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	—	—

In 1920 Delgado Palacios (*11*) found these same waters to contain 784.8 ppm of total salts, and Wieder (*12*) found a total salt concentration of 931–945 ppm a few years later (1939). From these data it is possible to construct the curve shown in Fig. 1.

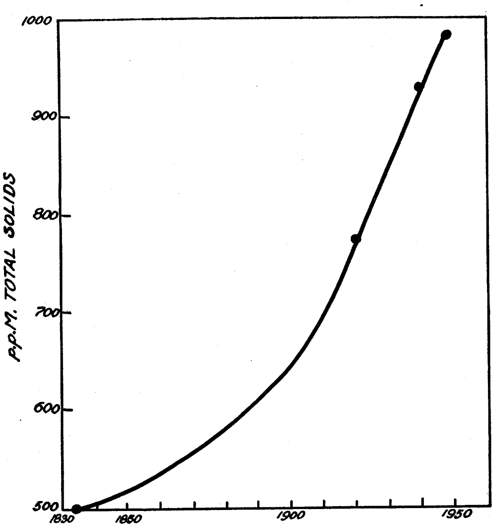

FIG. 1.

In an attempt to locate the origin of these large salt concentrations, Bonazzi in 1948 submitted the waters of a number of tributary streams to analysis. Sampling was left for the driest period of the year (March), since at that time the salt content of the waters logically should be at its highest. Many of the smaller tributaries were dry, so that sampling was done only of the rivers mentioned in Table 2, above the place where there could be a possibility of contamination from salts previously deposited in the lowlands or where the rivers might be passing through a salty area.

TABLE 2

ANALYSES OF TRIBUTARY STREAMS, 1947 AND 1948

		Sampling localities				
		R. Guigue	Station 6	R. Guayos	R. Delicias	R. Aragua
Silica	SiO_2	0.0	0.0	6.20	1.20	9.2
Alumina	Al_2O_3	0.0	0.0	1.38	—	0.84
Total iron	Fe_2O_3	—	—	4.82	5.28	8.36
Calcium	CaO	41.48	61.02	96.06	6.18	104.00
Magnesium	MgO	8.90	15.60	12.60	2.00	13.80
Sulphates	SO_4	19.00	46.50	31.80	3.40	41.70
Chlorides	Cl	4.83	12.07	7.24	4.83	6.04
Total solids, ppm		74.0	173.5	149.0	32.0	161.0

From the foregoing it is evident that the total salt concentration of the tributary streams today fluctuates around 118 ppm, the SO_4 around 28.5 ppm, and the Cl around 7.0 ppm.

The values presented in this paper may explain the mechanism of salinification of many agricultural soils of the valley of Aragua, which in some extreme cases have been found to contain 11,150 ppm of Cl and 28,604 ppm of SO_4. Evidently this process was already in progress in the early part of the 19th century and has recently become intensified.

References

1. CRIST, R. E., and CHARDON, C. E. *Geogr. Rev.*, **1941**, 430 (1941).
2. JAHN, A. *Biol. Acad. Nacion. Hist.*, **23**, 448 (1940).
3. AGUERREVERE, P. E., and ZULOAGA, G. *Bol. Geol. Min. Caracas*, **1**, 25 (1937).
4. BERRY, E. W. *Proc. Am. Phil. Soc.*, **81**, 547 (1939).
5. LOPEZ, V. *Rev. Fomento*, **4**, 47 (1942).
6. BERRY, E. *Op. cit.*
7. HUMBOLDT, A. *Viajes en las regiones equinocciales.* Caracas: Biblioteca Venezolana de Cultura, 1940.
8. BOUSSINGAULT, J. B. In J. Acosta (Ed.), *Viajes cientificos a los Andes Ecuatoriales, Nueva Granada, Ecuador y Venezula.* Paris: 1849.
9. CODAZZI, A. *Resumen Geogr. Venezuela*, **3**, 53 (1841).
10. *Ibid.* 55 (1841).
11. DELGADO, P. F. In I. Chacin (Ed.), *Algunus consideraciones sobre las aguas de Caracas y otros lugares vecinos.* Caracas: Author, 1920.
12. WIEDER, H. In R. Fernandez Garcia (Ed.), *Inform. An. Estac. Experim. Agr. Zoot.* Caracas: Minist. Agr. y Cria, 1939. Vol. 67.

The Synthesis of 1,1,1-Trichloro-2,2-bis-(4′-Chlorophenyl-4′-C^{14})-ethane

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In order to make available for tracer studies samples of the potent insecticide DDT [1,1,1-trichloro-2,2-bis-(4′-chlorophenyl)-ethane], we undertook the synthesis of this compound labeled in the benzene rings with carbon 14. Since both benzene-1-C^{14} (*1*) and aniline-1-C^{14} (*2*) are readily accessible, we investigated the preparation of tagged chlorobenzene by direct chlorination of benzene, as well as by the Sandmeyer reaction with aniline.

When chlorine is allowed to react with an excess of benzene in the presence of suitable catalysts such as aluminum turnings or iron and iodine, chlorobenzene is obtained in 80–90% yield based on the benzene actually consumed, and the formation of more highly chlorinated derivatives occurs to only a limited extent (*3, 4*). In the presence of an iron-iodine catalyst in a sealed tube at temperatures from 0° to 30°, the reaction of equimolar quantities of benzene and chlorine afforded chlorobenzene in yields ranging from 42 to 65%, together with unreacted benzene and considerable quantities of dichlorobenzene and resin.

The preparation of chlorobenzene was most satisfactorily achieved by reaction of benzene diazonium chloride with hot cuprous chloride solution (*5*). This procedure afforded pure chlorobenzene in 68–75% over-all yield from aniline, and is of particular advantage in the small-scale preparation of the labeled halide, since it yields a uniquely labeled derivative, and avoids the necessity of