University of America, and describing the equipments and instruments of the laboratory of aerodynamics recently erected there by Mr. Mattullath. Both gentlemen have been working on similar problems for many years, and Dr. Zahm was Secretary of the Aeronautical Congress at Chicago in 1893. On the floor of the laboratory is a wooden tunnel fifty feet long by six feet square in cross section, having a five-foot suction fan at one end and a netting, or two, of close mesh at the other. A wind is thereby generated of practically uniform velocity and direction, the speed varying less than one per cent., the direction but a small fraction of a degree. In this current are held objects whose resistances, lift, drift, skin-friction, etc., are to be measured. Among the various anemometers and wind-balances designed for this purpose, is a pressure gauge graduated to millionths of an atmosphere, and which may be adjusted to read to less than one ten-millionth. It is connected by hose to one or more Pitot nozzles, and is used to measure the air velocity and pressure at all points of the stream, particularly in the neighborhood of the exposed body. The prime motive of these investigations is to furnish a basis for calculations in aeronautics, particularly in the theory of mechanical flight.

The Society then adjourned till October 11, 1902.

CHARLES K. WEAD,
Secretary.

DISCUSSION AND CORRESPONDENCE.

VOLCANIC DUST AND SAND FROM ST. VINCENT CAUGHT AT SEA AND THE BARBADOS.

SOME days ago the Weather Bureau forwarded to the Geological Survey for examination a package of volcanic dust which had been collected May 7 at sea on board the British steamship *Coya* by Capt. Thomas in latitude 11° 21′ N., longitude 57° 47′ W., or about 275 miles southeast of the island of St. Vincent, W. I. The dust began to fall about 10 p. m. May 7, and Capt. Thomas reports it thickest between midnight and 2 a. m. May 8th. At 1:30 p. m. local or sun time there was absolute darkness. The dust was supposed by Capt. Thomas to have resulted from the eruption on Martinique or St. Vincent. The upper currents of that region during May 5, 6 and 7 were reported west with easterly surface winds. The transfer of the dust is therefore probably due wholly to upper currents, but the matter cannot be advantageously considered until the facts of distribution over the whole field are available.

The material is yellowish-gray in color, and to the naked eye of remarkably uniform fineness, having been thoroughly assorted from the larger fragments in its long flight. The gritty feel suggests that its particles are sharp and angular, and so they are, in strong contrast with the smooth round grains of the wind-blown desert sands which roll upon the surface.

The particles are so small that a microscope must be used for their study and reveals a range in their size from a diameter of .3 mm. down to .001 mm. or less. The largest particles have a sp. gr. of 2.7, with others almost as large having a sp. gr. 3.3. Considering the great distance this dust traveled through the air before falling to the vessel, it is suprising that it sinks so rapidly in water. Stirred into distilled water and allowed to stand, in five minutes fifteen per cent. falls to the bottom, in ten minutes fifty-seven per cent., in ninety minutes ninety-seven, and yet this material traveled through the air 275 miles. It must have been hurled up very high and carried away by strong currents.

The dust is a mixture of crystal fragments and glass and is clearly of volcanic origin. The crystal fragments constitute about sixty per cent. of the whole mass, and embrace feldspar, pyroxene, magnetite and possibly a number of other minerals not readily identified under such conditions. Feldspar is by far the most abundant mineral, occurring frequently in cleavage plates some of which show well-defined albite twinning, while others probably parallel to a different cleavage do not. The extinction angles, which rarely rise to twenty degrees, indicate that the feldspar approximates labradorite or bytownite, although there may be some orthoclase present. Many of the feldspar grains are full of included glass and other matter at times arranged in bands to mark zones of crystal growth. Quartz and orthoclase may be present in small quantities but they could not be positively determined.

Apparently two forms of pyroxene are present, a pale green non-pleochroic form whose prismatic fragments extinguish at a large angle and is probably augite, and a pleochroic yellowish form like hypersthene, but apparently having inclined extinction.

The glass particles vary greatly. Many are perfectly clear and transparent but rarely show the concave boundaries which are commonly characteristic of glossy volcanic dust. Occasional clear fragments are filled with microlites, minute crystals whose development was arrested by the eruption.

Opaque, white or yellowish-gray pumiceous fragments full of gas cavities are common and give color to the mass of which they constitute nearly twenty-five per cent. They appear to represent the molten material which floated the crystals and contained the explosive energy of eruption, blowing the mass to sand and dust with the relief of pressure. Although it is possible that the dust came from several sources, there is as yet no certain means of distinguishing the material from the different sources, nor in fact is there in the dust itself a definite suggestion of more than one source. In the process of crystallization the occluded gases are in large measure rejected and concentrated in the amorphous portion of the mass, so that when an outbreak occurs the glassy parts record the greatest expansion. The great distance traveled makes it probable that the proportion of amorphous material here is greater than in the original magma, for the crystal fragments being heavier would drop more readily than those of glass.

