A STUDY OF THE CHEMICAL AND PHYSICAL CHARACTERISTICS OF PUMICE FROM GLACIER PEAK, WASHINGTON AND MT. MAZAMA (CRATER LAKE), OREGON: REPORT OF PROGRESS, JUNE 16-SEPTEMBER 7, 1963

Research supported by the National Science Foundation through summer fellowships for Graduate Teaching Assistants

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INTRODUCTION

In March of this year, the writer was awarded a twelve-week summer fellowship for the period June 16-September 7, 1963. At the time of application, it was proposed that much of the summer would be spent in on-campus research, with a small percentage of time allotted for field work to supplement data already collected. Subsequent investigations showed, however, that much valuable information could be obtained by extending the proposed field investigation. Accordingly, the summer work schedule was rearranged to include 30 full days of field work. A full breakdown of the summer work schedule is given in Table 1.

TABLE 1

DISTRIBUTION OF WORKING TIME* FOR PERIOD JUNE 16 TO SEPTEMBER 7, 1963

Type of Research	Days	% Total Time
Field Includes: sample collecting, on-site soil, topographic, and vegetation descriptions; travel to and from field area	30	45
Laboratory Includes: cleaning, sorting, and describing samples; crushing samples, performing heavy liquid and magnetic separations; developing and cultivating techniques; gathering equipment	18	27
Library Includes: bibliography search, and reading of pertinent articles	11	17
Office Includes: recording and digesting field notes, plotting map data; answering pertinent correspondence	7	11
TOTAL	66	100

*Based on 5-1/2 to 8-hour-plus work days per week or 66 work days.

DATA COLLECTED

Decision was made to spend a large part of the summer in the field when it became apparent that the study of the physical and chemical properties of pumice was intimately concerned with the problem of weathering, and that the value of laboratory work would be far greater if supplemented by further environmental studies. Factors controlling weathering are essentially the same as the factors controlling soil formation, namely: parent material (composition), climate, organisms, relief, and time (Jenny, 1941).

The composition of the main explosions of Glacier Peak and Mt. Mazama are relatively the same (Wilcox and Powers, 1963). Both cones have thrown ejecta over areas with wide ranges of climate, vegetation zones, and relief. Radiocarbon dates have set the main Mazama eruption at around 6600 years before present. Occurrence of both Mazama and Glacier Peak ash in a Washington peat bog, with Glacier Peak ash occurring several feet below Mazama ash, demonstrates a long lapse of time between the two main explosions (Powers and Wilcox, in press). Radiocarbon dates of the peat above and below the two ash layers will give for the first time an absolute date for the main Glacier Peak eruption and act as a check on other Mazama dates.

Rarely is it possible to observe the process of weathering in two areas where the weathering factors can be so closely controlled. Using precipitation data, vegetation types, and topography, the writer was able to collect a comparative suite of samples from the Glacier Peak and Mt. Mazama pumice falls. Precipitation in both collecting areas ranged from more than

40 to less than 11 inches. Location of sampling sites in both areas include mountain meadows, high interstream ridges, steep hill sides, and alkali flats. A total of twenty-four Glacier Peak- and sixteen Mazama-pumice sites were visited, and samples and/or detailed field descriptions were collected at each locality. Site locations are shown in Fig. 1.

The field season extended from the middle of June until the end of July and consisted of three separate trips: (1) the Glacier Peak wilderness area northeast of the peak. (Base camp located at Holden Village); (2) The Glacier Peak wilderness area southeast of the peak. (Base camp located at Phelps Creek forest camp in the upper Chiwawa Valley); (3) the Columbia Plateau area near Chelan and the pumice fall area north of Crater Lake. (Main base camp located at Odell Lake in the Deschutes National Forest, Oregon).

Laboratory and library research was conducted intermittently throughout June and July and on a full-time basis during August and September. A preliminary investigation of the effect of weathering on the n values of untreated pumice glass from selected Mazama and Glacier Peak sites was made. Magnetic separation of the heavy mineral fraction of these samples also was performed in preparation for future studies. Literature search resulted in a relatively complete annotated bibliography of more than 25 pages, reviewing data on andesitic and dacitic volcanic soils for the period 1931 to present. A description of laboratory procedures, in flow sheet form, is shown in Fig. 2.

