	80.33
157-15-6	85.51	159-3-6	56.76	177-3-9		177-14-5		177-25-3	69.30
157-26-1	17.30	159-3-9	9.54	177-4-3		177-15-3		177-25-6	86.48
157-26-3	60.00	159-3-12	63.46	177-4-6		177-15-6		177-26-3	75.06
157-26-6	34.00	159-4-1	18.00	177-4-9		177-15-9		177-26-6	97.38
157-26.9	44.04	159-4-3	27.64	177-5-3		177-15-12		177-27-3	34.37
157-26-11	68.25	159-4-6	75.66	177-5-6		177-16-3		177-27-6	39.34
157-27-1	35.65	159-5-1		177-5-9		177-16-6		177-27-9	14.54
157-27-3	38.25	159-5-3	25.64	177-5-11		177-16-8		177-27-12	77.65
157-27-6	34.51	159-5-6	59.94	177-6-3		177-17-3		177-28-3	51.61
157-27-8	30.95	159-5-9	20.51	177-6-6		177-17-6		177-28-6	17.91
157-28-1	29.35	159-5-11		177-7-3		177-17-9		177-28-9	76.74
157-28-3	44.76	159-6-1	12.32	177-7-6		177-18-3	17.92	177-29-3	59.73
157-28-6	19.30	159-6-3	23.30	177-7-9		177-18-6	85.86	177-29-6	64.85

TABLE C-1

ASH CONTENT DATA, SUSITNA VALLEY

(Continued)

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
157-28-9	12.16	159-6-6	58.28	177-8-6		177-18-9	54.92	177-30-3	21.35
157-28-12	57.14	159-6-9	41.40	177-8-9		177-19-3	24.32	177-30-6	40.82
157-29-1	48.12	159-6-12	19.04	177-8-12		177-19-6	58.70	177-30-9	35.12
157-29-3	52.13	159-6-15	60.85	177-9-3		177-19-9	5.71	177-30-11	60.97
157-29-7	32.81	159-6-18	91.73	177-9-6		177-19-12	26.78	177-31-3	71.93
159-1-1	19.72	159-7-1	15.05	177-10-3	39.06	177-19-14	82.00	177-31-6	14.28
159-1-3	38.77	159-7-3	7.04	177-10-6	41.81	177-21-3	35.74	177-32-3	74.47
159-1-6	75.43	159-7-6	76.84	177-10-9	25.71	177-21-6	17.97	177-32-6	63.24
159-1-9	53.21	159-7-9	21.77	177-10-12	71.01	177-22-3	45.03	177-32-9	97.77
159-1-12	76.30	159-7-12	11.66	177-11-3		177-22-6	17.62		
		159-7-15	9.52	177-11-6		177-22-9	58.52		
177-33-3	61.62	7018-4-3	57.5	7178-8A-3	37.7	7425-6-9	41.81	2-009-5-15	62.3
177-33-6	68.46	7018-4-4	38.3	7178-8A-5	39.7	7425-7-3	28.78	2-009-3-18	57.8
191-1-4		7018-5-3	23.0	7148-9B-3	57.9	7425-7-6	56.25	3-007-1-3	74.1
191-2-3	88.04	7018-5-6	28.8	7148-9B-6	24.7	7425-7-9	100.00	3-007-1-6	24.5
191-3-3	60.00	9018-5-9	53.3	9148-9B-9	10.6	7425-8-3	59.67	3-007-1-9	4.3
191-4-3	62.59	7018-5-11	89.3	7148-9B-11	36.7	7425-8-6	46.51	3-007-1-12	8.9
191-4-6	39.07	7018-6-3	29.4	7420-11A-3	47.0	7425-8-9	29.62	3-007-1-13	63.7
191-4-7	38.21	7018-6-5	29.0	7420-11A-6	37.2	7425-9-3	CLAY	3-007-2-3	6.1
191-5-3	24.73	7018-7-3	64.3	7420-12B-3	60.6				
191-5-6	67.71	7018-8-3	37.8	7420-12B-6	24.5				
7180-1-3	19.71	7018-8-6	39.9	7420-12B-9	44.2				
7180-1-4	86.16	7018-9-3	81.8	7420-13C-3	37.6				
7180-2-3	91.93	7018-10-3	60.7	7420-13C-6	17.7				
7180-3-3	21.91	7018-1D-3	47.2	7420-13C-9	24.1				
7180-3-6	18.79	7018-1D-6	16.7	7420-13C-11	44.8				
7180-3-9	4.23	7018-1D-8	51.5	7146-14A-3	36.2				
7180-4-2	97.88	7018-2A-3	39.4	7146-14A-6	68.9				

TABLE C-1
ASH CONTENT DATA, SUSITNA VALLEY
(Continued)

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
7180-4-2	97.88	7018-2A-3	39.4	7146-14A-6	68.9				
7180-5-3	15.05	7018-2A-6	31.6	7425-1-3	93.6				
7180-5-6	13.72	7018-2A-7	90.0	7425-2-3	32.86				
7180-5-8	91.38	7016-3B-3	52.8	7425-2-6	36.12				
7180-6-3	27.59	7016-3B-6	32.3	7425-2-8	78.57				
7180-6-6	86.24	7016-4A-3	46.5	7425-3-3	23.53				
7180-7-3	59.69	7016-4A-6	40.8	7425-3-6	29.12				
7180-7-4	99.16	7014-5A-3	48.6	7425-3-7	82.25				
7180-8-3	50.00	7014-5A-6	43.5	7425-4-3	55.60				
7180-8-4	98.23	7176-6B-3	42.5	7425-4-6	65.82				
7018-1-3	32.1	7176-6B-6	46.7	7425-5-3	35.06				
7018-1-6	65.0	7176-6B-9	27.6	7425-5-6	58.40				
7018-2-3	29.5	7176-6B-11	63.3	7425-5-9	100.00				
7018-2-6	85.8	7176-7A-3	42.3	7425-5-12	71.85				
7016-3-3	22.6	7176-7A-6	30.5	7425-6-3	30.27				
7015-3-5	81.3			7425-6-6	36.50				

TABLE C-1A
ASH/DEPTH DISTRIBUTION SUSITNA VALLEY

DEPTH (ft)	053-1	053-2	053-3	053-4	053-5	053-6	053-7	053-8	053-9	053-10	053-11	053-12	053A1	053A2	053A3	053B1	053B2	053B3	053B4	053B5	053B6	053B7	053C1	053C2	053C3	053C4	053C5	053C6	053C7	053C8	053C9
1	26.5	20.6		62.5	23.5	55.1							23.1	13.3	18.9	21.7		19.1	8.7	31.4	24.6	20.6	25.0		26.7	11.1	36.0	40.0	16.5	18.8	9.3
3	22.2		25.0	91.7	38.6		20.7	30.8	37.2		39.1	73.0	12.5	16.5	23.7	20.0	18.0	18.8	38.6	16.7	24.3	45.5	31.7	18.3	25.6	27.7	41.2	26.5	39.6	13.3	25.0
4						89.3				96.0						95.0							41.3								
5		34.1	75.7		80.4				26.7				53.1			62.0		87.9	31.6						77.7						
6							85.5				19.4			18.8			80.5			80.3	40.0	16.7		29.0		51.8	68.5	43.6	73.0	48.6	41.2
7									45.3				17.3				89.4	33.7													
8		55.9									57.6													78.6				69.5			22.7
9													73.9	7.5	59.5				37.1	27.9	63.3	56.3				78.6	79.6		71.5		
10									92.3				77.1		45.4			98.2												42.0	
11																				20.8		97.9									
12														27.9															45.3		
13																															
14																															
15														34.0																	
16																															
17														99.1																	

*Note: This is sample number 053A-1-12 in accordance with the previously described numbering convention.

TABLE C-1A
ASH/DEPTH DISTRIBUTION SUSITNA VALLEY
(Continued)

DEPTH (ft)	053D1	053D2	053D3	053D4	053D5	053D6	053D7	053D8	053D9	053D10	053D11	053D12	053D13	053D14	053D15	053D16	053D17	053D18	053D19	053E1	053E2	053E3	053E4	053E5	053E6	051B12	051B13	051B14	051B15	051B16	051B17
1	15.7	27.2	14.3	14.4	16.0	27.4	11.5	22.7	18.2	19.5	21.1	73.3	14.4	12.3	13.4	19.4	17.4	17.3	19.4	88.9	18.1	27.9	42.2	24.3	20.6	25.0	36.5	29.2	10.5	24.0	46.0
3	27.2	29.1	29.6	34.7	23.3	52.8	33.3	56.1	24.1	15.7	34.6	88.6	17.0	12.5	27.8	61.1	27.5	15.2	19.2	83.9	20.9	78.7	71.3	15.4	16.9	44.3	52.1	26.1	23.4		27.7
4										38.5		98.3																			
5																					21.3										
6	18.3	72.6	72.7		36.9	37.3	89.4	58.6	46.0		35.3		57.4	13.5	48.5	51.4	22.1	33.5	71.3			27.5	41.0	77.8	24.8	63.4	14.6	55.8	21.4	54.8	24.7
7				29.8																											
8		81.7																	73.0							61.7		86.1			45.3
9	82.1		50.4		45.5	58.3					63.5		39.2	56.7	29.1		50.7	29.3				41.0		30.2	20.5	39.0	25.3		20.9		
10	44.2				70.8			49.6							22.1																
11																											82.8		55.8		
12													33.3	21.3	55.6									46.8	21.7						
13																									91.2						
14																															
15														81.0										88.9							
16																															
17																															
18																															
19																															
20																															
21																															
22																															

TABLE C-1A
ASH/DEPTH DISTRIBUTION SUSITNA VALLEY
(Continued)

DEPTH (ft)	057-4	057-5	057-6	057-7	057-8	057-9	057-10	057-11	057-12	057-13	057-14	057-15	057-16	057-17	057-18	057-19	057-20	057-21	057-22	057-23	057-24	057-25	057-26	057-27	057-28	057-29
1	35.6	40.0	28.9		13.7	?	?	?	?	25.2	12.8	30.5	30.0	29.4	21.6	42.9	22.4	31.3	22.9	5.6	29.1	33.6	17.3	35.7	79.4	48.2
3	44.9	46.3	14.8		18.7	?	?	?	?	50.0	35.2	57.5	15.9	26.8	24.1	49.5	41.0	61.9	12.5	28.0	69.0	63.6	60.0	38.3	44.8	52.1
4						?																				
5				20.0																						
6	96.6	36.6	28.3	28.8	74.2	?	?	?	?	80.6	31.4	65.0	23.7	40.7	29.0	71.3	71.0	27.6	36.3	39.0	38.3	85.5	34.0	34.5	19.3	
7			41.1																		60.7					32.8
8				95.0					?															31.0		
9		40.0			35.8					78.5	54.9	37.3	64.5	34.3	44.9			29.0	57.3	12.1			44.0		12.2	
10		91.7									32.1		25.3	36.5	67.1			80.6	81.9							
11					?																		68.3			
12												93.7								47.6					57.1	
13																										
14																				66.3						
15																										
16																										
17																										
18																										
19																										
20																										
21																										
22																										

TABLE C-1A
ASH/DEPTH DISTRIBUTION SUSITNA VALLEY
(Continued)

DEPTH (ft)	159-1	159-2	159-3	159-4	159-5	159-6	159-7	177-1	177-2	177-3	177-4	177-5	177-6	177-7	177-8	177-9
1	19.7	15.9	14.3	19.0	?	12.3	15.1									
3	38.8	40.6	26.4	27.6	25.6	23.3	7.0	?	?	?	?	?	?	?	?	?
4																
5																
6	75.4	29.0	56.4	75.7	59.9	58.8	76.8	?		?	?	?	?	?	?	?
7																
8								?								
9	53.2	8.8	9.5		20.5	41.4	21.8			?	?	?		?	?	
10																
11					?											
12	76.3	17.6	63.5			19.0	11.7								?	
13																
14																
15		99.0				60.9	9.5									
16																
17																
18						91.7	26.1									
19																
20																
21						100.0										
22																

DEPTH (ft)	177-10	177-11	177-12	177-13	177-14	177-15	177-16	177-17	177-18	177-19	177-21	177-22	177-23	177-24	177-25	177-26
1																
3	39.1	?	?	?	?	?	?	?	17.9	24.3	35.2	45.0	21.3	43.4	69.3	35.1
4																
5					?											
6	41.8	?	?	?	?	?	?	?	85.9	58.7	18.0	17.6	29.3	25.7	86.5	97.4
7																
8						?	?									
9	25.7		?	?		?		68.8	54.9	5.7		58.5	10.1	79.3		
10																
11		?												50.3		
12	71.0					?				26.8			52.0			
13																
14										82.0						
15																
16																
17																
18																
19																
20																
21																
22																

TABLE C-1A
ASH/DEPTH DISTRIBUTION SUSITNA VALLEY
(Continued)

DEPTH (ft)	177-27	177-28	177-29	177-30	177-31	177-32	177-33	191-1	191-2	191-3	191-4	191-5	193A	193B	193C
2															
3	34.4	51.6	59.1	21.4	71.9	74.5	61.6		88.0	60.0	62.6	24.7	?	?	?
4								?							
5															
6	39.3	13.9	64.9	40.8	14.3	63.2	68.5				39.1	67.7			
7											38.2				
8															
9	14.5	26.7		35.1		87.3									
10															
11				61.0											
12	77.7														
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															

DEPTH (ft)	232A	232B	232C	2425-1	2425-2	2425-3	2425-4	2425-5	2425-6	2425-7	2425-8	2425-9	[illegible]
2													
3	?	?	?	93.6	32.9	23.5	55.6	35.1	80.3	26.4	59.2	100.0	?
4													
5													
6					36.3	29.1	65.8	56.4	36.5	56.3	46.5		
7						82.3							
8					74.6								
9								106.0	41.8	130.0	29.6		
10													?
11													
12								71.9					
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													

TABLE C-1A
ASH/DEPTH DISTRIBUTION SUSITNA VALLEY
(Continued)

DEPTH (ft)	7180-1	7180-2	7180-3	7180-4	7180-5	7180-6	7180-7	7180-8	7018-1	7018-2	7018-3	7018-4	7018-5	7018-6	7018-7	7018-8
2																
3	19.7	91.9	21.9	97.9	15.1	27.6	59.7	50.0	37.1	29.5	22.6	57.5	23.0	29.4	64.3	37.8
4	86.2						99.2	98.2				38.3				
5											81.3			29.0		
6			18.4		13.7	86.2			65.0	85.8			26.8			39.9
7																
8					91.4											
9			4.2										51.3			
10																
11													89.3			
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																

DEPTH (ft)	7018-9	7018-10	7018-1D	7018-2A	7026-1B	7016-4A	7016-5A	7176-6B	7176-7A	7178-8A	7148-5B	7420-11A	7220-12B	7420-13C	7146-14A
2															
3	81.8	60.7	47.2	39.4	52.8	46.5	46.6	42.5	42.3	37.7	57.9	67.0	60.6	37.6	36.2
4															
5										39.7					
6			16.7	31.6	32.3	40.8	47.5	46.7	30.5		24.7	17.2	24.5	17.7	68.9
7				90.3											
8			51.5												
9								77.6			10.6		44.2	20.1	
10															
11								63.3			36.7			44.8	
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															

TABLE C-2

Ash content data, Dillingham*

Sample	%Ash
CP 1-3	48.5
CP 1-6	3.7
CP 1-8	38.7
11.5m 1-3	24.3
11.5m 1-6	36.8
11.5m 2-3	9.5
11.5m 2-6	41.9
13.5m 1-3	72.6
13.5m 1-6	71.2
13.5m 1-9	85.1
13.5m 2-3	58.3
13.5m 2-6	51.2
13.5m 2-7	65.0
2-009 1 (3)	65.3
2-009 2 (3)	38.8
2-009 2-6	44.6
2-009 2-9	28.4
2-009 2-12	24.2
2-009 2-15	52.7
2-009 2-8 Clay	95.8
2-009 3-3	36.5
2-009 3-6	51.4
2-009	55.6
2-009 3-12	36.1
2-009 3-15 Clay	88.4

*See AOF-151

TABLE C-2

Ash content data, Dillingham

Sample	%Ash
(Continued)	
2-009 4-3	20.0
2-009 4-6	19.9
2-009 4-9	28.0
2-009 4-12	30.0
2-009 4-15	22.1
2-009 4-18+	61.6
2-009 5-3	9.5
2-009 5-6	20.4
2-009 5-9	30.8
2-009 5-12	12.4
2-009 5-15	62.3
2-009 5-18	57.8
3-007 1-3	74.1
3-007 1-6	24.5
3-007 1-9	4.3
3-009 1-12	8.9
3-009 1-15	63.7
3-007 2-3	6.1
3-007 2-6	5.0
3-007 2-9	7.3
3-007 2-12	9.3
3-007 3-3	13.2
3-007 3-6	89.7
3-007 4-3	24.6
3-007 4-6	12.4

TABLE C-2

Ash content data, Dillingham

Sample	%Ash
(Continued)	
3-007 4-9	10.6
3-007 4-12	34.9
3-007 4-15	18.2
3-007 4-18	44.0
3-007 4-21	44.3
3-007 4-24+	9.8
3-007 5-3	8.5
3-007 5-6	5.1
3-007 5-9	11.2
3-007 5-12	37.6
3-007 5-15	15.7
3-007 5-18	25.4
3-007 5-21	88.0
3-007 6-3	19.2
3-007 6-6	16.2
3-007 6-9	70.9
3-009 6-12	92.5
7018 1-3	32.1
7018 1-6	65.0
7018 2-3	29.5
7018 2-6	85.8
7018 3-3	22.6
7018 3-5	81.3
7018 4-3	57.5
7018 4-4	38.3