The destruction of St. Pierre has been attributed largely to gases shot out from the volcanic vent with burning sulphur, and it is probable that the gases ejected by la Soufrière on St. Vincent were of a similar nature. To get evidence concerning them it was proposed to crush the fragments of pumice in a vacuum and liberate the enclosed gases for chemical investigation, but the amount and character of the material at hand was entirely inadequate.

An inquiry as to the presence of soluble salts in the dust gave more definite data. None of the dust components thus far enumerated are soluble in water nor has it a decided taste, and yet when 10 grammes of the dust were treated with 400 cubic centimeters of water for 2 hours on water bath a neutral solution having the composition noted below with proportions indicating that the substances dissolved were $CaSo_4$ and NaCl and constituted about .5% of the dust. They were not discerned with certainty under the microscope but are supposed to appear as coatings deposited on some of the grains during the eruption. The large amount of superheated water vapor usually given off by volcanic eruptions is generally accompanied by much hydrochloric (HCl) and sulphurous acids (So_2), sulphurated hydrogen (H_2S) and other gases. The sulphurous acid upon reaching the air partially oxidizes to sulphuric acid, and with the hydrochloric acid would naturally attack the shattered lime-soda feldspar fragments forming a coating film of gypsum and common salt.

CHEMICAL ANALYSIS OF DUST FROM THE COYA I. AND OF HYPERSTHENE ANDESITE II. FROM CRATER LAKE, OREGON.

	I.	II.
Soluble in water.		
CaO	.20	
$(AlFe)_2O_3$	none	
Na_2O	.08	
SO_3	.29	
Cl	strong trace	
Insoluble in water.		
SiO_2	57.62	58.41
Al_2O_3	19.76	17.85
Fe_2O_3	3.43	2.67
FeO	3.90	3.29
MgO	1.82	3.61
CaO	6.25	6.81
Na_2O	3.79	3.77
K_2O	.71	1.23
H_2O-	.41	.34
H_2O+	.59	.86
TiO_2	.87	.69
CO_2	none	
P_2O_5	.17	.24

S	.11	
SO_3	none	
MnO	.08	trace
	100.08	99.77
		.05 (BaO)
		.05 (SrO)
		99.87

Native sulphur is abundant at Mt. Pelee as at many other volcanic vents and results from the reaction of the escaping gases SO_3 and H_2S. The last mentioned gas is readily inflammable and like SO_3 and HCl with which it is commonly associated issuing from volcanoes it is deadly and quickly proves fatal when inhaled in large proportions. To these heavy gases, in part inflammable, most likely commingled with others, is probably due the sudden destruction of life at St. Pierre.

The above chemical analysis I. by Mr. Steiger shows the presence of .11% sulphur in the insoluble portion of the dust. Tests with carbon disulphide indicate that the sulphur is not free but probably in the form of sulphides. No trace of boracic acid could be found, nor of ammonia or carbonic acid. Salts of ammonia and carbonates are formed only at low temperatures and would fail to leave a record among the solid compounds. Tests for arsenic and antimony were negative also.

By the kindness of Mr. W. C. Douglas, of the Geological Survey, I obtained a sample of the sand which fell at the Barbados, ninety miles from St. Vincent (one hundred and twenty from Martinique) on the afternoon of May 7. It was collected by Mrs. Mary D. Aughenbaugh, whose interesting observations are published in the *Evening Star,* Washington, D. C., May 23, p. 7: "Although the volcanic dust from St. Vincent was coming from the west there was a fairly strong east wind blowing all the time interspersed with hot waves of sulphurous air. The volcanic dust rained continuously here in Barbados from four o'clock P.M. Wednesday, May 7, until Thursday morning at five o'clock and accumulated to a depth of three fourths of an inch."

The particles of sand collected at the Barbados are of the same material as those noted in the dust collected by Capt. Thomas, although differing in proportion, and they evidently came from the same source, traveling between Barbados and the Coya in 6 hours, at the rate of nearly 31 miles an hour. Magnetite appears to be somewhat more abundant and much of it is enclosed in glass. The largest particles have a diameter of about .6 mm. with an average of .3 mm., and therefore a mass of over eight times that of the particles noted above borne to a distance three times as great. The sand from Barbados contains a much larger proportion of crystal fragments than the dust from the Coya, for the glassy matter is less than twenty per cent. The dust and sand from St. Vincent drifted mainly to the eastward, for the fall at Kingston, on the southwest side of St. Vincent, as reported by Mrs. Aughenbaugh was about as great as at Barbados, 90 miles away.

