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Progress Report on Determinations of Major Constituents of Sea Water

by

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The chemical section of our sea water investigation is not as advanced as the physical work but some interesting points have emerged.

The acid radicals, fluoride, bromide, borate, sulphate and chloride in about 300 samples have been determined by Dr. J.P. Riley and his staff at Liverpool University. With the exception of fluoride, which shows some regional variations, the acid radical results show very constant ratios to chlorinity. The only acid radical which could have a bearing on the conductivity/chlorinity ratios is sulphate, but the variations which Riley has found in sulphate/chlorinity ratios for ca. 300 samples cannot account for more than a quarter of the variations in the conductivity/chlorinity ratio.

The determinations of the metal ions is being carried out at N.I.O. and so far about seventy samples have been examined. Most of the samples have been selected from those which showed large variations in conductivity/chlorinity ratios. The chemical variations we have found are probably indicative of the maximum variations to be found in open ocean waters.

The two metals which have given the most interesting results are calcium and magnesium. A summary of these results is given below.

Calcium analyses

Samples	Mean Ca/Cl ratio	Range	Ca g/kg for 35 ‰	Std. dev. %
Std. sea water (12 samples)	0.02145	0.02141 0.02152	0.4156	0.00074 = 0.18%
Surface (33 samples)	0.02147	0.02132 0.02159	0.4160	0.00119 = 0.29%
Intermediate (8 samples)	0.02152	0.02145 0.02156	0.4167	0.00091 = 0.22%
Deep (16 samples)	0.02154	0.02147 0.02165	0.4172	0.00084 = 0.20%

Magnesium analyses

Samples	Mean Mg/Cl ratio	Range	Mg g/kg for 35‰	Std. dev. %
Std. sea water (12 samples)	0.06677	0.06666 0.06684	1.2935	0.00079 = 0.05%
Surface (33 samples)	0.06680	0.06640 0.06709	1.2947	0.0022 = 0.17%
Intermediate (8 samples)	0.06679	0.06666 0.06691	1.2936	0.0017 = 0.13%
Deep (16 samples)	0.06682	0.06668 0.06698	1.2941	0.0016 = 0.12%

These results show a tendency for calcium to increase, relative to chlorinity, with depth. This difference in calcium content between surface and deep waters could account for about a quarter of the variations which we have found in conductivity/chlorinity ratios. There is a negative correlation between the calcium/chlorinity ratio and chlorinity/conductivity ratio, i.e. high calcium means high conductivity. There do not appear to be any significant regional variations in the calcium/chlorinity ratios.

In contrast to calcium, magnesium shows no tendency to vary with depth but it does vary regionally . Our deep Mediterranean samples have lower than average magnesium/chlorinity ratios while those for N. Atlantic surface samples are high. These variations in magnesium are about double those of calcium but are unexplained so far. If confirmed by further work they could account for about half of the observed conductivity/chlorinity variations.

Although the correlation between chemical analysis and other variations is far from perfect it appears that the variations in conductivity/chlorinity ratios are largely due to variations in chemical composition.