Technical Papers

Evidence for the Entry into the Upper Atmosphere of High-speed Protons during Auroral Activity

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During the intense auroral activity on the nights of August 18–19 and 19–20, 1950, several spectra were taken with the spectrograph designed by the writer (*1*). It will take some time to analyze all the information contained in these spectra, but one result of the observation seems worth recording at once.

A spectrum of an auroral arc in the magnetic zenith taken on August 19–20 showed that the H-alpha emission line is strongly asymmetric to the violet. On this occasion the spectrograph was pointed parallel to the magnetic lines of force so that any incident auroral particles would be approaching the spectrograph. The profile of H-alpha is found to be asymmetrical, with a maximum violet displacement of 60 A, corresponding to a velocity of 2,800 km/sec. The H-alpha line viewed perpendicularly to the magnetic lines is, however, symmetrical and undisplaced, but it is broadened by approximately 6 A. The red edge of the asymmetrical H-alpha emission has a profile showing a similar spread of 6 A. Broadened hydrogen lines have been observed before by Gartlein (*2*). These earlier observations, however, were made with the spectrograph pointed normal to the magnetic lines. Consequently, no Doppler displacements of the kind noted here have been observed before. These observations therefore establish for the first time that protons of probably solar origin are streaming into the upper atmosphere at velocities of the order of 2,500–3,000 km/sec.

References

1. MEINEL, A. B. *Publ. Astro. Soc. Pacific,* **60**, 257 (1948); also *Astrophys. J.,* **111**, 555 (1950).
2. GARTLEIN, C. W. *Trans. Am. Geophys. Union,* **31**, 19 (1950).

Speed of Salt Increase in the Waters of Lake Tacarigua, Venezuela

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Lake Tacarigua (or Valencia), recently described by Crist and Chardon (*1*), and Jahn (*2*), lies in the valley of Aragua, the center of a zone of fluvial and lacustrine deposits that form the depression in the intrusive and metamorphic mass of the Cordillera de la Costa in northern Venezuela.

According to Aguerrevere and Zuloaga (*3*), the lake was formed after the development of the peneplane and during the process of general uplift of the mountain range. It occupied in 1939 an approximate area of 436 sq km (*4*).

Today the lake has no visible outlet and rests on water-worked deposits that have been found by Berry (*4*) to be more than 450 ft deep in the southeast quadrant, near Tocoron, which was on dry land at the time of his study. On the other hand, Lopez (*5*) did not find mother rock at a depth of 60 m near Naguanagua, a suburb north of the city of Valencia, whereas he found it at a depth of 160 m in the northern outskirts of the city proper. It is evident from this that the gravel beds forming the bottom of the depression extend beyond the area of the existing lake.

Of great interest in the present connection are the well-defined wave-worn escarpments found by Berry on the island of Horno, the oldest, chronologically, being 50 ft above the surface of the waters.

Within historic times Lake Tacarigua has suffered changes in level (*6*) that have been summarized by Crist and Chardon, and, according to Humboldt (*7*), Boussingault (*8*), and Codazzi (*9*), the valley of Aragua was a region of intensive and productive agriculture during the first part of the nineteenth century.

As part of a biologic study of the waters of the lake begun by Bonazzi in 1946, several analyses were made during that and the following years. The methods of the A.P.H.A. were followed, and the results are reported in Table 1.

According to Codazzi (*10*), analyses of these same waters made by Boussingault and Rivero (probably 1830–40) yielded a concentration of 1:2,000 of sodium, calcium, and magnesium carbonates and calcium sulphate.

TABLE 1

ANALYSES OF THE WATERS OF LAKE TACARIGUA

		Sample No.			
		1	2, 3, 4	5, 6	7
Date of sampling (1947)		August	August	October	October
Distance from shore, m		300	500	300	100
Depth of sample, m		3	0.25–3.0	36	7.6
pH		7.75	7.75	7.60	7.60
Total solids, ppm		971.0	971.0	970.0	970.0
Dissolved oxygen		6.21	5.18	0.00	6.89
Carbonates	CO_3	—	37.60	35.40	35.40
Bicarbonates	HCO_3	—	462.80	422.00	390.00
Nitric nitrogen	N	0.57	0.54	9.24	4.16
Chlorides	Cl	52.70	52.70	30.24	37.00
Total iron	Fe_2O_3	0.58	0.53	0.21	0.34
Calcium	CaO	21.55	18.49	45.26	79.91
Magnesium	MgO	67.45	68.33	56.28	45.99
Silica	SiO_2	23.00	24.00	17.00	15.00
Alumina	Al_2O_3	—	—	3.80	3.20
Sulphates	SO_4	353.00	353.46	332.91	329.83
Sodium	Na_2O	105.00	104.16	—	—