TABLE C-2

Ash content data, Dillingham

Sample	%Ash
(Continued)	
7018 5-3	23.0
7018 5-6	28.8
7018 5-9	53.3
7018 5-11	89.3
7018 6-3	29.4
7018 6-5	29.0
7018 7-3	64.3
7018 8-3	37.8
7018 8-6	39.9
7018 9-3	81.8
7018 10-3	60.7

TABLE C-3

Comparison Samples, Davis/McCauley

A1 - DAVIS

A2 - DAVIS

A3 - DAVIS

AM - McCAULEY

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
157A1-3	29.90	157A2-3	26.55	157A3-3	31.41	157AM-3	13.65
157A1-6	41.95	157A2-3	24.02	157A3-6	49.36	157AM-5	33.05
157A1-9	13.79	157A2-9	23.15	157A3-9	26.03		
157A1-12	21.96	157A2-12	35.87	157A3-12	18.78		
157A1-13	31.33	157A2-13	18.61	157A3-13	31.02		
157B1-3	20.39	157B2-3	21.01	157B3-3	23.53	157BM-3	21.48
157B1-6	79.98	157B2-6	33.07	157B3-6	83.32	157BM-5	18.04
157B1-9	63.89	157B2-9	52.29	157B3-9	29.77		
157B1-10	46.34	157B2-10	44.76	157B3-10			
157C1-3	60.90	157C2-3	74.65	157C3-3	50.37	157CM-3	39.32
157C1-6	54.09	157C2-6	50.94	157C3-6	71.94	157CM-4	77.72
157D1-3	51.35	157D2-3	25.45	157D3-3	64.96	157DM-3	13.95
157D1-6	78.42	157D2-6	37.14	157D3-6	55.26	157DM-6	
157D1-10	53.33	157D2-10	73.33	157D3-10	51.92	157DM-9	37.63
157E1-3	35.84	157E2-3	34.24	157E3-3	35.29	157EM-3	24.18
157E1-6	41.27	157E2-6	29.30	157E3-6	34.68	157EM-6	32.2
157E1-9	42.72	157E2-9	40.00	157E3-9	50.00		
157F1-3	19.23	157F2-3	31.94	157F3-3	17.86	157FM-3	18.57
157F1-6	70.23	157F2-6	54.83	157F3-6	39.41	157FM-6	11.45
157F1-9	17.65	157F2-9	15.91	157F3-9	26.15		
157F1-12	38.80	157F2-12	19.18	157F3-12	31.88		
157F1-14	77.14	157F2-14	97.93	157F3-14	95.88		
157G1-3	24.59	157G2-3	24.62	157G3-3	26.10	157GM-3	15.54
157G1-6	23.93	157G2-6	23.34	157G3-6	43.00	157GM-6	25.00

TABLE C-3
Comparison Samples, Davis/McCauley
(Continued)

A1 - DAVIS
A2 - DAVIS
A3 - DAVIS
AM - McCAULEY

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
157G1-9	24.00	157G2-9	21.13	157G3-9	59.79		
157H1-3	38.02	157H2-3		157H3-3		157HM-3	43.48
157H1-6	42.37	157H2-6	25.22	157H3-6	52.35	157HM-5	38.89
157H1-9	33.64	157H2-9	41.38	157H3-9	62.35		
157X1-3	73.49	157X2-3	23.77	157X3-3	24.35	157XM-3	19.37
157X1-4	63.69	157X2-3	74.42	157X3-4	80.20	157XM-4	32.53
157X1-5	31.78	157X2-5	63.72	157X3-5	70.87	157XM-5	59.61
157X1-6	19.03	157X2-6	25.63	157X3-6	31.09	157XM-6	50.14
157X1-7	10.00	157X2-7	11.00	157X3-7	10.20		
157X1-8	14.81	157X2-8	9.43	157X3-8	22.92		
157X1-9	17.19	157X2-9	6.90	157X3-9	12.19		
157X1-10	9.52	157X2-10	33.33	157X3-10	13.51		
157X1-11	40.68	157X2-11	35.84	157X3-11	26.83		
157X1-12	85.55	157X1-12	88.67	157X3-12	93.26		
157Y1-3	65.24	157Y2-3	50.60	157Y3-3	60.20	157YM-3	62.93
157Y1-4	32.32	157Y2-4	69.93	157Y3-4		157YM-4	44.44
157Y1-5	13.11	157Y2-5	25.30	157Y3-5	19.05	157YM-5	53.57
157Y1-6	16.36	157Y2-6	17.57	157Y3-6	38.67	157YM-6	31.94
157Y1-7	15.15	157Y2-7	15.78	157Y3-7	10.86		
157Y1-8	13.43	157Y2-8	14.55	157Y3-8	15.20		
157Y1-9	28.05	157Y2-9	22.86	157Y3-9	71.73		
157Z1-3	15.94	157Z2-3	14.71	157Z3-3	16.88	157ZM-3	30.51
157Z1-4	90.21	157Z2-4	76.66	157Z3-4	52.67	157ZM-4	30.63
157Z1-5	24.21	157Z2-5	82.88	157Z3-5	34.74	157ZM-5	81.96
157Z1-6	16.27	157Z2-6	17.56	157Z3-6	23.53	157ZM-6	43.00

TABLE C-3

Comparison Samples, Davis/McCauley

A1 - DAVIS

A2 - DAVIS

A3 - DAVIS

AM - McCAULEY

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
157A1-3	29.90	157A2-3	26.55	157A3-3	31.41	157AM-3	13.65
157A1-6	41.95	157A2-3	24.02	157A3-6	49.36	157AM-5	33.05
157A1-9	13.79	157A2-9	23.15	157A3-9	26.03		
157A1-12	21.96	157A2-12	35.87	157A3-12	18.78		
157A1-13	31.33	157A2-13	18.61	157A3-13	31.02		
157B1-3	20.39	157B2-3	21.01	157B3-3	23.53	157BM-3	21.48
157B1-6	79.98	157B2-6	33.07	157B3-6	83.32	157BM-5	18.04
157B1-9	63.89	157B2-9	52.29	157B3-9	29.77		
157B1-10	46.34	157B2-10	44.76	157B3-10			
157C1-3	60.90	157C2-3	74.65	157C3-3	50.37	157CM-3	39.32
157C1-6	54.09	157C2-6	50.94	157C3-6	71.94	157CM-4	77.72
157D1-3	51.35	157D2-3	25.45	157D3-3	64.96	157DM-3	13.95
157D1-6	78.42	157D2-6	37.14	157D3-6	55.26	157DM-6	
157D1-10	53.33	157D2-10	73.33	157D3-10	51.92	157DM-9	37.63
157E1-3	35.84	157E2-3	34.24	157E3-3	35.29	157EM-3	24.18
157E1-6	41.27	157E2-6	29.30	157E3-6	34.68	157EM-6	32.2
157E1-9	42.72	157E2-9	40.00	157E3-9	50.00		
157F1-3	19.23	157F2-3	31.94	157F3-3	17.86	157FM-3	18.57
157F1-6	70.23	157F2-6	54.83	157F3-6	39.41	157FM-6	11.45
157F1-9	17.65	157F2-9	15.91	157F3-9	26.15		
157F1-12	38.80	157F2-12	19.18	157F3-12	31.88		
157F1-14	77.14	157F2-14	97.93	157F3-14	95.88		
157G1-3	24.59	157G2-3	24.62	157G3-3	26.10	157GM-3	15.54
157G1-6	23.93	157G2-6	23.34	157G3-6	43.00	157GM-6	25.00

TABLE C-3

Comparison Samples, Davis/McCauley

(Continued)

A1 - DAVIS

A2 - DAVIS

A3 - DAVIS

AM - McCAULEY

SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH	SAMPLE	% ASH
157Z1-7	12.94	157Z2-7	49.15	157Z3-7	16.66		
157Z1-8	17.43	157Z2-8	24.21	157Z3-8	20.58		
157Z1-9	23.53	157Z2-9	34.25	157Z3-9	25.53		

TABLE C-4

Comparison Samples, Old/New Davis

SAMPLE	% ASH	SAMPLE	% ASH
053CO2-3	48.2	053CN2-3	37.8
053CO2-6	54.5	053CN2-6	46.7
053CO2-8	52.5	053CN2-8	52.9
053CO3-3	52.7	053CN3-3	88.5
053DO1-1	11.8	053DN1-1	11.0
053DO1-3	13.3	053DN1-3	14.7
053DO1-6	32.7	053DN1-6	45.9
053DO1-9	25.6	053DN1-9	19.7
053DO2-3	26.1	053DN2-3	57.7
053DO2-6	75.1	053DN2-6	72.3
053DO3-3	24.8	053DN3-3	37.5
053DO3-6	30.0	053DN3-6	13.5
053DO4-1	11.6	053DN4-1	10.9
053DO7-1	12.7	053DN7-1	12.6
053DO7-6	78.1	053DN7-6	88.4
053DO8-10	49.1	053DN8-10	78.5
053BO3-1	14.7	053BN3-1	16.3
053BO3-3	33.0	053BN3-3	18.6
053BO3-5	25.7	053BN3-5	32.1
053BO4-1	12.2	053BN4-1	13.5
053BO5-11	30.0	053BN5-11	56.7
053BO6-6	47.9	053BN6-6	16.8
053BO6-9	32.1	053BN6-9	37.2
051BO12-6	11.4	051BN12-6	15.5
051BO13-3	87.0	051BN13-3	69.2
051BO14-6	15.2	051BN14-6	21.6
051BO15-1	15.8	051BN15-1	14.9
051BO15-11	23.9	051BN15-11	54.2

TABLE C-5

Laboratory Comparison Data

(Note: BB-M1 is identical to BB-RL1 and
BB-MZ is identical to BB-RL2, etc.)

Laboratory 1 Analysis		Laboratory 2 Analysis	
SAMPLE	% ASH	SAMPLE	% ASH
BB-M1	28.34	BB-RL1	27.7
BB-M2	26.89	BB-RL2	27.2
BB-M3	28.57	BB-RL3	30.6
BB-M4	26.15	BB-RL4	26.4
BB-M5	27.45	BB-RL5	27.1
BB-M6	27.47	BB-RL6	26.9
BB-M7	26.71	BB-RL7	27.3
BB-M8	26.54	BB-RL8	27.4
BB-M9	27.64	BB-RL9	27.2
BB-M10	27.38	BB-RL10	26.1

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES

Sample Number	Basis*	Moisture %	Volatile Matter, %	Fixed Carbon, %	Ash %	Heating Value Btu/lb.	C, %	H, %	N, %	O, %	Total Sulfur
051B12 (3)	1	86.14	8.05	3.02	2.79	1105	6.32	10.36	0.21	80.29	0.03
	2	--	58.07	21.79	20.14	7970	45.59	5.18	1.51	27.35	0.23
	3	--	72.71	27.29	--	9979	57.08	6.48	1.90	34.26	0.28
051B13 (6)	1	78.13	8.30	3.30	10.27	1195	6.84	9.53	0.30	73.01	0.05
	2	--	37.94	15.09	46.97	5419	31.29	3.60	1.37	16.54	0.23
	3	--	71.54	28.46	--	10218	59.01	6.79	2.59	31.17	0.44
051B14 (3)	1	66.69	6.86	3.21	23.24	821	4.97	8.12	0.29	63.32	0.06
	2	--	20.60	9.62	69.78	2466	14.92	1.98	0.88	12.26	0.18
	3	--	68.14	31.86	--	8159	49.37	6.54	2.89	40.60	0.60
051B15 (3)	1	83.47	9.27	3.85	3.41	1314	7.48	10.17	0.39	78.49	0.06
	2	--	56.08	23.32	20.60	7952	45.25	5.03	2.35	26.42	0.35
	3	--	70.64	29.36	--	10015	57.00	6.34	2.95	33.27	0.44
051B15 (6)	1	79.11	9.32	3.76	7.81	1314	7.60	9.71	0.35	74.46	0.07
	2	--	44.61	18.02	37.37	6288	36.39	4.12	1.68	20.12	0.32
	3	--	71.23	28.77	--	10041	58.10	6.58	2.69	32.13	0.50
051B15 (9)	1	85.00	8.56	3.75	2.69	1253	7.10	10.29	0.23	79.64	0.05
	2	--	57.04	25.00	17.96	8354	47.34	5.21	1.52	27.65	0.32
	3	--	69.52	30.48	--	10182	57.70	6.35	1.84	33.72	0.39
051B17 (3)	1	62.48	7.49	2.08	27.95	867	5.16	7.71	0.29	58.55	0.34
	2	--	19.96	5.53	74.51	2311	13.75	1.91	0.77	8.16	0.90
	3	--	78.27	21.73	--	9066	53.94	7.49	3.04	32.01	3.52

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter, %	Fixed Carbon, %	Ash %	Heating Value Btu/lb.	C, %	H, %	N, %	O, %	Total Sulfur
051B17 (8)	1	67.08	8.03	1.87	23.02	938	5.65	8.22	0.29	62.53	0.29
	2	--	24.38	5.69	69.93	2851	17.15	2.18	0.88	8.97	0.89
	3	--	81.07	18.93	--	9480	57.05	7.24	2.93	29.81	2.97
053A2 (6)	1	84.77	5.57	2.24	7.42	734	4.07	10.00	0.17	78.30	0.04
	2	--	36.57	14.72	48.71	4822	26.72	3.39	1.12	19.82	0.23
	3	--	71.30	28.70	--	9403	38.48	6.62	1.61	38.65	0.34
053A3 (5)	1	75.72	7.08	2.68	14.52	943	5.14	9.14	0.21	70.94	0.05
	2	--	29.18	11.02	59.80	3886	21.18	2.75	0.86	15.19	0.22
	3	--	72.58	27.42	--	9665	52.70	6.84	2.14	37.77	0.55
053B3 (3)	1	85.42	7.70	3.15	3.73	1077	5.69	10.24	0.22	80.09	0.03
	2	--	52.78	21.66	25.56	7384	39.00	4.66	1.50	29.07	0.21
	3	--	70.90	29.10	--	9920	52.39	6.26	2.02	39.05	0.28
053B5 (3)	1	89.50	6.35	2.44	1.71	857	5.00	10.57	0.14	82.56	0.02
	2	--	60.46	23.29	16.25	8159	47.60	5.31	1.31	29.34	0.19
	3	--	72.20	27.80	--	9742	56.84	6.34	1.57	35.02	0.23
053B5 (9)	1	83.66	8.54	3.24	4.56	1156	6.76	10.12	0.31	78.20	0.05
	2	--	52.28	19.83	27.89	7077	41.35	4.64	1.87	23.95	0.32
	3	--	72.51	27.49	--	9814	57.34	6.43	2.60	33.19	0.44
053B6 (3)	1	89.24	6.08	2.02	2.66	785	4.70	10.51	0.22	81.88	0.03
	2	--	55.83	19.48	24.69	7297	43.70	4.84	2.04	24.46	0.27
	3	--	74.14	25.86	--	9689	58.03	6.43	2.71	32.47	0.36

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter, %	Fixed Carbon, %	Ash %	Heating Value Btu/lb.	C, %	H, %	N, %	O, %	Total Sulfur
053B6 (6)	1	81.02	7.52	2.53	8.93	981	5.52	9.74	0.33	75.43	0.05
	2	--	36.65	16.29	47.06	5171	29.07	3.54	1.73	18.32	0.28
	3	--	74.89	25.11	--	9768	54.92	6.69	3.26	34.59	0.54
053B7 (6)	1	85.02	7.43	2.73	4.82	988	5.73	10.16	0.35	78.89	0.05
	2	--	49.59	18.27	32.14	6599	38.25	4.35	2.34	22.60	0.32
	3	--	73.08	26.92	--	9725	56.37	6.41	3.44	33.31	0.47
053D4 (3)	1	75.67	9.13	2.74	12.46	1135	6.55	9.31	0.39	71.23	0.06
	2	--	37.54	11.25	51.21	4667	26.92	3.46	1.58	16.59	0.24
	3	--	76.93	23.07	--	9564	55.18	7.09	3.25	33.98	0.50
053D4 (7)	1	70.36	10.95	3.79	14.90	1564	8.63	9.42	0.47	66.47	0.11
	2	--	36.96	12.77	50.27	5276	29.11	3.55	1.58	15.13	0.36
	3	--	74.31	25.69	--	10608	58.53	7.13	3.19	30.42	0.73
053D5 (6)	1	71.19	6.03	1.82	20.96	694	4.16	8.54	0.23	66.00	0.11
	2	--	20.94	6.32	72.74	2408	14.42	1.98	0.81	9.66	0.39
	3	--	76.81	23.19	--	8833	52.91	7.26	2.97	35.42	1.44
053D5 (9)	1	86.36	7.86	3.30	2.48	1114	6.42	10.38	0.30	80.37	0.06
	2	--	57.59	24.25	18.16	8169	47.04	5.25	2.22	26.91	0.42
	3	--	70.36	29.64	--	9981	57.48	6.41	2.71	32.89	0.51
053D6 (6)	1	75.36	9.51	2.43	12.70	1174	6.62	9.24	0.41	70.89	0.14
	2	--	38.60	9.86	51.54	4764	26.88	3.29	1.65	16.08	0.56
	3	--	79.64	20.36	--	9831	55.47	6.79	3.40	33.18	1.16

