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Some implications of the 1940 redefinition of chlorinity*

W. S. REEBURGH

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EFFORTS to refine the relationships of sea water density, electrical conductivity, and refractive index as functions of chlorinity and temperature have led to plans for the redetermination of these properties on a large number of well-distributed sea water samples. The new values will doubtless be compared with those from earlier studies. A precaution that must be taken to obtain a reliable comparison deals with differences in the meaning of chlorinity during the 1930's and implications of these differences on interpretation of properties measured as a function of chlorinity. These differences and their implications have not been specifically mentioned in recent reviews (COX, 1963, 1965; JOHNSTON, 1964; PARK and BURT, 1965) and appear to have been overlooked by a number of workers.

The word chlorinity was defined by FORCH, KNUDSEN and SØRENSON (1902) as the total weight of halides, calculated as chlorine, in a kilogram of sea water. This stated definition was dependent on the choice of atomic weight values. Standard Sea Water provided a convenient working standard. This working standard was independent of changes in atomic weight values since all batches of Standard Sea Water were compared directly or indirectly with a primary standard sea water whose chlorinity was determined according to the stated definition using KCl (1900 atomic weight values) as the standard. By 1940, changes in atomic weight values led to a difference between the stated definition and the working standard of about 0·05% (0·009‰). To avoid this difficulty, JACOBSEN and KNUDSEN (1940) redefined chlorinity as :

> The number giving the chlorinity in grams per kilogram of sea water sample is identical with the mass in grams of 'atomic weight silver' just necessary to precipitate the halogens in 0·3285233 kilogram of sea water sample.

Chlorinity is, according to this definition, independent of changes in atomic weight values and numerically identical to the chlorinity defined by FORCH, KNUDSEN and SØRENSON in 1902. Standard Sea Water provides a working standard as before.

During the 1930's, comprehensive investigations of the chlorinity and temperature dependence of the electrical conductivity and refractive index of sea water were performed by Dr. Thomas G. Thompson and his co-workers at the University of Washington, Seattle. The values obtained during these investigations have since seen wide use. In their work on electrical conductivity (THOMAS *et al.*, 1934) and refractive index (UTTERBACK *et al.*, 1934), identical sea water samples were studied. Carefully purified NaCl (1932 atomic weight values) was used as the standard in their Volhard chlorinity titrations. Standard Sea Water was not mentioned. It should be made clear that their reported chlorinities actually were chlorinities in 1934, but following the redefinition of chlorinity by JACOBSEN and KNUDSEN (1940), they have become measurements of chlorine-equivalent. These chlorine-equivalent measurements have been widely interpreted as chlorinities, resulting in a number of erroneous tables and interpolation formulae.

Since the pertinent atomic weight values were not changed between 1932 and 1940, the ratio of chlorine-equivalent to chlorinity reported by LYMAN and FLEMING (1940) may be used to convert these reliable measurements of chlorine-equivalent to chlorinity. In comparing recent and future work to that of THOMAS *et al.* (1934) and UTTERBACK *et al.* (1934), their reported "chlorinities" should be divided by 1·00045 to obtain true chlorinities.

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