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LIMNOLOGICAL STATUS OF BIG SODA LAKE, NEVADA, OCTOBER 1970

Ervon R. Koenig¹, John R. Baker¹, Larry J. Paulson¹, and Richard W. Tew¹

ABSTRACT.—On 17 October 1970, the thermocline in the mixolimnion of Big Soda Lake, Nev., was located between 15 and 20 m below the surface. The chemocline was found to lie between 30 and 35 m depth. Significant dilution of the lake has occurred since 23 July 1933.

INTRODUCTION

Big Soda Lake, near Fallon, Nev., is of interest because it is meromictic and because the mixolimnion is thermally stratified. This post-Lahontan crater lake was last analyzed in detail by G. E. Hutchinson on 23 July 1933 (Hutchinson, 1937), who noted the ectogenic origin of meromixis as a result of regional irrigation and predicted that dilution by ground water would eventually abolish chemical stratification altogether at a rate of 1570 metric tons chloride per year. Sufficient time has passed since Hutchinson collected his data to reinvestigate the characteristics of the lake and to check on the fate of chemical stratification.

METHODS²

Samples were collected and temperatures determined by the use of Dussart bottles (Golterman, 1969). Chemical analyses were performed according to Standard Methods for the Examination of Water and Wastewater (American Public Health Association, 1960). The chloride data in Table 1 are the averages of single mercuric nitrate assays performed by two groups of analysts. Salinities were determined with a Hach #2200 meter and are reported as the specific conductance noted for the *stated dilution of sample*. Sulfides were determined colorimetrically.

RESULTS

The data in Table 1 indicate that on 17 October 1970 Big Soda Lake was stratified chemically between 30 and 35 m and thermally in the mixolimnion between 15 and 20 m. The deepest point noted in a transect of the lake was 65 m, indicating no significant change in level since 1933.

The temperatures recorded for the October 1970 monimolimnion and the mixolimnion below the thermocline correlate closely with Hutchinson's (1937) data for these regions of the lake in July 1933.

Comparison of data for October 1970 and 23 July 1933 (Hutchinson, 1937) indicates that significant dilution has occurred and that

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²Confirmation of sulfide data by Mr. James H. Parrott, manager, and Mr. Sam Shannon, analyst, Clark County Sanitation District No. 1, is gratefully acknowledged.

TABLE 1. Analyses of Big Soda Lake, 17 October 1970. Hutchinson's (1937) data for 23 July 1933 are in parentheses.

Depth, m	Temperature, C	Chloride, ppm	Sulfides, ppm	Specific Conductance Dilution umho/cm	Visual Color
0 (0)	16.5 (24.75)	6783 ± 33 (8200)	0 (0)	10 4200	Clear
5 (5)	16.5 (23.03)	6985 ± 210	0	10 4200	Clear
(7)	(17.82)				
(10)	(11.82)	(8200)	(0)		
15	16.5	6795 ± 10	0	10 4200	Clear
20 (20)	9.0 (8.94)	6200 ± 5 (15100)	0 (456)	10 4200	Pink
25	9.5	6732 ± 33	0	10 4200	Pink
30	8.2	6980 ± 95	3	10 4500	Light Yellow
35 (40)	12.0 (12.60)	18175 ± 700 (27300)	400 (456)	25 4350	Yellow
45 (60)	12.5 (12.60)	25650 ± 338 (27300)	300 (786)	25 5670	Yellow
65	12.5	23412 ± 462		25 5300	Yellow

On 17 October 1970, the 55 m temperature was 12.5. The sample was subsequently lost.

a more sharply defined chemocline now exists at a considerably deeper level. The datum of 7520 ppm chloride recorded for surface waters in 1958 (Whitehead and Feth, 1961) partially substantiates the evidence for continuing dilution over the past 27 years.

Sulfides were not found below the thermocline in the mixolimnion. The purple sulfur bacteria ("bacterial plate") noted in this region may be expected to convert sulfides leaking through the chemocline to sulfate as long as the mixolimnion is stratified and the "hypolimnion" anaerobic. Thus, net loss of gaseous hydrogen sulfide from the lake, as noted by Borchert and Muir (1964) for marine sediments, may occur only during the period of mixolimnion circulation. Thus, it is not surprising that the sulfides present in the central monimolimnion were not dramatically lower than values recorded for 1933. However, Hutchinson's value of 786 ppm sulfide at 60 m is more difficult to reconcile with our finding of 300 ppm at 65 m but may represent discrepancies in the actual points of sampling. Our sampling regime may have missed a localized area of high sulfide concentration located by Hutchinson.

Actually, since 700 ppm sulfate were noted in the central monimolimnion in October 1970, considerable potential for additional sulfide production exists, and the discrepancy in the data for sulfides near the sediment-monomolimnion interface may also reflect reduced amounts of hydrogen sources sinking through the monimolimnion from the mixolimnion and becoming available for sulfate reduction. Obviously needed are additional studies correlating (1) the migration of sulfate to the sediment surface, (2) concomitant addition to the monimolimnion and sediments of hydrogen sources from the mixolimnion, and (3) the actual count of sulfate reducing bacteria throughout this region of the lake.

Identification of plankton was not attempted except for the organisms in the bacterial plate, which consisted mainly of *Rhodotheca* and *Thiotheca* (Breed, et al., 1957; Pfennig, 1967).

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