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter,%	Fixed Carbon,%	Ash %	Heating Value Btu/lb.	C,%	H,%	N,%	O,%	Total Sulfur
053D7 (3)	1	86.42	8.35	2.85	2.38	1150	6.54	10.43	0.24	80.38	0.03
	2	--	61.49	21.02	17.49	8470	48.15	5.62	1.81	26.71	0.22
	3	--	74.52	25.48	--	10266	58.36	6.81	2.19	32.37	0.27
053D17 (3)	1	80.63	6.96	2.59	9.82	964	5.47	9.74	0.22	74.72	0.03
	2	--	35.91	13.38	50.71	4978	28.24	3.72	1.12	16.05	0.16
	3	--	72.83	27.17	--	10096	57.28	7.55	2.27	32.57	0.33
053D17 (6)	1	78.98	6.84	2.78	11.40	979	5.67	9.50	0.21	73.18	0.04
	2	--	32.56	13.23	54.21	4658	36.96	3.17	1.02	14.45	0.19
	3	--	71.10	28.90	--	10174	58.87	6.91	2.24	31.56	0.42
11.5 (5)**	1	86.26	7.42	2.85	3.47	927	5.44	10.21	0.16	80.69	0.03
	2	--	54.03	20.70	25.27	6743	39.63	4.03	1.13	29.69	0.25
	3	--	72.30	27.70	--	9023	53.04	5.39	1.51	39.73	0.33
CP1 (6)**	1	85.02	6.92	2.64	5.42	908	5.27	10.15	0.19	78.91	0.06
	2	--	46.22	17.57	36.21	6064	35.19	4.28	1.28	22.65	0.39
	3	--	72.46	27.54	--	9507	55.18	6.70	2.01	35.50	0.61
157-6 (6)	1	80.68	9.03	3.75	6.54	1334	7.56	9.85	0.30	75.69	0.06
	2	--	46.74	19.43	33.83	6906	39.11	4.27	1.56	20.93	0.30
	3	--	70.63	29.37	--	10437	59.10	6.45	2.35	31.64	0.46
157-7 (6)	1	91.68	4.94	1.99	1.39	625	3.71	10.68	0.12	84.08	0.02
	2	--	59.39	23.91	16.70	7507	44.55	5.04	1.42	32.09	0.20
	3	--	71.30	28.70	--	9013	53.48	6.05	1.71	38.52	0.24

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

**Dillingham samples.

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter,%	Fixed Carbon,%	Ash %	Heating Value Btu/lb.	C,%	H,%	N,%	O,%	Total Sulfur
157-16 (3)	1	86.54	7.68	2.99	2.79	1028	6.00	10.34	0.17	80.68	0.02
	2	--	57.02	22.28	20.70	7641	44.59	4.88	1.28	28.37	0.18
	3	--	71.91	28.09	--	9636	56.22	6.15	1.63	35.78	0.22
157-16 (6)	1	72.65	9.29	3.11	14.95	1185	7.15	9.48	0.26	68.11	0.05
	2	--	33.98	11.35	54.67	4332	26.14	4.93	0.97	13.10	0.19
	3	--	74.97	25.03	--	9557	57.68	10.88	2.14	28.87	0.43
157-17 (3)	1	86.73	7.12	2.80	3.35	967	5.61	10.34	0.16	80.52	0.02
	2	--	53.66	21.10	25.24	7290	42.29	4.76	1.21	26.32	0.18
	3	--	71.78	28.22	--	9751	56.57	6.37	1.62	35.20	0.24
157-18 (3)	1	83.87	8.59	3.55	3.99	1371	7.01	10.17	0.25	78.55	0.03
	2	--	53.28	22.01	24.71	8500	43.45	4.84	1.55	25.24	0.21
	3	--	70.76	29.24	--	11290	57.71	6.42	2.05	33.54	0.28
157-18 (6)	1	81.65	8.25	3.38	6.72	1164	6.61	9.85	0.25	76.52	0.05
	2	--	44.98	18.39	36.63	6343	36.02	3.90	1.35	21.85	0.25
	3	--	70.98	29.02	--	10010	56.85	6.15	2.13	34.48	0.39
157-23 (3)	1	85.73	5.51	2.89	5.87	768	4.37	10.11	0.24	79.38	0.03
	2	--	38.64	20.19	41.17	5382	30.64	3.61	1.71	22.64	0.23
	3	--	65.67	34.33	--	9148	52.08	6.13	2.91	38.49	0.39
157-23 (6)	1	65.51	7.90	2.22	24.37	1020	4.14	8.02	0.32	64.48	0.08
	2	--	22.90	6.45	70.65	2958	12.01	1.99	0.93	14.18	0.24
	3	--	78.02	21.98	--	10078	40.92	6.78	3.17	48.31	0.82

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter,%	Fixed Carbon,%	Ash %	Heating Value Btu/lb.	C,%	H,%	N,%	O,%	Total Sulfur
157-23 (9)	1	75.45	6.97	2.04	15.54	853	4.92	9.11	0.24	70.09	0.10
	2	--	28.41	8.28	63.31	3474	20.03	2.73	0.97	12.55	0.41
	3	--	77.43	22.57	--	9469	54.61	7.43	2.65	34.19	1.12
193A (3)	1	77.47	9.01	6.33	7.19	1564	9.08	9.70	0.34	73.65	0.04
	2	--	39.98	28.12	31.90	6944	40.28	4.57	1.53	21.52	0.20
	3	--	58.72	41.28	--	10198	59.15	6.71	2.25	31.60	0.29
193B (3)	1	87.54	4.94	1.83	5.69	622	3.62	10.21	0.21	80.24	0.03
	2	--	39.65	14.70	45.65	4992	29.10	3.31	1.67	20.01	0.26
	3	--	72.95	27.05	--	9185	53.54	6.08	3.08	36.82	0.48
193C (3)	1	86.67	7.59	2.92	2.84	1126	5.80	10.34	0.21	80.76	0.05
	2	--	56.96	21.71	21.33	8445	43.54	4.82	1.55	28.42	0.34
	3	--	72.41	27.59	--	10735	55.34	6.13	1.98	36.12	0.43
13.5 (6)**	1	61.51	6.98	2.02	29.49	724	4.92	7.26	0.18	57.94	0.21
	2	--	18.12	5.26	76.62	1880	12.78	0.99	0.46	8.60	0.55
	3	--	77.53	22.47	--	8041	54.67	4.23	1.97	36.77	2.36
3-007 (6)	1	91.66	5.09	1.78	1.47	659	3.72	10.68	0.19	83.89	0.05
	2	--	61.07	21.31	17.62	7902	44.62	5.07	2.26	29.78	0.65
	3	--	74.13	25.87	--	9593	54.17	6.15	2.74	36.15	0.79
232A (3)	1	77.51	12.52	4.34	5.63	1652	9.42	9.74	0.40	74.77	0.04
	2	--	55.67	19.29	25.04	7346	41.88	4.76	1.77	26.38	0.17
	3	--	74.27	25.73	--	9799	55.86	6.35	2.36	35.21	0.22

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

**Dillingham sample.

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter, %	Fixed Carbon, %	Ash %	Heating Value Btu/lb.	C, %	H, %	N, %	O, %	Total Sulfur
232B (3)	1	87.85	6.74	2.32	3.09	880	5.07	10.39	0.27	81.14	0.04
	2	--	55.43	19.14	25.43	7242	41.75	4.63	2.23	25.62	0.34
	3	--	74.33	25.67	--	9712	55.99	6.20	2.99	34.36	0.46
232C (3)	1	81.56	9.61	3.22	5.61	1231	7.20	9.92	0.42	76.78	0.07
	2	--	52.13	17.43	30.44	6674	39.04	4.31	2.29	23.53	0.39
	3	--	74.95	25.05	--	9595	56.12	6.19	3.31	33.83	0.55
7176-7A (6)	1	80.28	9.30	3.34	7.08	1264	7.40	9.76	0.37	75.33	0.06
	2	--	47.16	16.93	35.91	6407	37.52	3.94	1.86	20.49	0.28
	3	--	73.59	26.41	--	9997	58.54	6.14	2.91	31.97	0.44
7176-6B (9)	1	80.09	8.09	2.99	8.83	1046	5.65	9.59	0.31	75.56	0.06
	2	--	40.64	15.02	44.34	5253	28.37	3.17	1.55	22.26	0.31
	3	--	73.01	26.99	--	9438	50.98	5.70	2.79	39.98	0.55
7148-9B (9)	1	73.15	9.15	2.89	14.81	1178	6.95	8.95	0.38	68.84	0.07
	2	--	34.06	10.76	55.18	4388	25.88	2.84	1.41	14.45	0.24
	3	--	76.00	24.00	--	9788	57.73	6.34	3.13	32.25	0.55
7148-9 (6)	1	80.48	8.69	2.81	8.02	1241	6.60	9.79	0.36	75.18	0.05
	2	--	44.52	14.38	41.10	6360	33.81	4.01	1.86	18.96	0.26
	3	--	75.58	24.42	--	10799	57.41	6.81	3.16	32.18	0.44
7420-12B (3)	1	79.25	6.38	2.17	12.20	908	5.17	9.47	0.28	72.85	0.03
	2	--	30.75	10.47	58.78	4378	24.93	2.90	1.34	11.89	0.16
	3	--	74.59	25.41	--	10620	60.49	7.04	3.24	28.83	0.40

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter,%	Fixed Carbon,%	Ash %	Heating Value Btu/lb.	C,%	H,%	N,%	O,%	Total Sulfur
7420-12B (6)	1	84.75	8.68	3.35	3.22	1244	7.38	10.28	0.31	78.78	0.03
	2	--	56.89	21.96	21.15	8158	48.42	5.25	2.05	22.90	0.23
	3	--	72.15	27.85	--	10346	61.41	6.66	2.59	29.05	0.29
7420-12B (9)	1	85.04	6.89	2.90	5.17	953	5.70	10.15	0.24	78.71	0.03
	2	--	46.05	19.40	34.55	6369	38.10	4.25	1.60	21.28	0.22
	3	--	70.37	29.63	--	9731	58.21	6.49	2.44	32.53	0.33
7420-13C (6)	1	82.47	8.14	3.20	6.19	1146	6.54	9.93	0.30	77.00	0.04
	2	--	46.45	18.21	35.34	6535	37.33	4.01	1.73	21.37	0.22
	3	--	71.84	28.16	--	10106	57.73	6.20	2.67	33.06	0.34
7420-13C (9)	1	90.98	5.13	1.95	1.94	759	4.26	10.66	0.21	82.91	0.02
	2	--	56.88	21.57	21.55	8411	47.27	5.27	2.35	23.31	0.25
	3	--	72.51	27.49	--	10722	60.26	6.72	2.99	29.71	0.32
7423A (3)	1	85.49	7.06	3.09	4.36	930	5.74	10.22	0.32	79.32	0.04
	2	--	48.65	21.28	30.07	6407	39.55	4.49	2.23	23.41	0.25
	3	--	69.56	30.44	--	9162	56.56	6.42	3.19	33.48	0.35
7423A (11)	1	87.81	6.39	2.73	3.07	862	4.92	10.37	0.27	81.33	0.04
	2	--	52.41	22.40	25.19	7070	40.35	4.47	2.21	27.46	0.32
	3	--	70.06	29.94	--	9415	53.94	5.98	2.96	36.69	0.43
7425A (3)	1	65.81	11.48	12.87	19.84	1477	8.18	8.40	0.45	63.05	0.08
	2	--	33.59	8.39	58.02	4321	23.94	3.03	1.30	13.49	0.22
	3	--	80.02	19.98	--	10294	57.03	7.21	3.12	32.11	0.53

*Basis: 1 As received
2 Moisture free
3 Moisture and ash free

TABLE C-6

PROXIMATE AND ULTIMATE ANALYSES OF PEAT SAMPLES (continued)

Sample Number	Basis*	Moisture %	Volatile Matter,%	Fixed Carbon,%	Ash %	Heating Value Btu/lb.	C,%	H,%	N,%	O,%	Total Sulfur
7425-3 (6)	1	85.36	7.06	2.81	4.77	915	5.59	10.17	0.14	79.31	0.02
	2	--	48.25	19.19	32.56	6248	38.17	4.22	0.99	23.89	0.17
	3	--	71.55	28.45	--	9265	56.59	6.25	1.48	35.43	0.25
7425-6 (3)	1	79.39	9.27	3.60	7.74	1235	6.91	9.67	0.45	75.17	0.06
	2	--	44.96	17.50	37.54	5994	33.54	3.80	2.17	22.68	0.27
	3	--	71.98	28.02	--	9597	53.69	6.08	3.46	36.34	0.43
7425-7 (3)	1	83.20	8.53	3.05	5.22	1098	6.58	10.06	0.30	77.80	0.04
	2	--	50.78	18.14	31.08	6538	39.19	4.45	1.79	23.25	0.24
	3	--	73.67	26.33	--	9486	56.86	6.46	2.60	33.74	0.34
7425-8 (9)	1	75.72	8.05	2.87	13.36	1030	5.96	9.19	0.26	71.19	0.04
	2	--	33.16	11.80	55.04	4240	24.56	2.94	1.09	16.19	0.18
	3	--	73.77	26.23	--	9433	54.64	6.53	2.43	35.99	0.41

APPENDIX D

Scanning Electron Microscope Study and
Petrographic Analyses of Ash

SCANNING ELECTRON MICROSCOPIC PETROGRAPHY OF TWO VOLCANIC ASH LAYERS IN THE TALKEETNA AREA

M. Albanese[1]

Abstract: The ash morphology of two volcanic ash samples from the Talkeetna area suggests two separate nonviscous magmatic eruptions. The source of these ash layers is probably volcanic activity from the North Aleutian Arc.

Ash Morphology and Eruption Type

Ash morphology, particularly the glassy fraction, can provide useful information concerning the nature of the volcanic eruption of the ash source. In general, there are three types of morphology that can be identified by scanning electron microscopy: viscous magmatic eruptions, nonviscous magmatic eruptions, and phreatomagmatic eruptions.

Viscous magmatic eruptions occur when silicic material is extruded, producing violent nuee ardante (fiery gas cloud) eruptions. The quickly cooled, glassy ash material produced by these types of eruptions is generally thin, fragile, curved or Y-shaped shards formed by the fracturing of masses of vesicular glass. The vesicles are caused by escaping gases as the material is quickly cooled, and the fragmented shards are produced by violent explosions of volatile gases associated with silicic eruptions (Heiken, 1972).

Nonviscous eruptions occur as quiet outpourings of basic lava. The glassy material associated with basic ashes is generally "spongy" masses of glass with numerous vesicles (Heiken, 1972).

[1] Division of Geological and Geophysical Surveys.

Phreatomagmatic eruptions occur when the rising magma column contacts the water table near the surface and explodes, forming a craterlike depression covered with volcanic lapilli. Blocky, pyramid-shaped volcanic fragments are characteristic of this type of eruption (Heiken, 1972).

The Talkeetna Ash #177

Samples of volcanic ash were collected from within a peat bog in the Talkeetna area during August, 1981. Two samples of this ash (both #177) were viewed with the scanning electron microscope. One sample was taken from 4 ft. below the surface and the other from 9 ft below the surface.

Under a polarized light microscope, these samples were found to contain predominantly feldspars with minor hornblende, augite, quartz, and glass fragments (see Petrographic Analysis of Volcanic Ash Layers, pg.D-9).