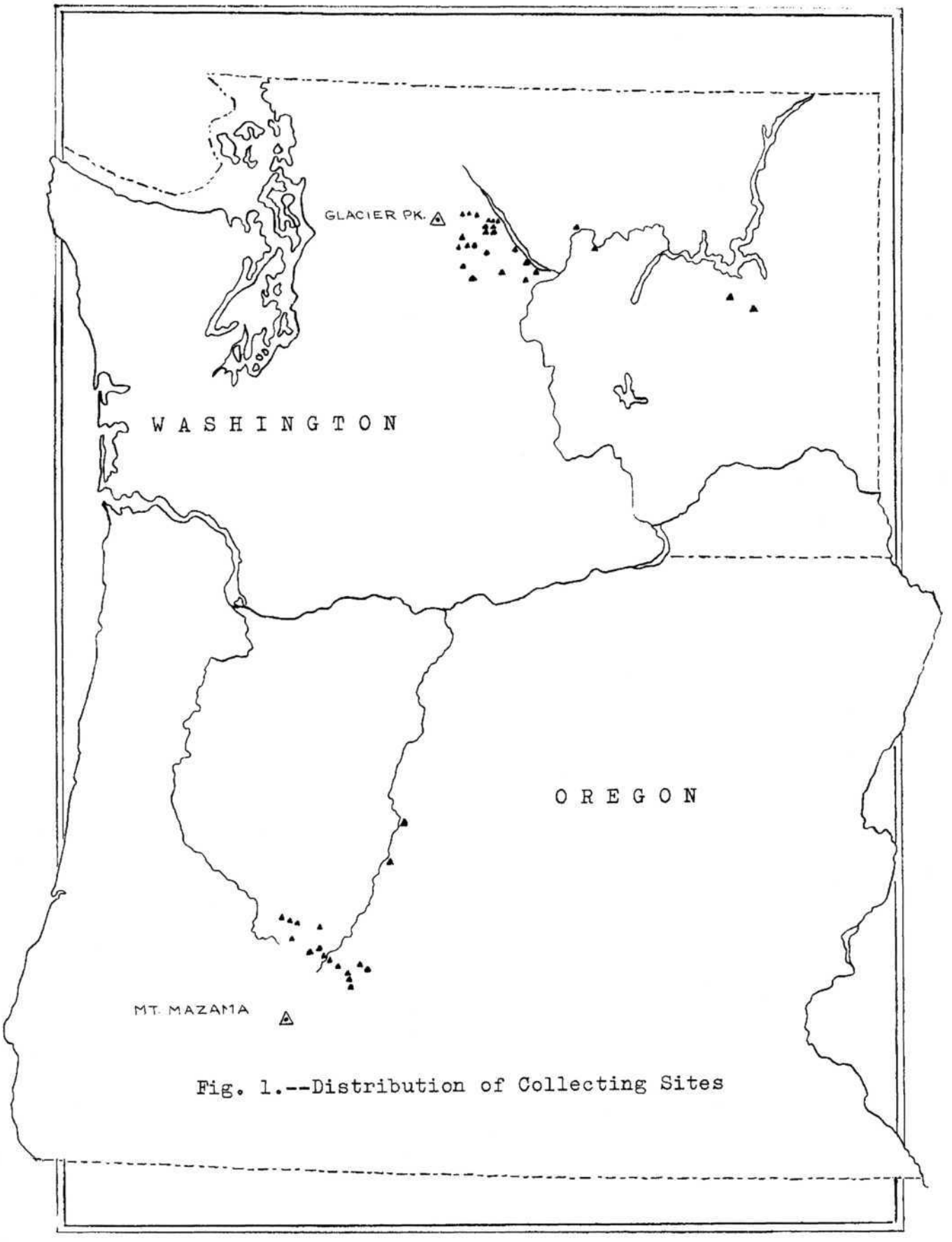

Fig. 1.--Distribution of Collecting Sites

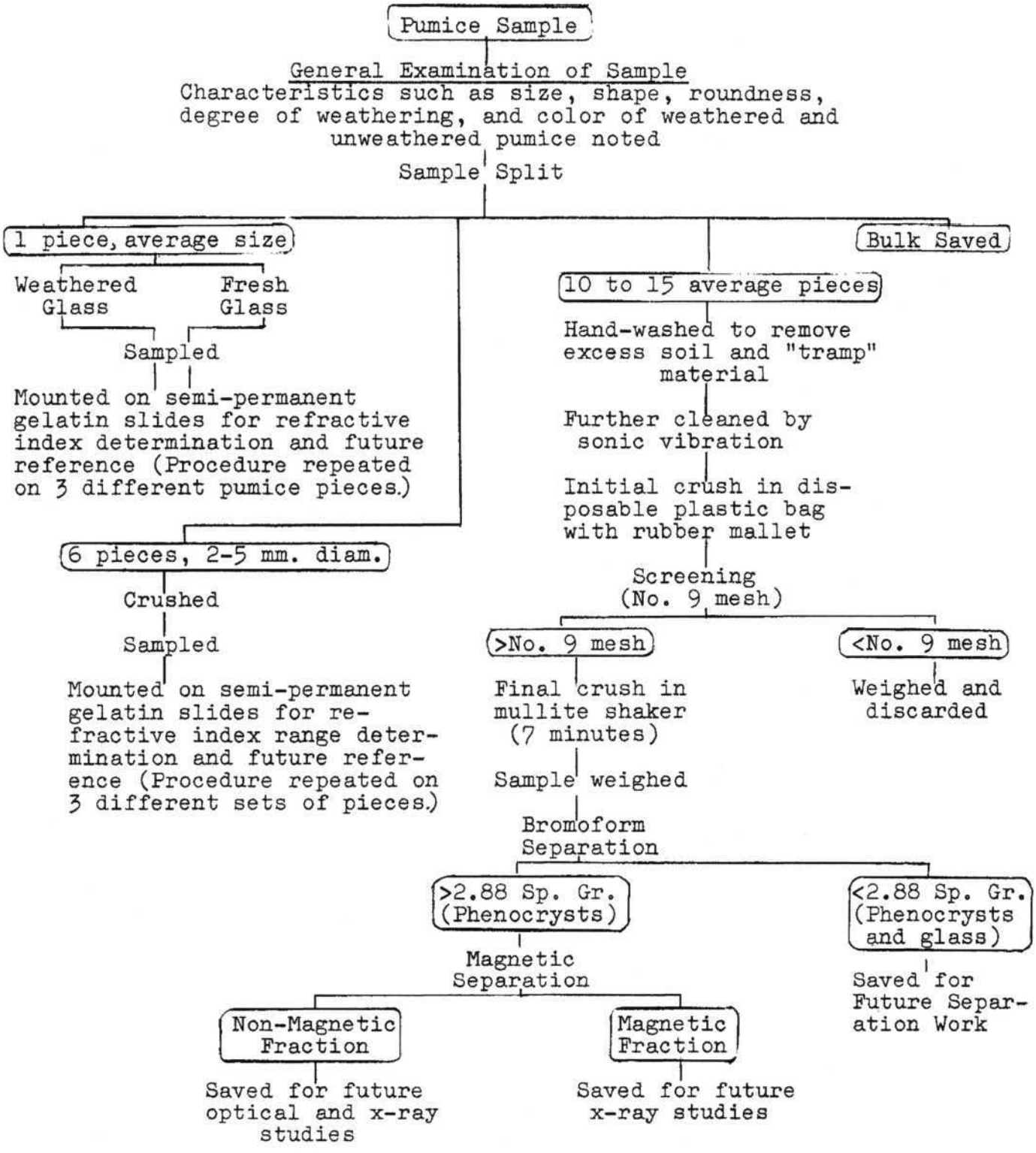

Fig. 2.--Schematic Laboratory Flow Sheet, Summer, 1963

SIGNIFICANCE OF DATA COLLECTED AND PROPOSED FUTURE STUDIES

As a result of this summer's work, comparative suites of pumice samples, complete with detailed soil, vegetation, and location description have been collected, providing the foundation for proposed future work at this laboratory in the fields of geology, geochronology, archaeology, and pedology.

Geology

An investigation of prime importance and interest will be comparison of data with the work of Powers and Wilcox, using pumice samples with detailed areal, environmental, and stratigraphic controls. If the indices of refraction of glass and selected phenocrysts are found to lie within the ranges they have established, their methods for identifying the source of volcanic ejecta may be used with greater confidence in areas with extreme climatic and topographic conditions.

Differences in refractive indices of transparent phenocrysts may imply differences in unit-cell arrangement of the component atoms. Using methods developed by the soil mineralogy staff of Washington State University, the writer plans to x-ray these phenocrysts to see if a unit-cell distortion exists.

To date, no research has been done using the x-ray patterns of magnetite as an aid in identifying pumice sources. A reconnaissance study of this nature, in the near future, is planned by the writer.

Geochronology

Ash sampled from numerous documented peat bogs in Washington is available to the writer for study. Positive identi-