When compared with the dust and sand furnished by other volcanoes in recent years it bears the closest analogy with that of the Bogoslov eruption in Behring's Sea, October 23, 1883, and collected at Unalaska, sixty miles away. Mineralogically the sands are somewhat different and that at Unalaska is the coarsest, but they are alike in having a decided predominance of crystal fragments over those of volcanic glass. On the other hand, the dust from the great eruption of Krakatoa in the same year wafted many thousands of miles from its source was composed chiefly of glass particles, and crystal fragments formed a very small part of the mass. The explosion at Krakatoa was much greater than those of St. Vincent and Martinique. In both cases there was molten rock material erupted by the explosion, although at Krakatoa there was no flow of lava. In Japan, however, a few years ago the only material erupted was mud, giving evidence of the action of steam without real fusion. The character of the dust and sand examined is such as to indicate that if they were accompanied by lava streams upon the surface the streams would be similar to many flows in the Cascade Range of Oregon instead of the mud flows of Bandaisan in Japan. The similarity is well illustrated by a chemical analysis given above (II.), made by H. N. Stokes of a hypersthene-augite andesite of Crater lake.

J. S. Diller,
George Steiger.

U. S. Geological Survey.

THE GRAY SQUIRREL AS A TWIG-PRUNER.

Last year my attention was called to some elm street trees in New Haven, which had been injured by having the twigs eaten off early in June. The twigs were cut off through the hard wood formed the previous season, just below the new growth. Under certain trees the ground was fairly covered with the detached twigs. No borers were found in the severed portions as is the case when infested by the oak pruner, *Elaphidion villosum* Fabr., which attacks several kinds of shade trees. Still, it was supposed that some insect caused the damage, as climbing cut-worms sometimes eat off the new growth—but usually through the soft tissue.

The present season, similar injury has been reported from Farmington and New Haven.

On May 23, while cycling through the streets of New Haven, I noticed a small elm tree under which the ground was covered with freshly severed twigs. The same tree was attacked last year. Four gray squirrels were seen in the top busily engaged in devouring the nearly ripe seeds. As the seeds of the American elm are near the extremity of last season's growth where the twigs are very slender, the squirrels were obliged to perform many noteworthy acrobatic feats in order to obtain the seeds. Some were hanging by the hind feet from slender branches to reach twigs beneath them, and all were munching away at the seeds as if half starved. In some cases they were not able to reach the clusters of seeds, and would bite off the twigs, which dropped to the ground where they could find their food later. Several twigs were dropped in this way in a period of about two minutes, while the writer was watching them. In some cases the squirrels cut off twigs from which they had already eaten the seeds. Trees bearing no seeds are not pruned in this manner, and none of the trees will probably be injured very seriously. This habit of squirrels may have been recorded by other observers, but I do not remember seeing it in print.

The best remedy seems to be to provide the squirrels with plenty of other food at this season of the year when their natural food supply has been nearly exhausted.

W. E. Britton.

Conn. Agr. Experiment Station.

W. E. HAMILTON.

In Chatham, Ontario, there died a short time ago William Edwin Hamilton, the elder son of Sir W. R. Hamilton, the great Irish mathematician. He gave his father some help in reading the proof sheets of the 'Elements of Quaternions,' and his name appears as editor on the title page of the first edition. As the book had been printed off in sheets under the care of his father, his work as editor of the posthumous volume did not amount to much. He had graduated B.A. at Trinity College, Dublin, and had been trained to the profession of civil engineer. The editing finished, he left for the West Indies, located in various parts of the New World, and finally settled down in Chatham, then the center of immigration to the peninsula of Ontario. He was employed on the newspaper of the town, and through drinking habits fell into very wretched circumstances. When I first saw him, underclothes were conspicuous by their absence, and his sleeping place was said to be the loft of a livery stable. By taking the gold cure he was able to master his alcoholic enemy; but no cure could recall or even make up for the years he had wasted. Every Saturday he might be seen distributing a leaflet of a newspaper called the *Market Guide,* which contained advertisements, a list of prices of farm produce, a few witticisms, and occasionally some doggerel verses which he called poetry. In his later years he lived poor but respectable. He loved to talk about the members of that brilliant society in which his father moved, and he had not a few friends who esteemed him, if not for his own, at least for his father's sake. He was about sixty years of age, and his death was very sudden.

Alexander Macfarlane.