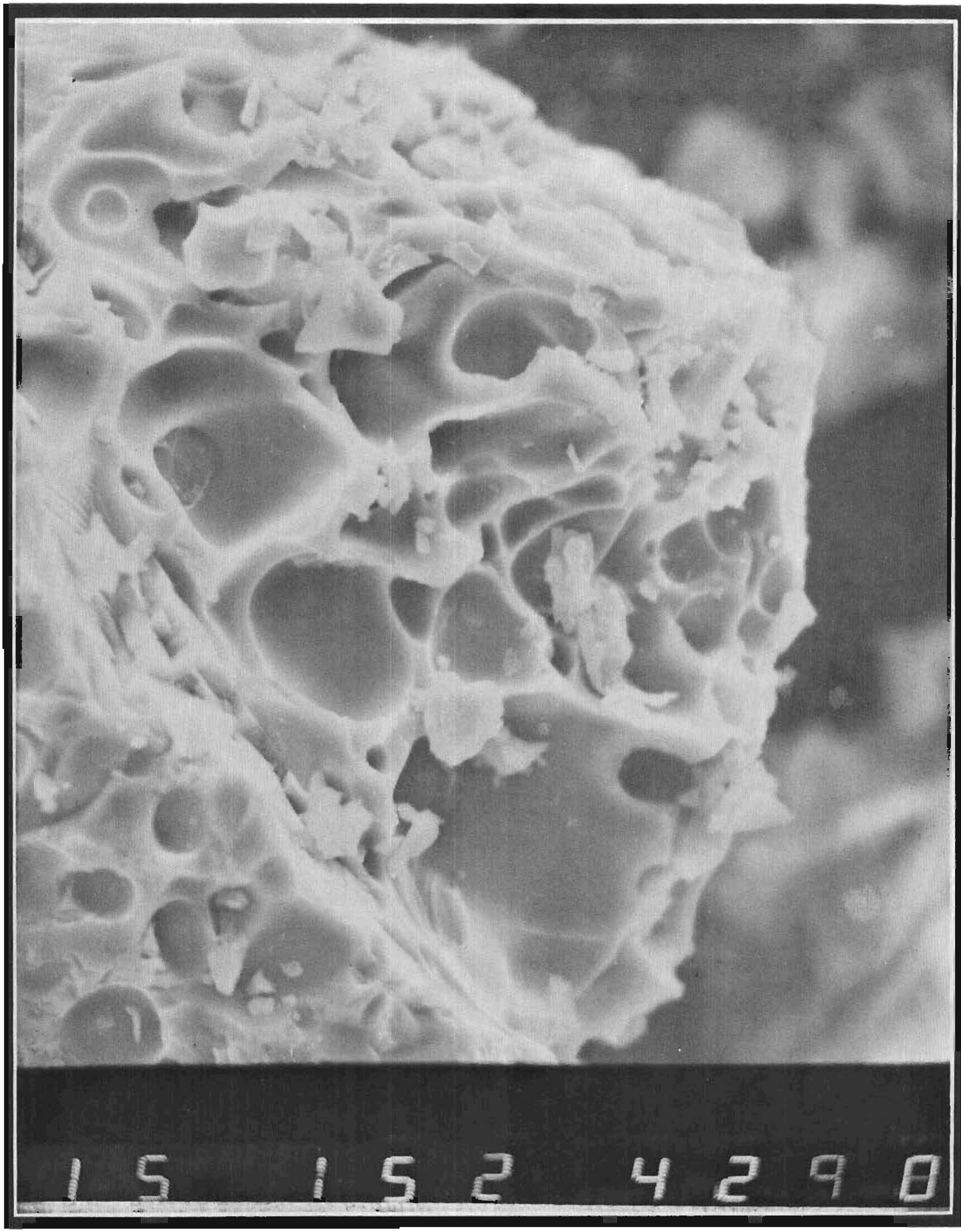
When viewed under the scanning electron microscope, the glass fraction of these samples revealed vesicular glassy particles about 50 microns in diameter. The ash sample taken from 4 ft. revealed a moderate density (25 percent) of glass particles with highly spherical vesicles (photos 4298, 4299). This morphology suggests a nonviscous magmatic eruption for this ash.

The ash sample taken from 9 ft. revealed a low density (less than 5 percent of glass particles with vesicles). The vesicles of these particles tend to be small and occasionally elongated rather than orbicular, suggesting a viscous magmatic eruption. Photos 4349 and 4350 typify the small and elongated vesicles of the ash taken from 9 ft.

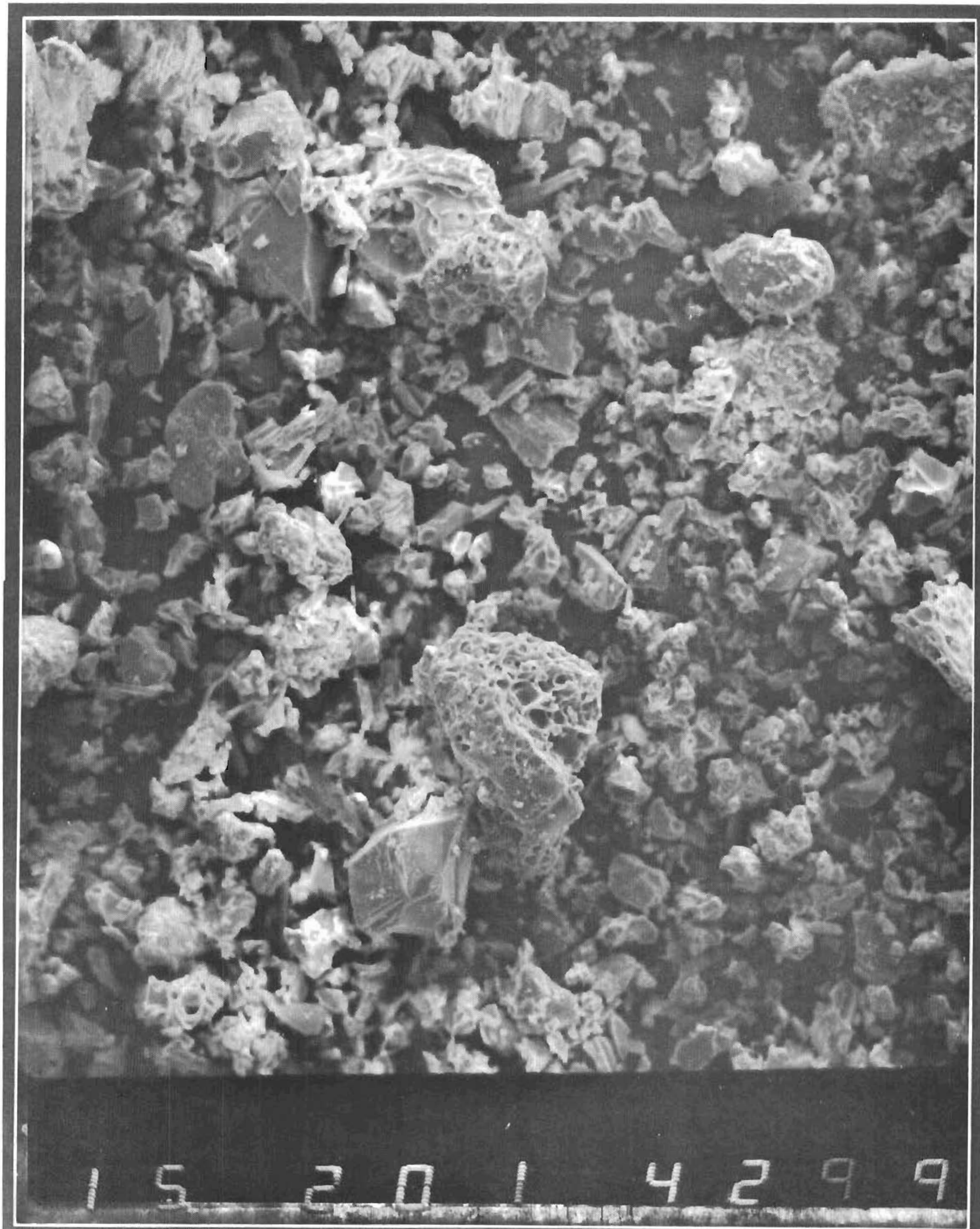
The source of these two ash layers is probably from eruptions in the northern Aleutian Arc; either Augustine, Iliamna, Redoubt, or Mt. Spurr. Ash samples of each eruptive event of these volcanoes are not presently available, and a definitive correlation or source cannot be determined.

Reference

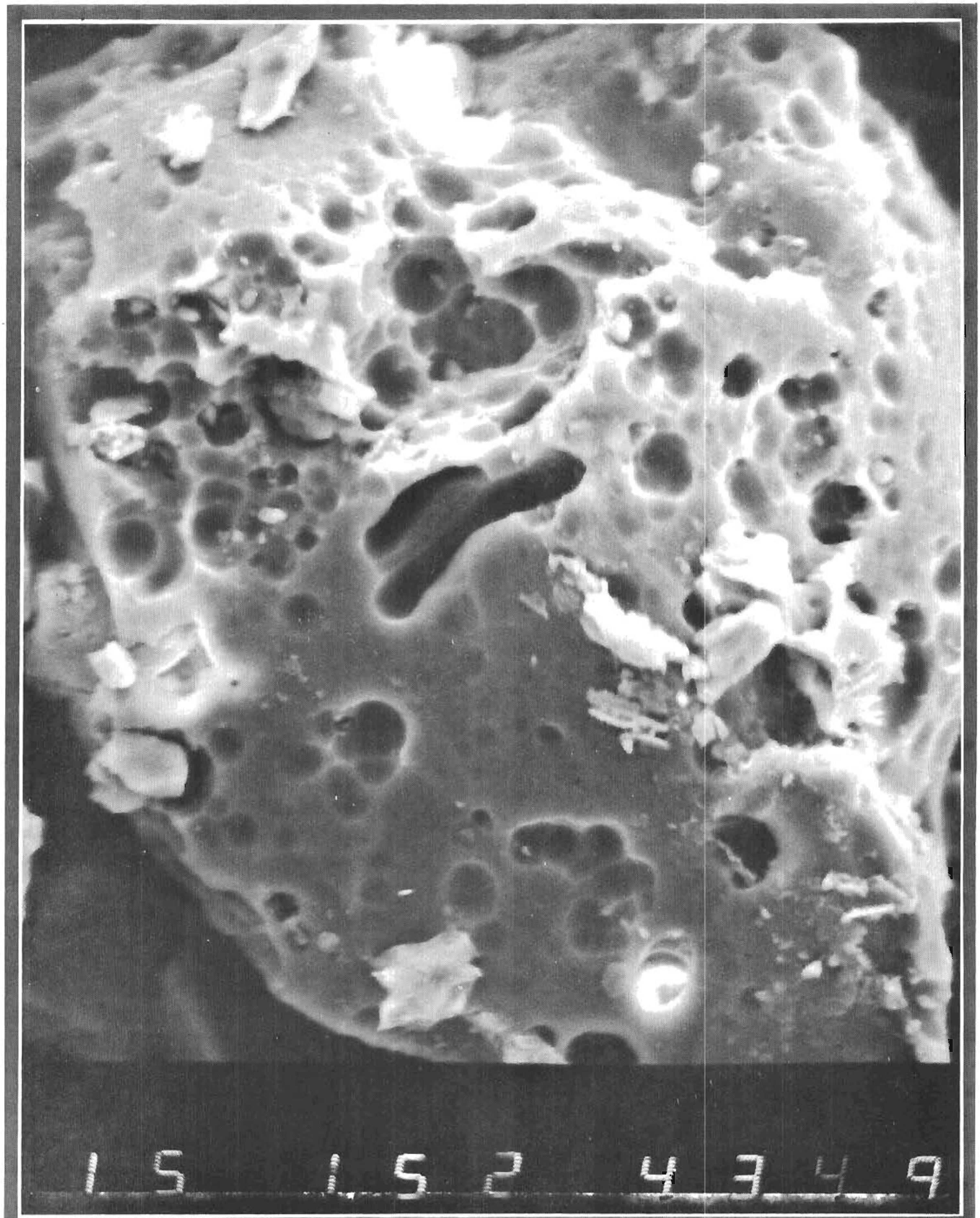
Heiken, G., 1972. Morphology and petrography of volcanic ashes: Geological Society of America Bulletin, v. 83, no. 7, p. 1961-1968.



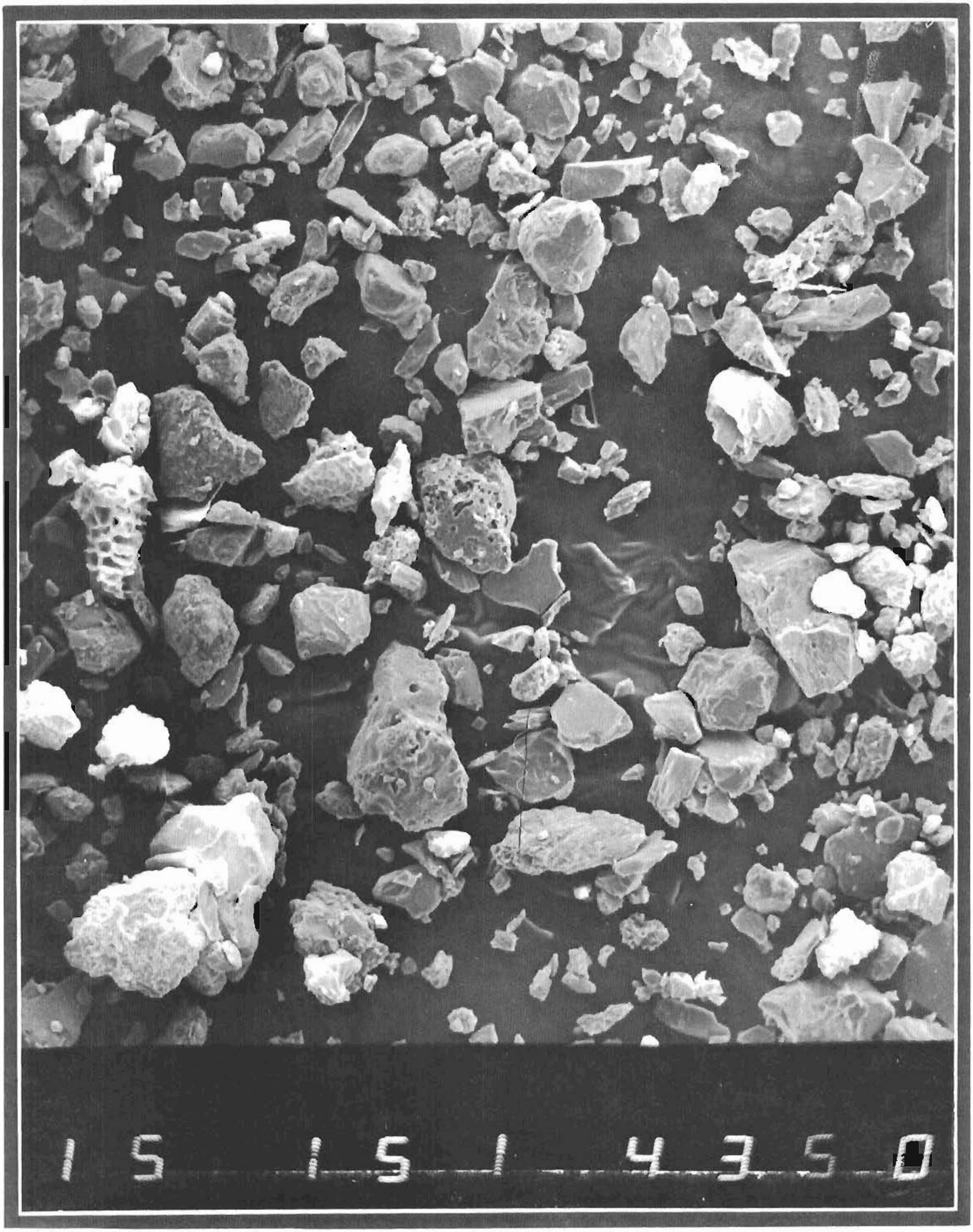
SCANNING ELECTRON PHOTOMICROGRAPH 4298 -
VOLCANIC ASH SAMPLE 177, (3900 X), 4 FT.



SCANNING ELECTRON PHOTOMICROGRAPH 4299-
VOLCANIC ASH SAMPLE 177, (520X), 4 FT.



SCANNING ELECTRON PHOTOMICROGRAPH 4349 -
VOLCANIC ASH SAMPLE 177, (3900 X), 9 FT.



SCANNING ELECTRON PHOTOMICROGRAPH 4350-
VOLCANIC ASH SAMPLE 177, (390X), 9 FT.

A. PETROGRAPHIC ANALYSIS OF VOLCANIC ASH LAYERS

177-16 4 ft.	Chiefly brown organic material with quartz and feldspar; minor hornblende and glass; all highly altered.
177-16, 9 ft.	Chiefly subangular grains of quartz and feldspar in a matrix of black and brown organic material; minor blue-green amphiboles, augite, and partially devitrified glass.

B. PETROGRAPHIC ANALYSIS OF PEAT ASH

7148-9-6	Chiefly angular grains of quartz and feldspar with light orange and black organic material; minor glass prisms, hornblende, and relict-biotite; biotite altering to clay.
053D-2-3	Chiefly clean subangular to subrounded grains of quartz and alkali (?) feldspar; minor glass prisms, and hornblende, hornblende slightly altered.
053D-7-6	Chiefly subrounded and altered, fine-grained quartz and feldspar with abundant, large black and brown organic material; about 10% large detrital quartz grains; about 6% transparent organic material; transparent organic material 0.1mm) shows internal structure.
053CN-3-3	Chiefly subrounded, altered grains of quartz, feldspar, and minor hornblende in matrix of devitrified glass; minor red-brown organic material.
053BN-6-6	Chiefly subangular quartz and alkali (?) feldspar with minor hornblende, hematite and iron orthopyroxene (?) in matrix of devitrified glass.
0538N-3-3	Chiefly clean prisms (to 0.2mm) of glass in matrix of feldspar, quartz, and some devitrified glass; minor hornblende, biotite, and clean, ribbed organic material; biotite altering to clay.

PETROGRAPHIC ANALYSES OF ASH
(Continued)

Sample No.	Petrographic Description of Ash
053BO-6-6	Chiefly clean, threads (to 0.7mm) of glass (Pele's hair structure); about 20% fine-grained, clean, angular feldspar; minor quartz.
7018-10-8	Chiefly black opaque material (carbon ?); about 15% feldspar with some quartz; minor ribbed, orange organics; two assemblages of feldspar: one altered (less common), one prismatic, unaltered.
7146-14A-6	Chiefly black opaque material (carbon ?) with red-brown, translucent organic material; minor altered feldspar and fragments of detrital lithic grains.
7176-6B-9	Chiefly black opaque material (carbon ?) with red translucent ribbed organic material; about 15% fine-grained, altered feldspar and quartz.
7016-4A-3	Chiefly organic material with slightly weathered subrounded quartz and feldspars; minor mafics (hornblende ?), glass prisms, with some devitrified glass in matrix.
051B-13-3	Chiefly light orange glass, quartz, and feldspar fragments; fragments angular and slightly weathered; some iron amphiboles (?).
7016 3B-6	Chiefly orange, ribbed organics; some subangular quartz and feldspar; minor green hornblende, glass prisms, and large carbon fragments.
7018-2A-7	Chiefly clean, fine-grained, subangular quartz and feldspar with reddish amphiboles (?); devitrified glass (?) in fine-grained matrix.
7420-12B-9	Chiefly reddish-brown, semi-opaque organic material (?); some subangular to subrounded quartz and feldspar fragments with minor mafics hornblende (?).