fication of these ash lenses based on refractive index studies will aid in development of the post-glacial geochronology of the Washington area, and will be integrated with field evidence already gathered defining the relative stratigraphic and topographic positions of the two ash layers.

Archaeology

Occurrence of volcanic ash layers intermixed with cultural material in archaeologic sites in the Columbia Basin has long been a source of interest to the archaeologists of the area. Identification of these ash layers using the methods of Powers and Wilcox and other methods proposed by the writer will supply them with absolute time-stratigraphic horizons and will furnish another tool whereby the history of early man in the Pacific Northwest may be interpreted.

Pedology

Volcanic ejecta form the basic component of many of the richest soils in the Pacific Northwest. The close control of the soil forming factors offered by the samples collected opens up many fields of investigation, including the study of the weathering of volcanic glass and phenocrysts of similar composition as a function of: time, climate, topography, organisms.

RELATION OF STUDY TO OTHER RESEARCH IN PROGRESS

Investigation of physical and chemical characteristics of Glacier Peak and Mt. Mazama pumice and ash was initiated and is being carried out under NSF Grant G-24959. (The development of an integrated late-glacial and post-glacial geological and archaeological chronology for the Columbia Basin of Washington.)

The twelve-week summer fellowship enabled the writer to spend full-time on the problem, which will be continued on a half-time research basis for the 1963-64 school year.

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