PETROGRAPHIC ANALYSES OF ASH
(Continued)

Sample No.	Petrographic Description of Ash
3-009-1-9	Chiefly reddish-orange organic material and slightly devitrified, dirty glass fragments; minor subangular quartz fragments; trace feldspar fragments.
7176-6B-11	Chiefly orange-brown organic material with subrounded feldspars; minor quartz and black organic material (to 0.5mm).
051B-12-6	Chiefly prisms of glass (0.2mm) and quartz, feldspar, and iron-amphiboles (0.05 to 0.2mm) in slightly devitrified glass matrix; fragments angular in shape.
7148-9B-9	Chiefly reddish-orange, dirty, fibrous organic material; minor weathered, fine-grained quartz.
053D-2-6	Chiefly brown, opaque organic material; minor feldspar (some zoned alkali feldspar) and altered quartz.
7146-14A-7	Chiefly black carbon material, both massive and patterned; some dirty, orange organic material; about 10% altered feldspar; about 5% fibers of glass; minor quartz.
7014-5A-6	Chiefly orange glass with orange organic material and carbon material; about 10% altered feldspar and subrounded quartz.
7420-13C-6	Chiefly carbon material, coarse to fine-grained; minor glass prisims, hornblende, and subangular feldspar and quartz.
7148-9B-3	Chiefly black carbon material and glass prisms (to 0.4mm) about 35% each; about 25% clean to moderately altered feldspar; minor green hornblend (to 0.2mm).
7016-4A-6	Chiefly black carbon material and red organic material; moderate to minor altered quartz; some subrounded green hornblende.

PETROGRAPHIC ANALYSES OF ASH
(Continued)

Sample No.	Petrographic Description of Ash
7420-11A-6	Chiefly black carbon material with some sub-euhedral feldspar and fine-grained quartz; minor green hornblende.
053DO-8-10	Chiefly subrounded, altered quartz (to 0.2mm); minor feldspar, hornblende, glass, and chert fragments.
7420-12B-6	Chiefly fine-grained, subrounded, altered feldspar and quartz with orange organic material and black carbon material; minor euhedral hornblende.
7176-7A-3	Chiefly devitrified glass matrix with subangular to subrounded, altered quartz and feldspar grains; minor orange organic material, glass needles (to 0.4mm), and hornblende.
7018-1D-6	Chiefly devitrified glass matrix with about 20% black carbon and orange organic material, fine-grained, subrounded, altered quartz, and feldspar; some Pele's hair structure.
053CO 2-6	Chiefly clean, glass (some devitrified) matrix with prisms and bent laths of glass; about 15% feldspar and quartz (to 0.4mm); minor horneblende (to 0.3mm).
7018-2A-3	Chiefly black carbon material and reddish-brown organic material; minor feldspar, sub-rounded, altered quartz (to 0.2mm), and green hornblende.
7420-13C-9	Chiefly subangular to subrounded, slightly altered quartz and feldspar; minor chert, devitrified glass, lithic, and hornblende fragments.
7176-7A-6	Chiefly reddish-orange, ribbed organic material with subangular, fine-grained feldspar (predominantly plagioclase) and quartz; minor glass needles, hornblende, and black carbon material.

APPENDIX E

Figures

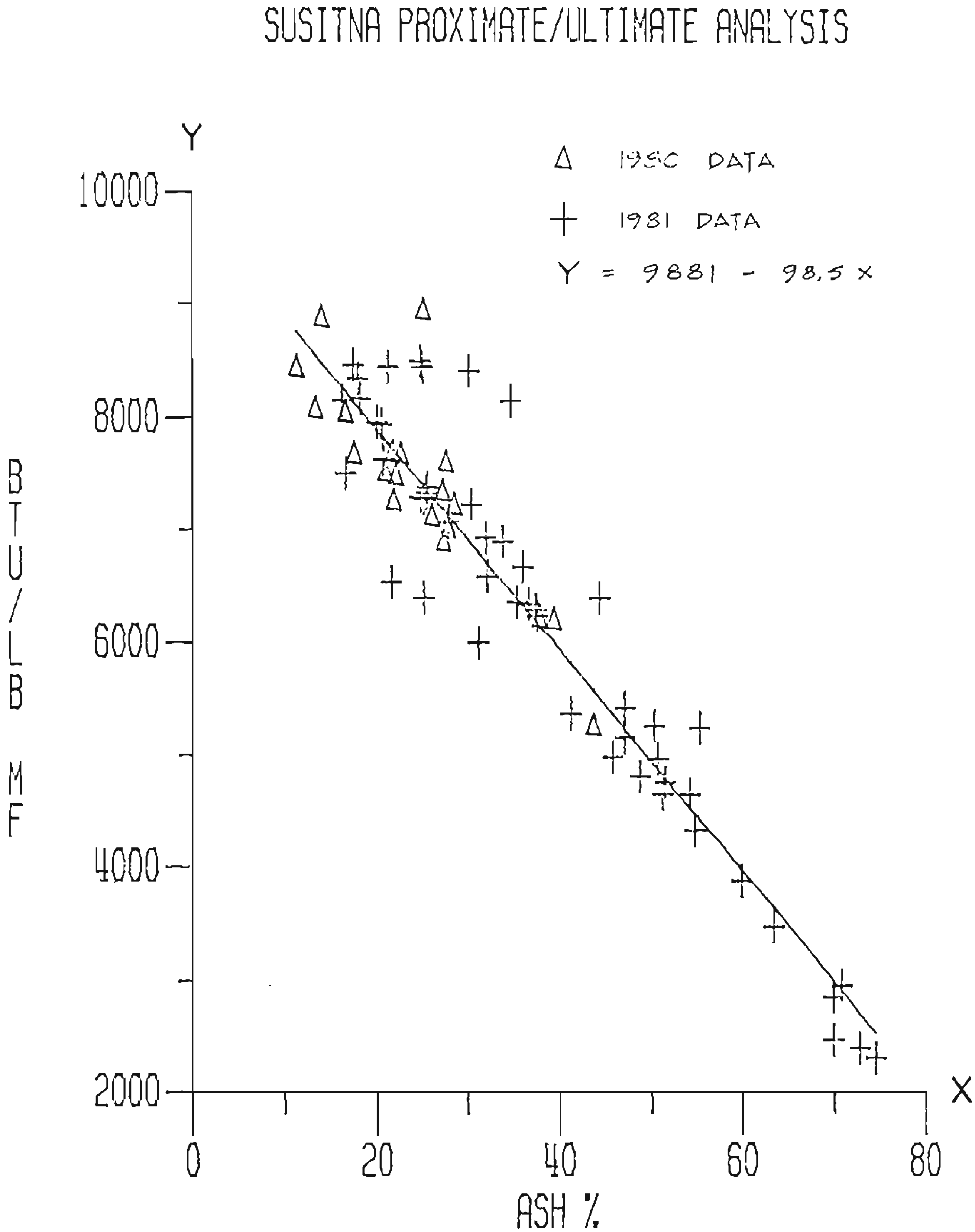


FIGURE E-1
HEATING VALUE vs. ASH CONTENT

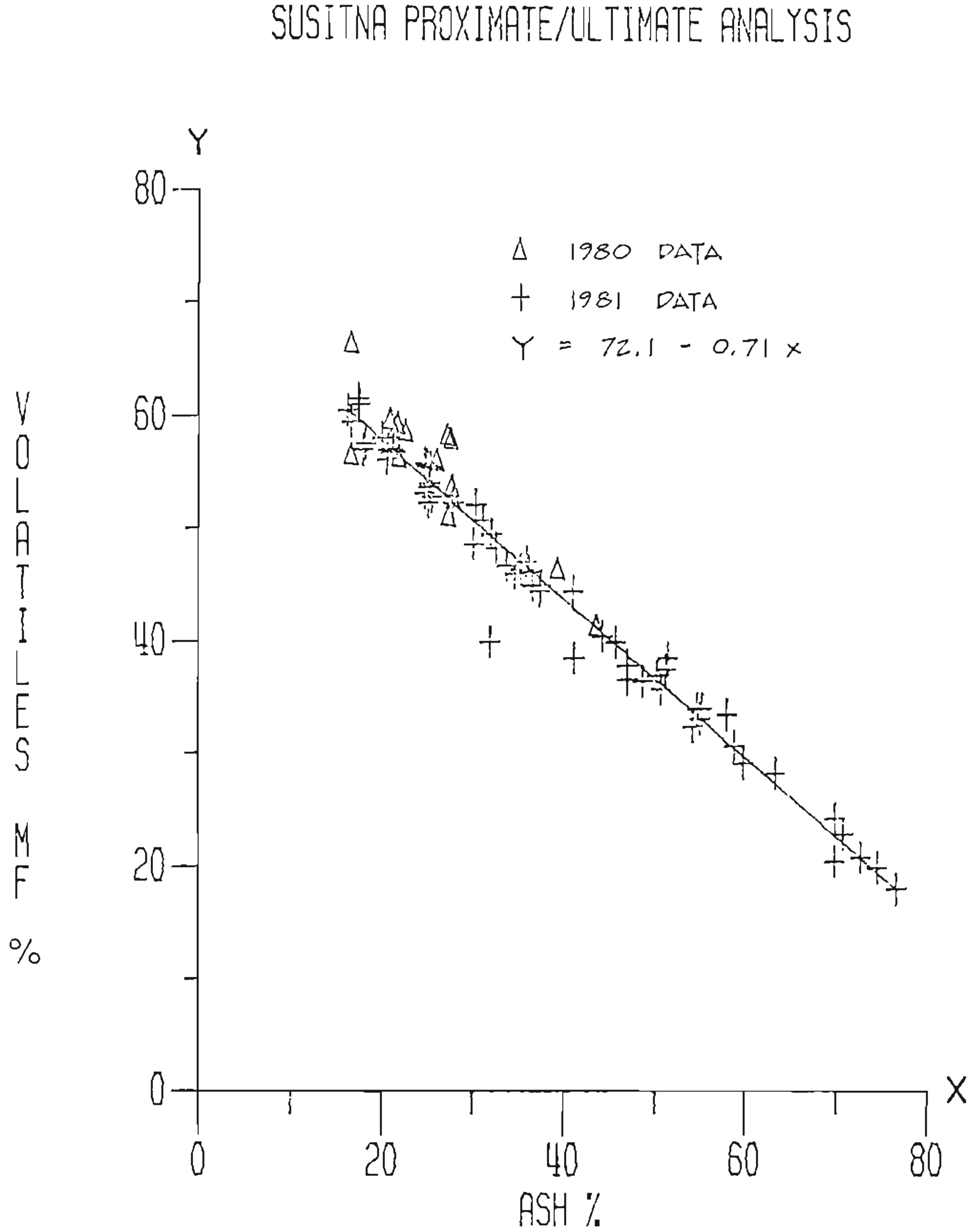


FIGURE E-2
VOLATILES vs. ASH CONTENT

SUSITNA PROXIMATE/ULTIMATE ANALYSIS

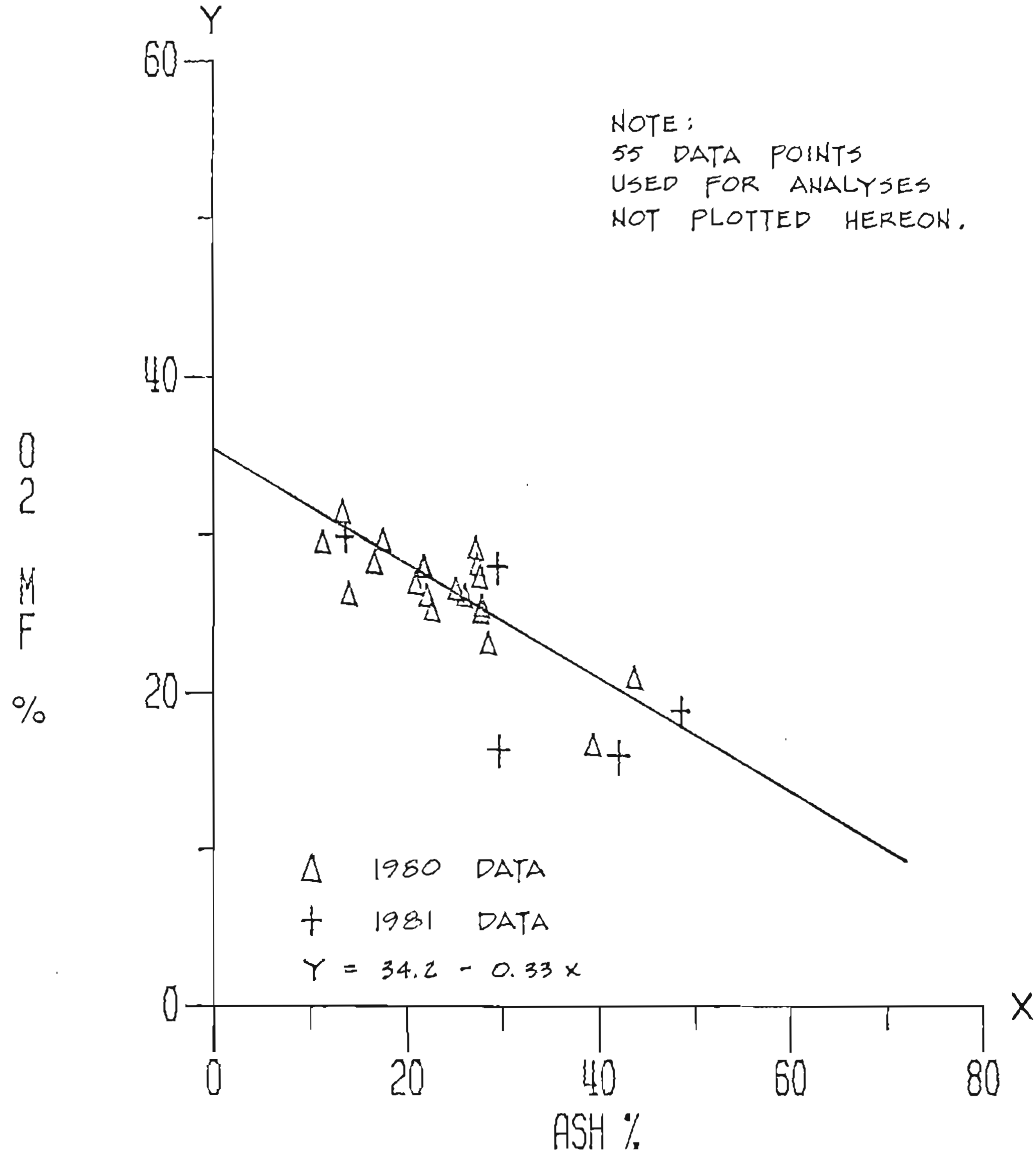


FIGURE E-3
OXYGEN CONTENT vs. ASH CONTENT

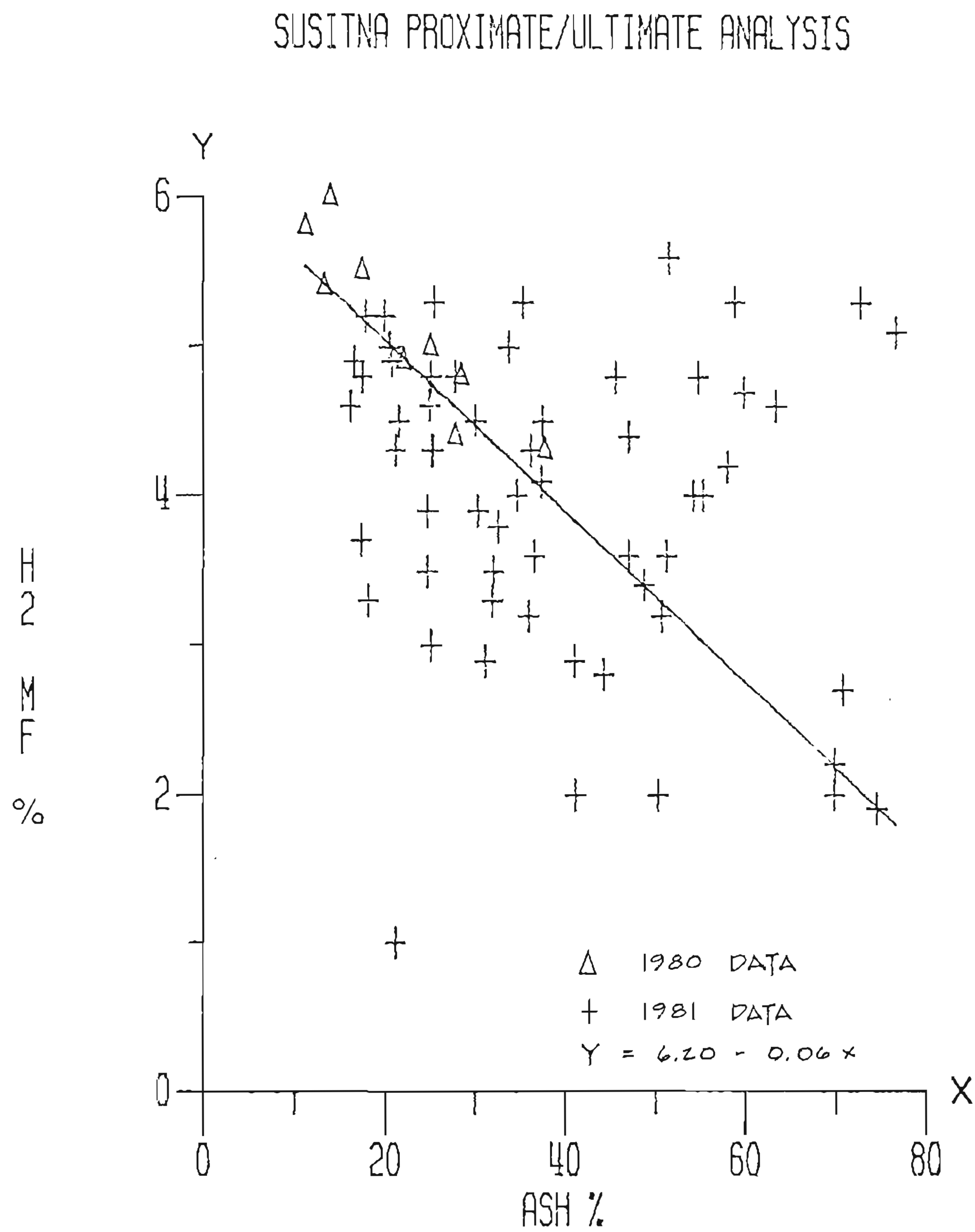


FIGURE E-4
HYDROGEN CONTENT vs. ASH CONTENT

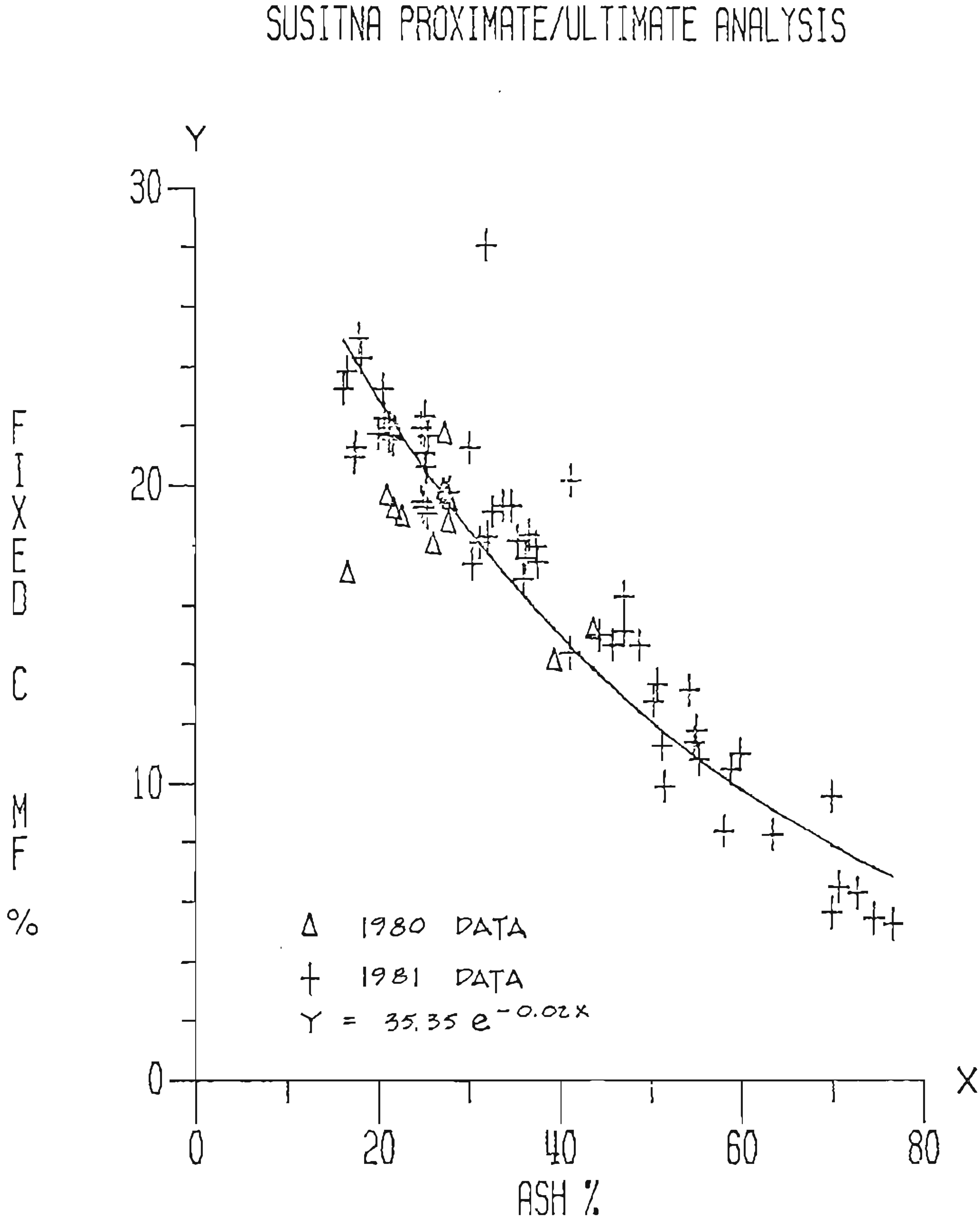


FIGURE E-5
FIXED CARBON vs. ASH CONTENT

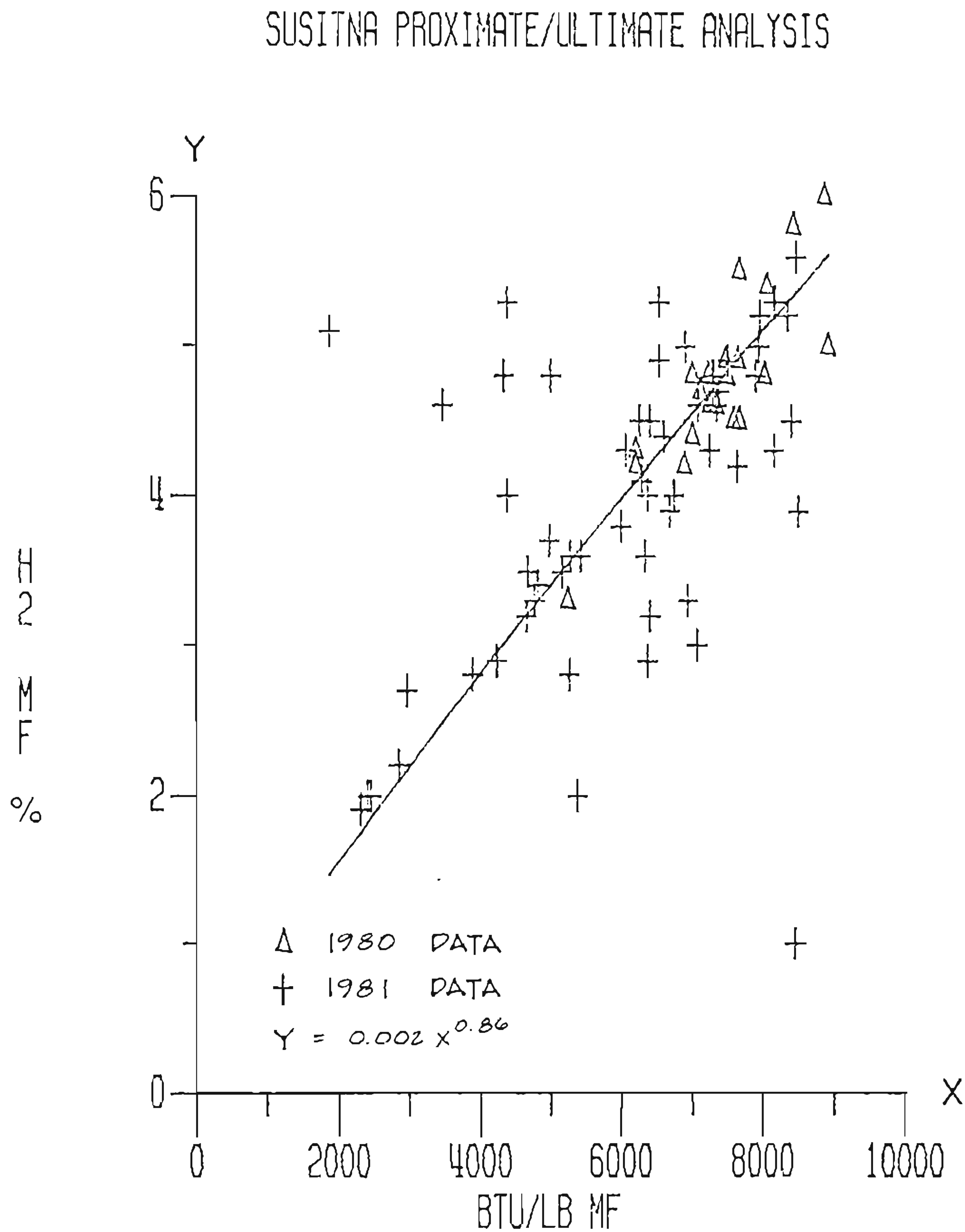


FIGURE E-6
HYDROGEN vs. HEATING VALUE

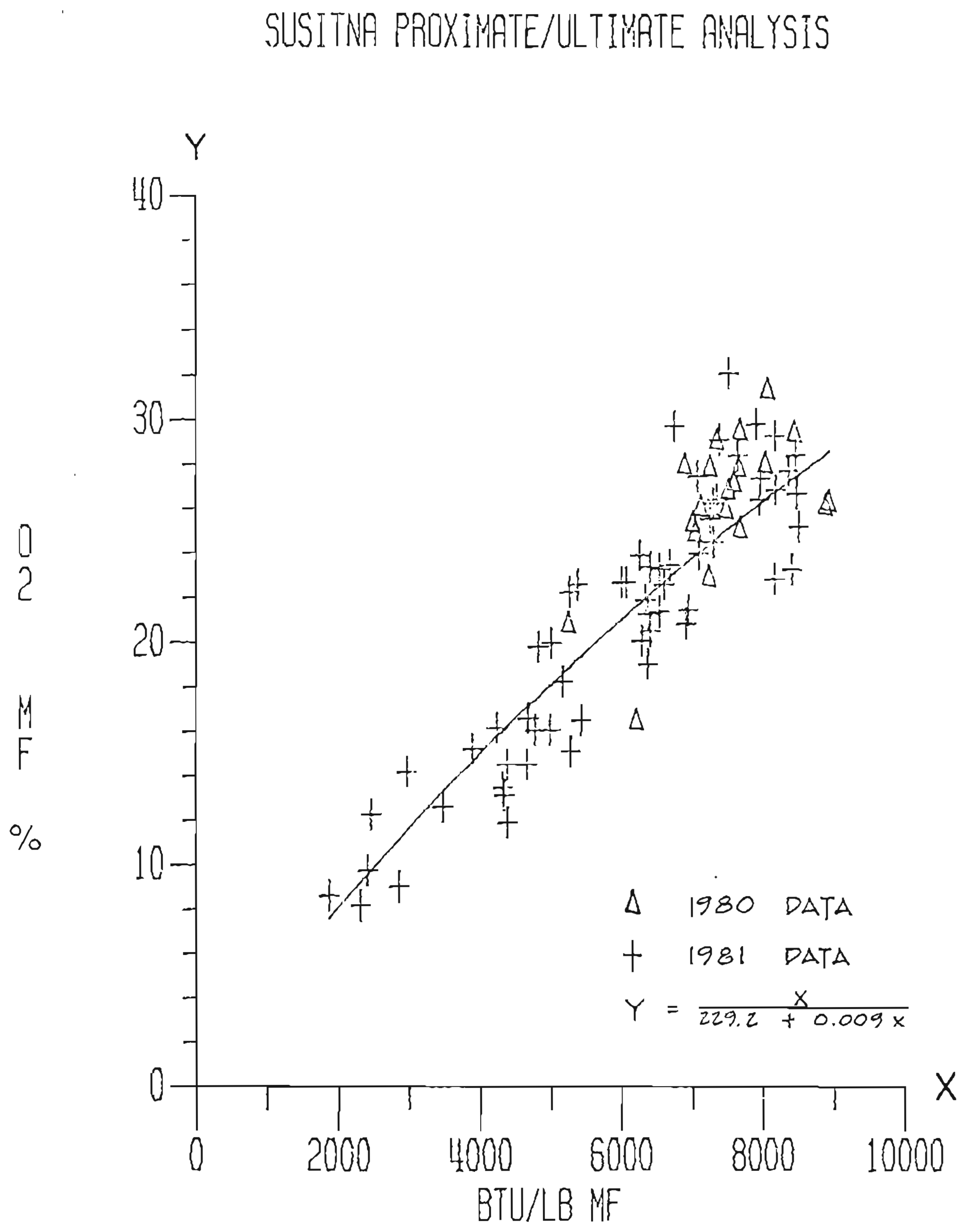


FIGURE E-7
OXYGEN vs. HEATING VALUE

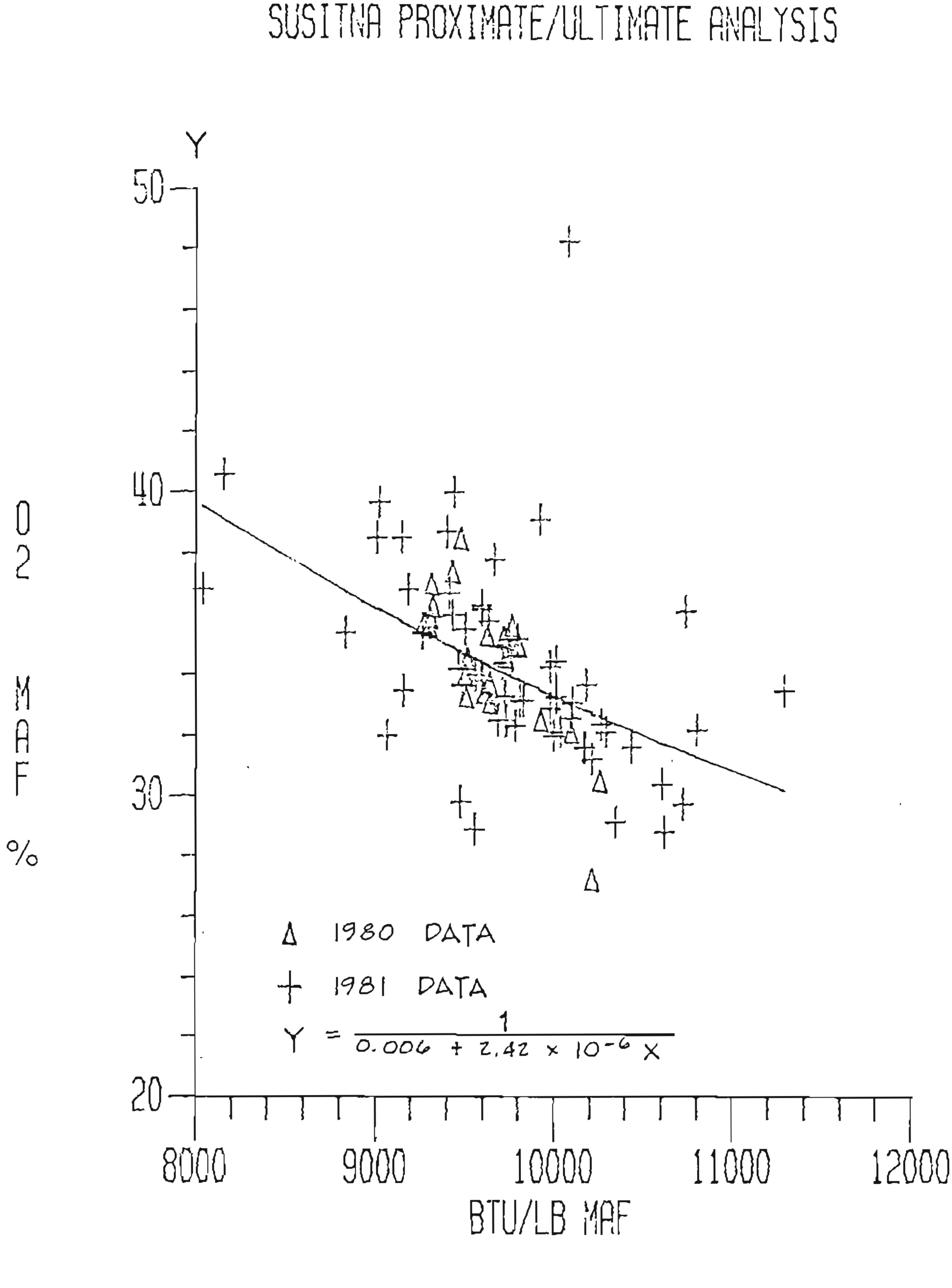


FIGURE E-8
ASH FREE OXYGEN vs. HEATING VALUE

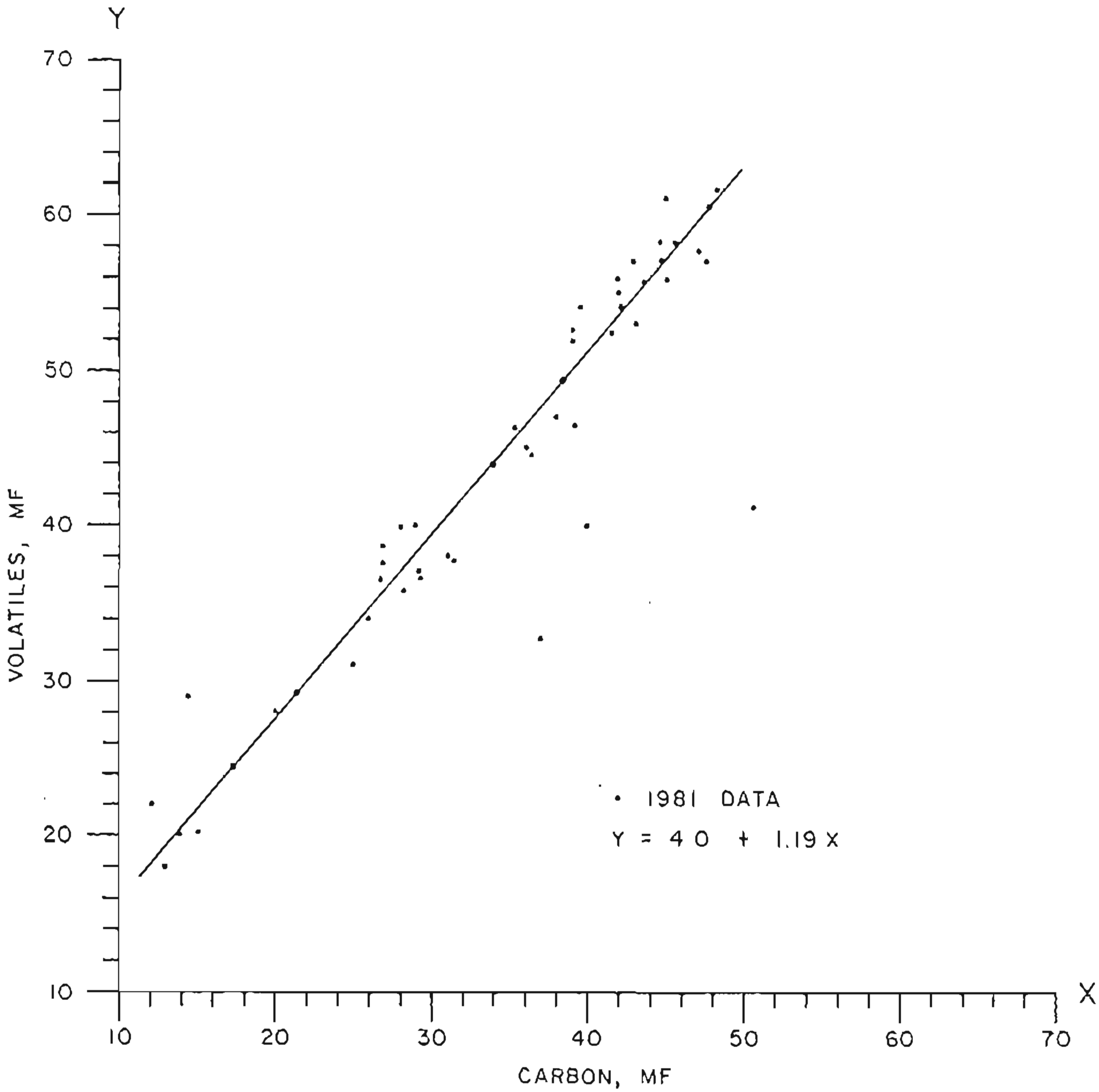


FIGURE E-9

VOLATILES vs. CARBON

APPENDIX F

Statewide Proximate and Ultimate Data
(key to symbols for Statewide data superimposed)

LEGEND

Location	Year	Symbol
SUSITNA	1980	△
SUSITNA	1981	+
DILLINGHAM	1980	○
DILLINGHAM	1981	⊙
KENAI	1980	□
KING SALMON	1980	⊙
KODIAK	1980	◇

KEY TO SYMBOLS FOR
STATEWIDE DATA SUPERIMPOSED

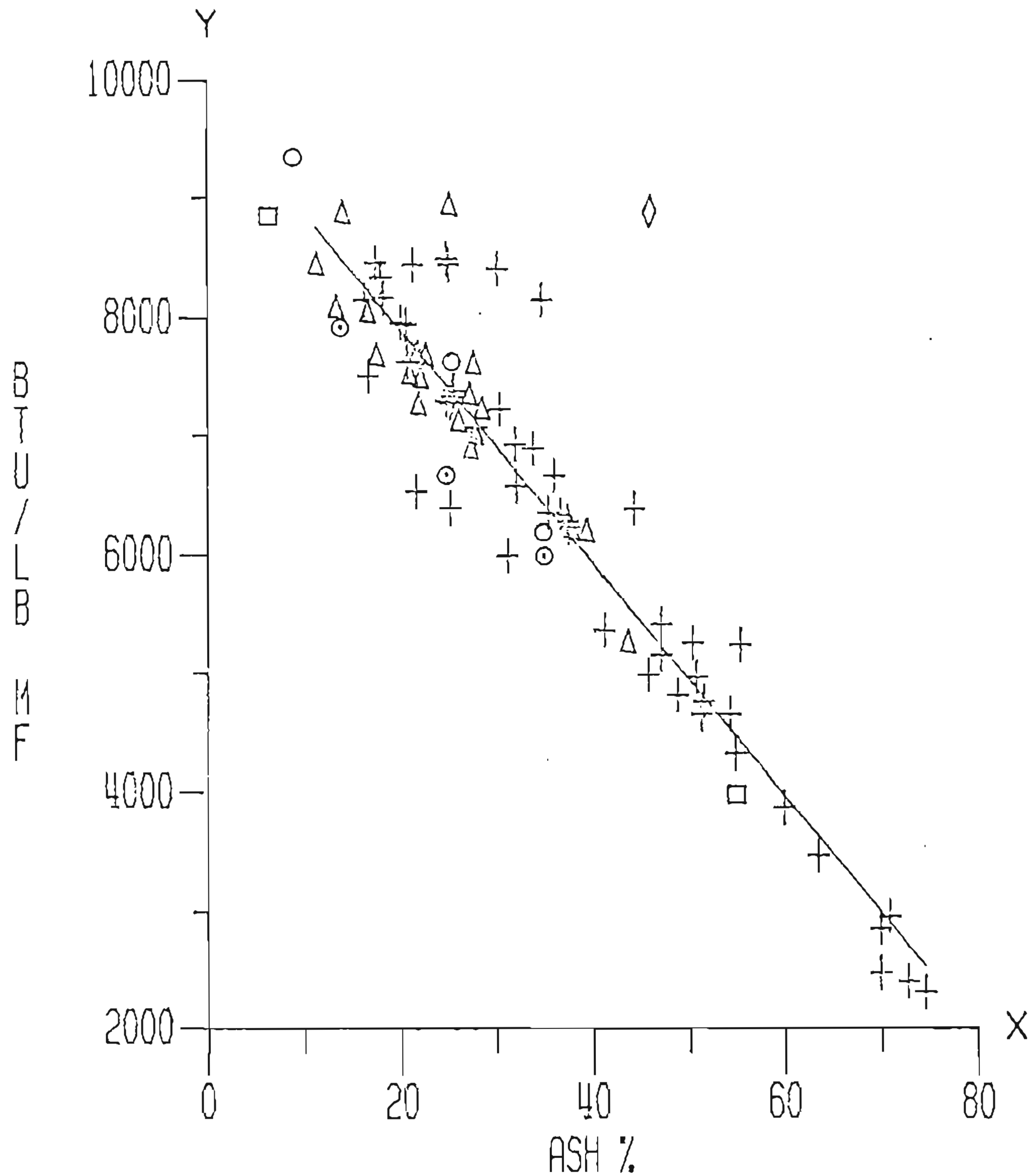


FIGURE F-1
HEATING VALUE vs. ASH CONTENT

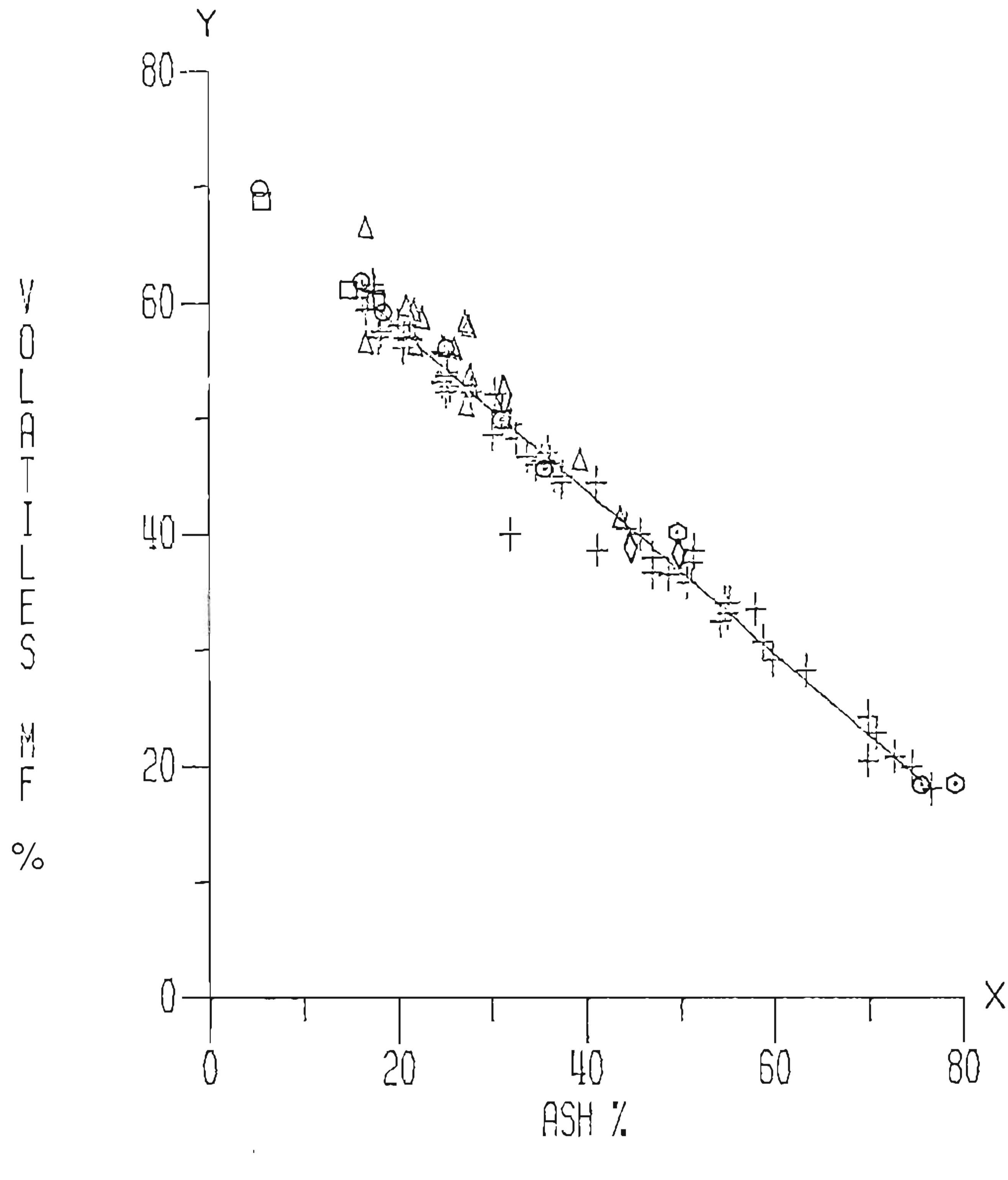


FIGURE F-2
VOLATILES vs. ASH CONTENT

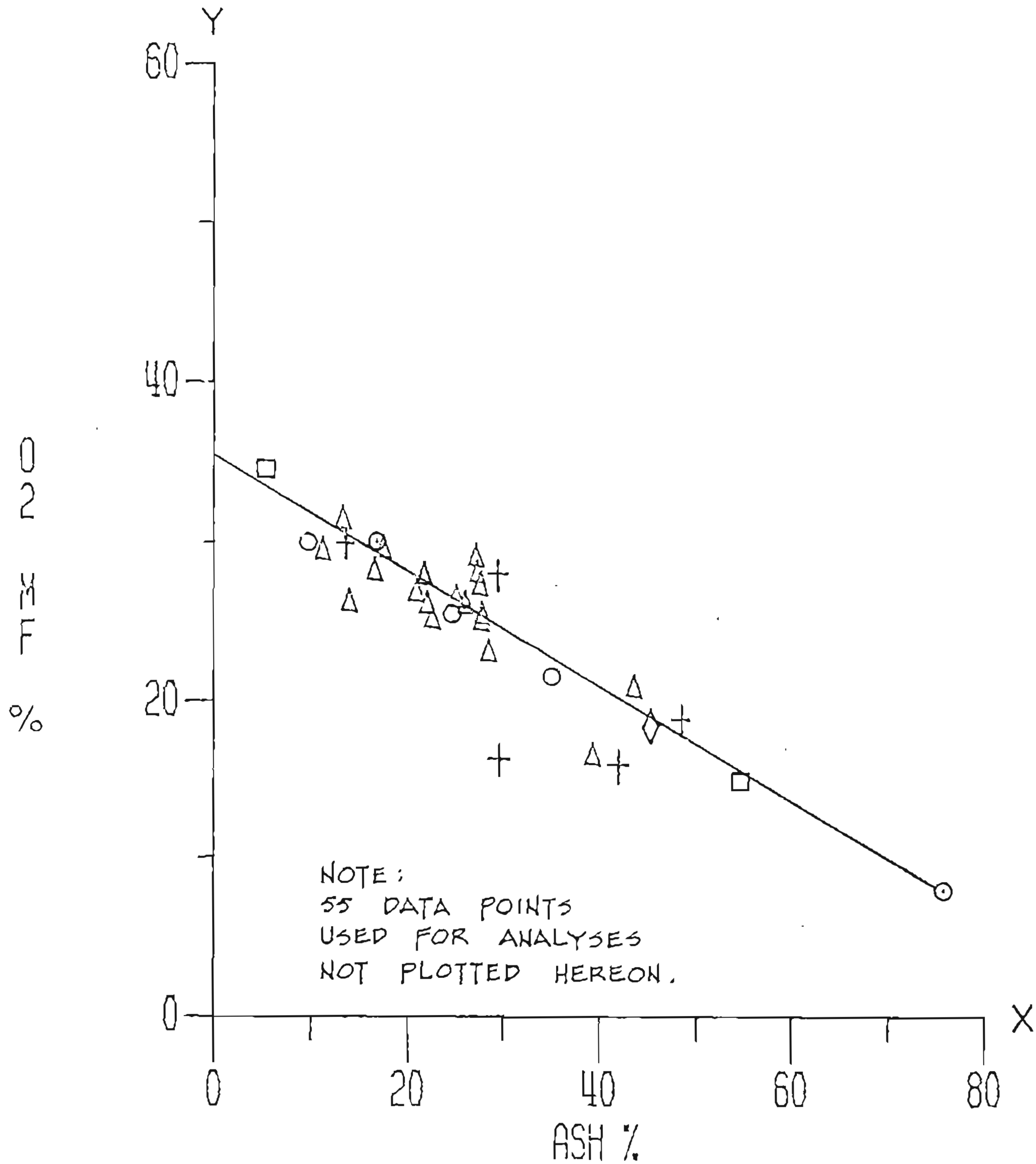


FIGURE F-3
OXYGEN CONTENT vs. ASH CONTENT

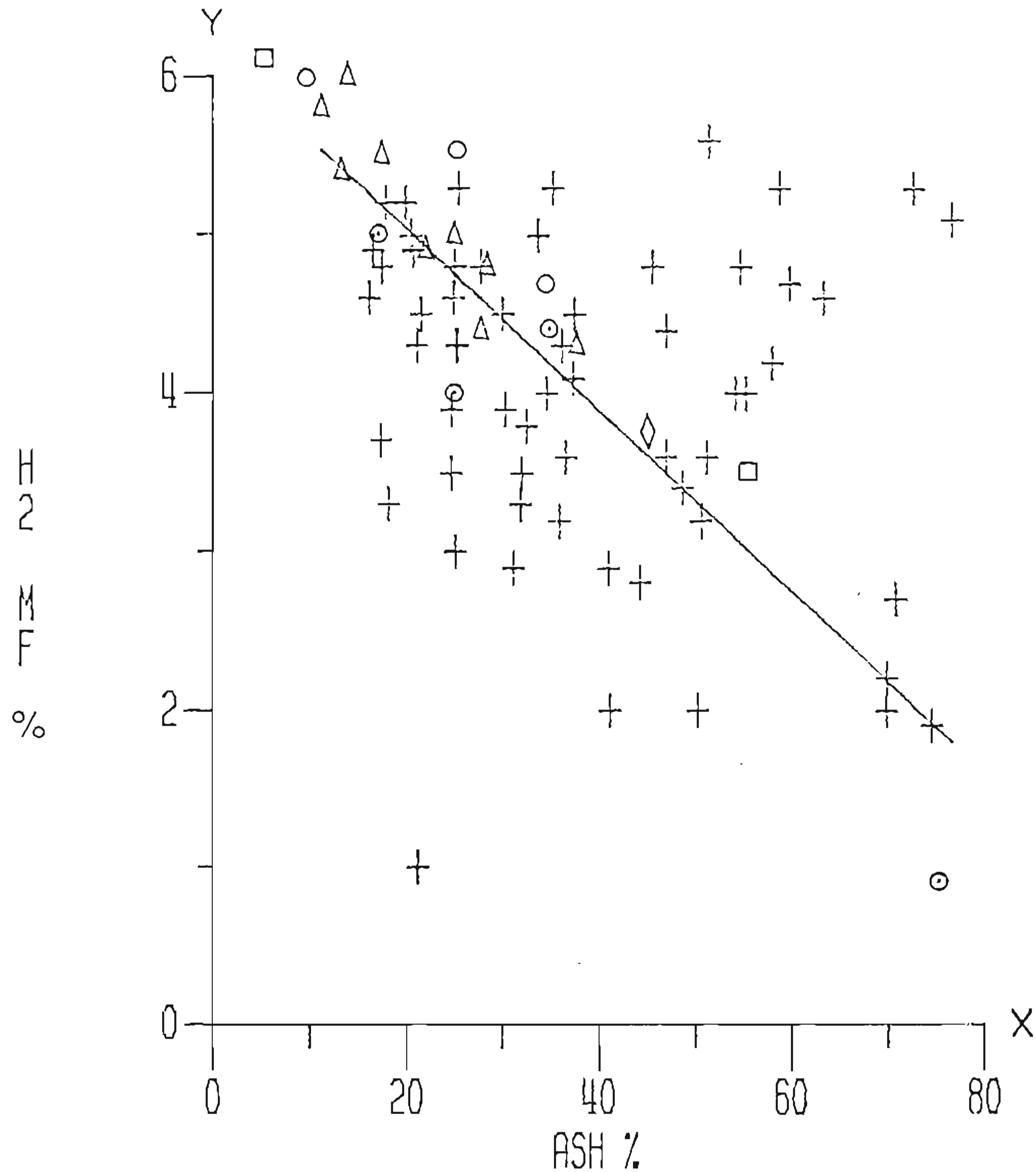


FIGURE F-4
HYDROGEN CONTENT vs. ASH CONTENT

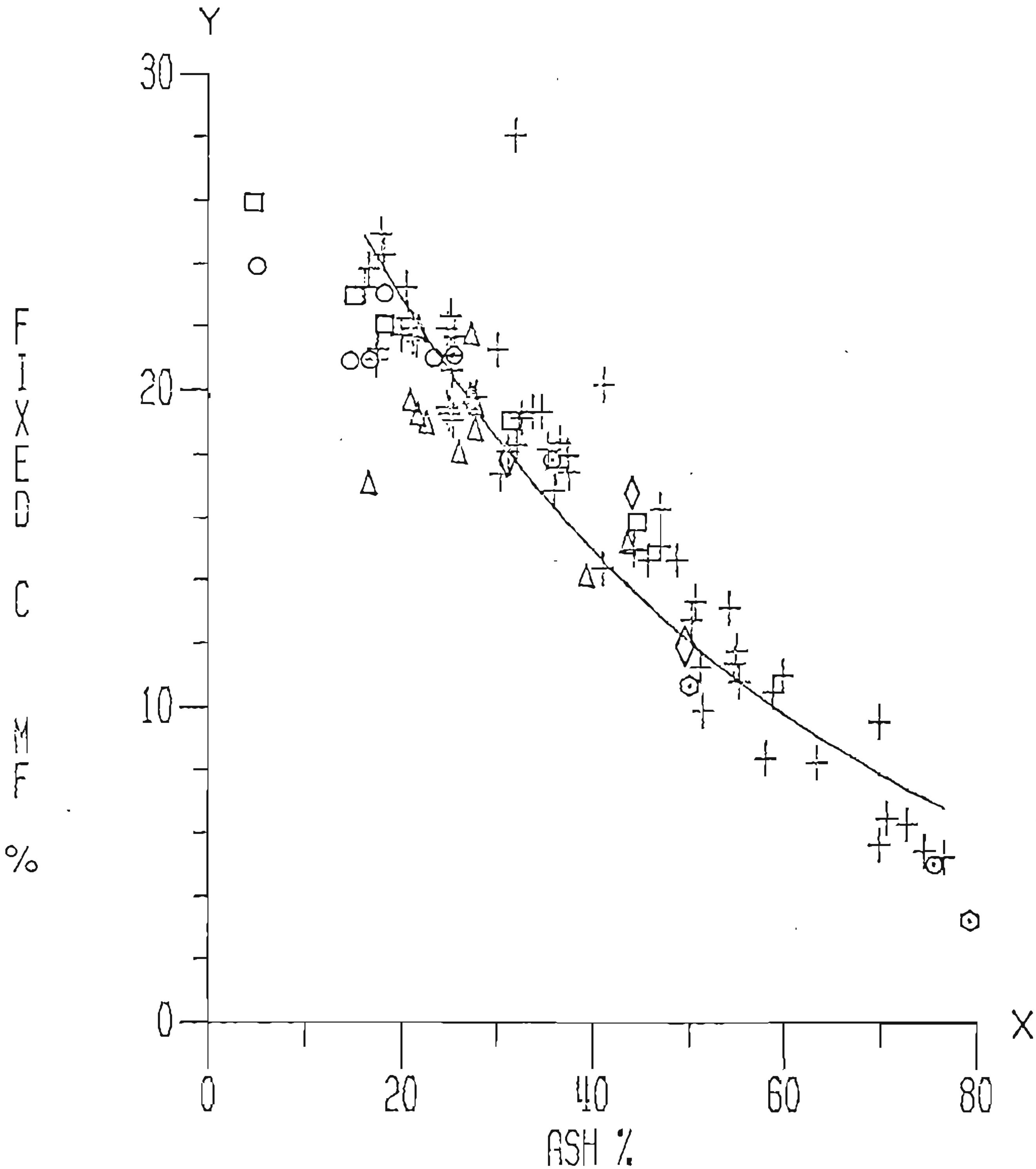


FIGURE F-5
FIXED CARBON vs. ASH CONTENT

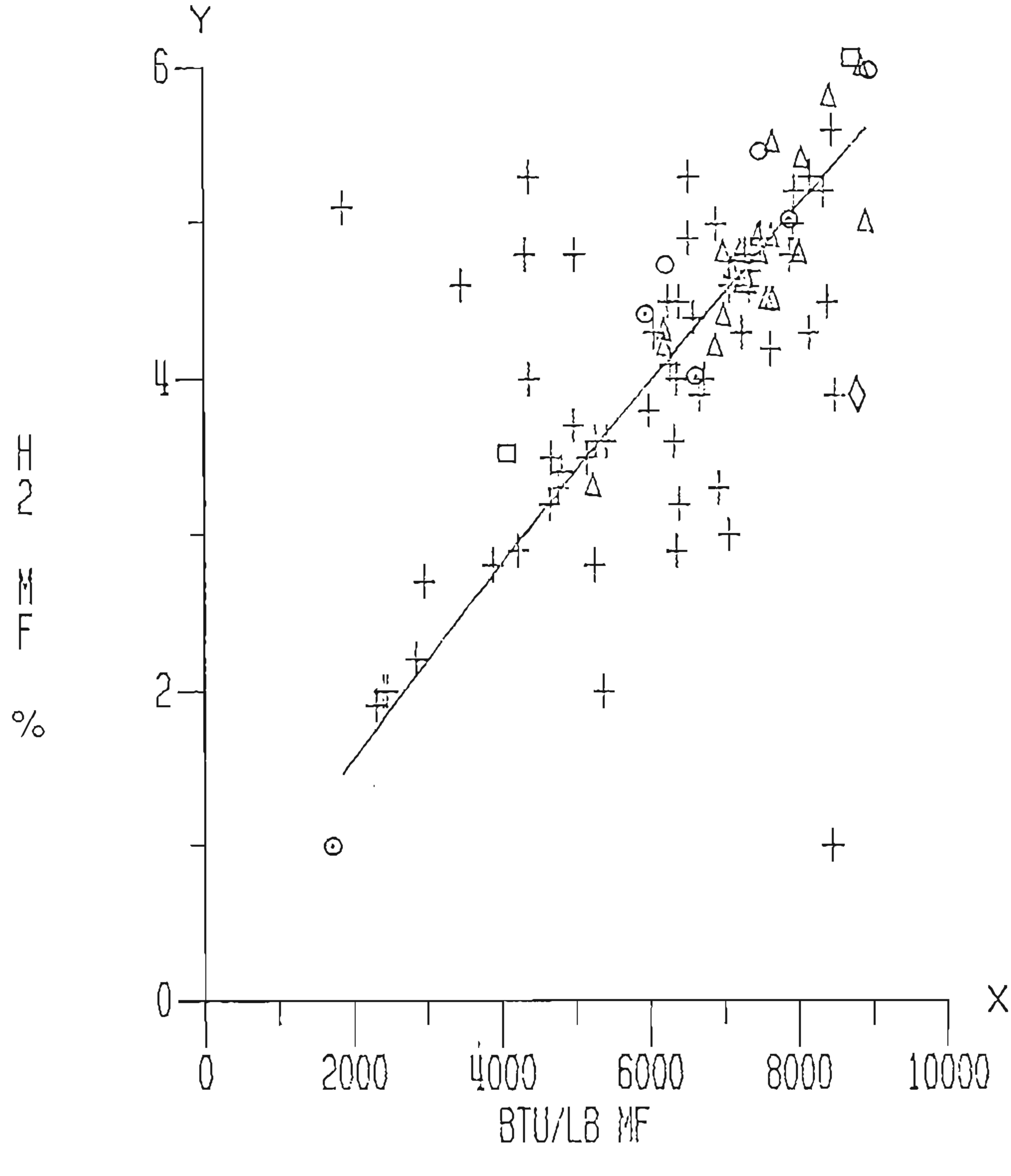


FIGURE F-6
HYDROGEN vs. HEATING VALUE

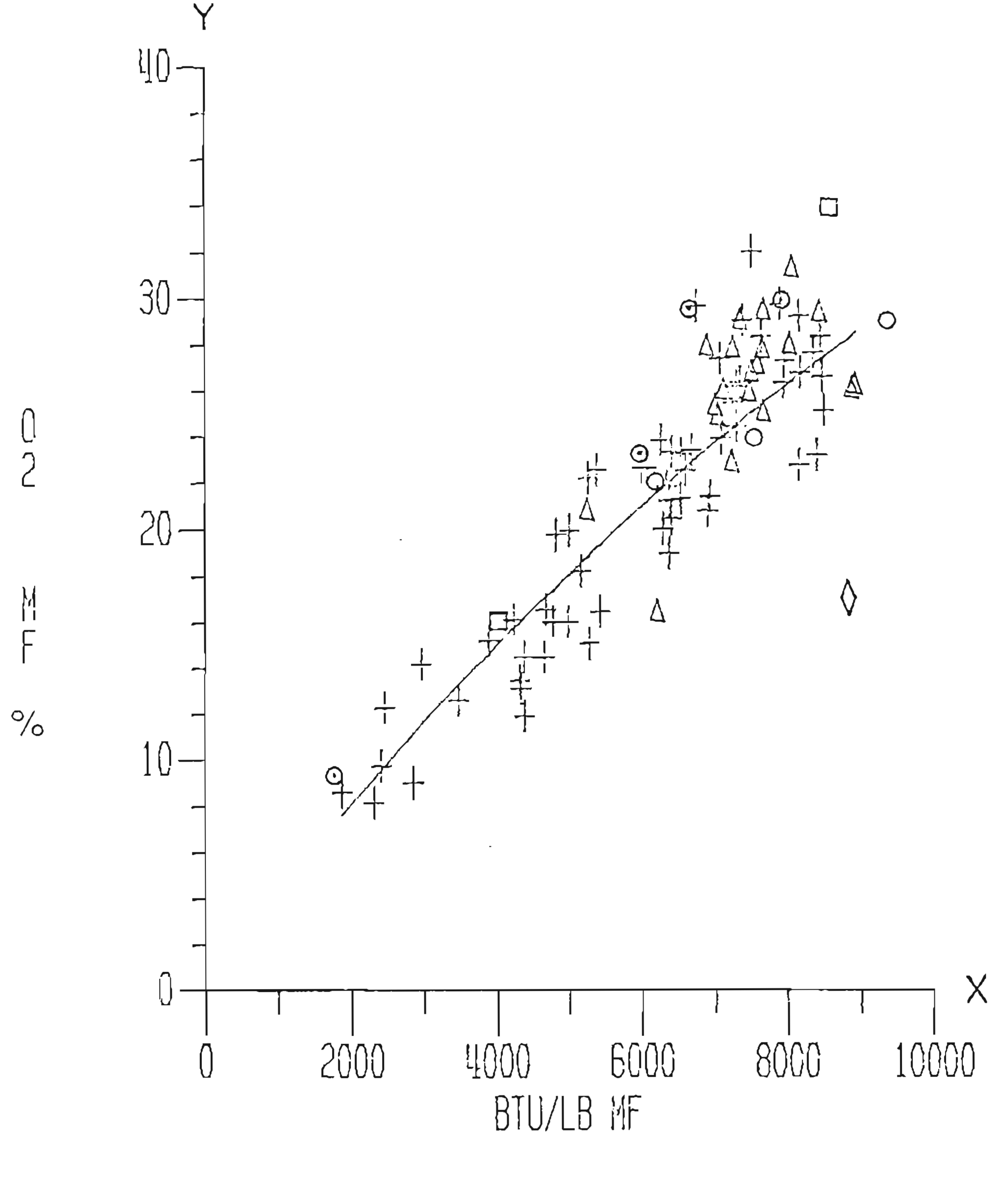


FIGURE F-7
OXYGEN vs. HEATING VALUE

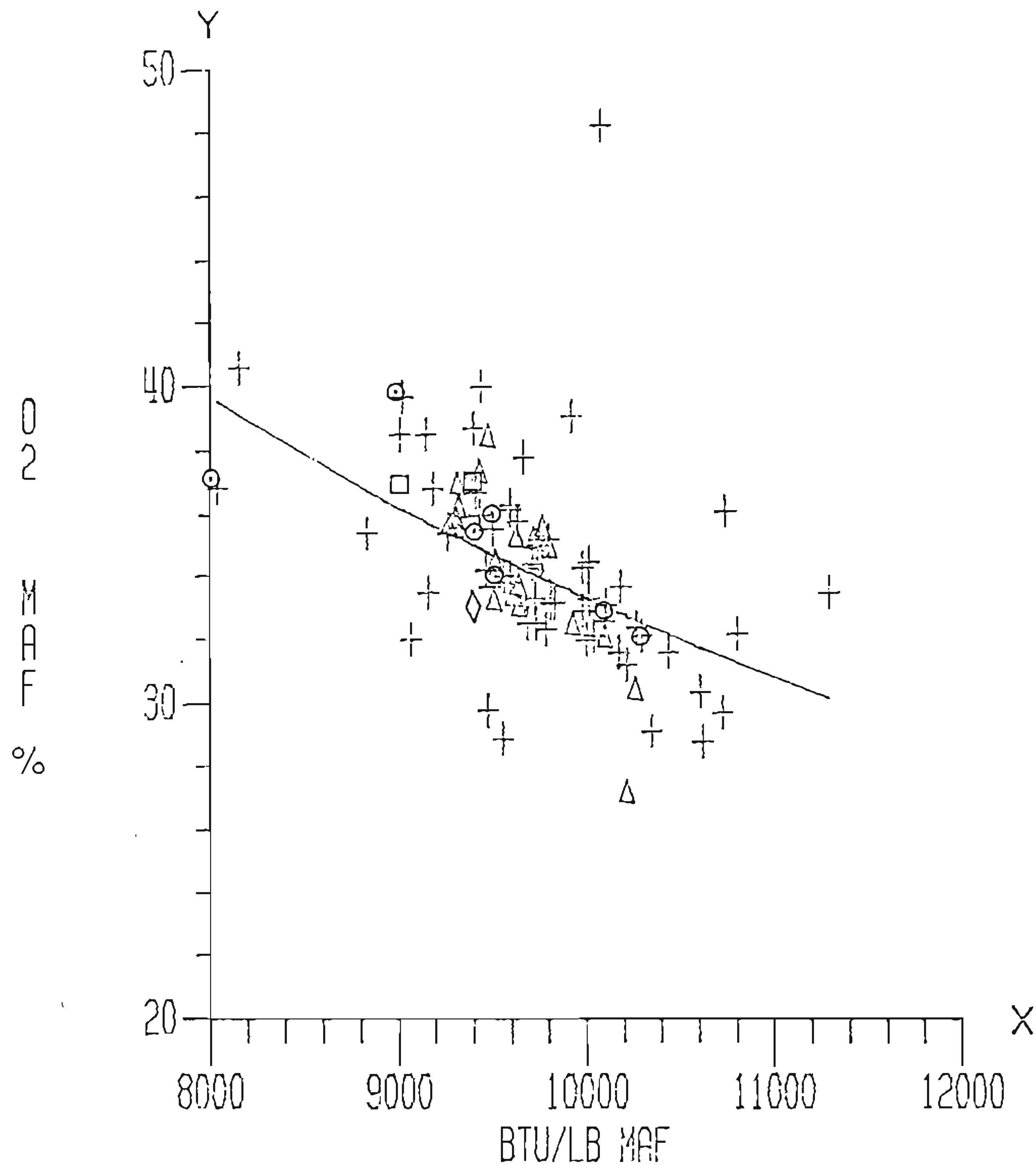


FIGURE F-8
ASH FREE OXYGEN vs. HEATING VALUE