VI. GROUND WATER

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Although no studies of ground water had been made on the islets of Jaluit Atoll prior to the coming of Typhoon OPHELIA, dug wells have for many years furnished potable water, so fresh water lenses may be assumed to have existed on all but the very small islets. The quality of this water probably was similar, in general, to that reported from fresh water lenses on other Pacific limestone islands. Storm waves of the typhoon, however, submerged many of the islets, so their supply of ground water was locally contaminated and its composition greatly altered by mixing with sea water.

Samples of ground water were collected for analysis in May, 1958, about four months after the storm. These samples were obtained from four wells in existence prior to the typhoon, three wells dug at the time of sampling, one scour pool cut by the typhoon, and one mangrove pond (for location of wells, see Figs. 6, 8, 11, 12, 13). The three test wells and one of the original wells were on islets known to have been covered by a sheet of water during the typhoon (Jabor and Mejatto); the other three old wells were on islets not inundated (Pinlep, Majurirek, Kinajon) and their waters apparently were relatively little changed as a result of the storm.

Temperature and pH readings were taken at each of the wells examined (Table III). Temperatures ranged from 82° F. to 87° F. These were read near the middle of the day and probably are relatively high because all of the wells were in the open, unprotected from the sun, as a result of typhoon destruction of surrounding trees. Well waters ranged from about pH 6.0 to pH 7.0, all of the higher figures representing wells on islets known to have been inundated by typhoon-driven sea water.

TABLE III.--Readings of pH and temperature for well water

Well description	pH	Temperature*
Majurirek	6.0	86
Pinlep	6.5	83
Mejatto well #1	7.0	85
Mejatto well #2	7.0	87
Jabor well #2	7.0	82

* degrees Fahrenheit

Hardness of water (Table IV) in the three samples from islets not inundated by storm waves is less than 500 parts per million; in all others it is greater than 1200 ppm, apparently the result of contamination by sea water. Thus, low calcium and low magnesium in well waters of Pinlep, Majurirek and Kinajon islets probably represent amounts normal for fresh water on these islets; water of similar composition is reported from

fresh water lenses in the northern Marshall Islands (Arnow, 1954, p.7) and on Kapingamarangi Atoll (McKee, 1958, p. 267). The amount of calcium and magnesium in such waters, higher than in average fresh water streams and lakes, results from solution of limestone and lime sand of the islets.

Well water from Jabor and Mejatto Islets (Table IV) which were covered by sea water during the typhoon are much higher in both calcium (over 200 ppm) and magnesium (over 170 ppm) than water from the islets cited above that were not inundated. Furthermore, the amount of magnesium in the Jabor-Mejatto samples is essentially equal to or greater than the amount of calcium, a result of contamination, since normal sea water has proportionately more magnesium than calcium, whereas most fresh waters are the reverse.

The extent of contamination by sea water is illustrated by analyses of sulfate (SO_4) and chloride (Cl) for well water from Jabor and Mejatto Islets (Table IV). Both of these islets were covered by ocean water during the typhoon, but apparently the lens on Mejatto with a combined sulfate and chloride content ranging from 10,000 to 15,000 ppm was contaminated more than that on Jabor where it ranges from 4,000 to 5,000 ppm. It is instructive to compare these figures with the 250 ppm sulfate and 250 ppm chloride recommended by the U. S. Public Health Service as the upper limit for water used in normal domestic consumption.

A summary of available data on the ground water resources of Jaluit Atoll after Typhoon OPHELIA is as follows. The fresh water lenses on those islets not covered by storm waters appear to be normal for Pacific atolls and probably were little or not affected by the typhoon. The fresh water lens on Jabor and that on Mejatto, judged by samples from two wells on each, show a sulfate-chloride content far too high for drinking purposes and will require a considerable period of dilution by rainwater to again become potable. How long a period of "freshening" will be needed with present annual precipitation of about 200 inches, is not known, but samples from the four wells in question, collected and analyzed periodically during the coming year should give significant information.

TABLE IV.—Analyses of water samples from original dug wells and test wells and comparative data for a mangrove pool and for normal sea water. (Analyses by U. S. Geological Survey)

LOCATION OF WELL	Chemical Components (ppm)						Physical characteristics		
	Ca	Mg	Na	K	SO_4	Cl	Hardness (ppm)	% Sodium	Sp.Gr.
Majurirek, 190 feet from lagoon beach crest W. end of island center.	102	17	138	11	45	238	324	47	1.000
Pinlep, 190' from lagoon beach crest.	53	8.8	62	5.8	26	62	168	43	1.000
Kinajon, 130' from low water, 99' from ridge on SW islet.	142	27	316	27	102	570	466	58	1.000
Mejatto, well #1, 174' from seaward gravel ridge.	285	529	4900	214	1370	8700	2890	73	1.011
Mejatto, well #2, 301' from lagoon beach crest.	362	888	7550	252	1910	13000	4550	77	1.017
Jabor, well #1, 130' from lagoon beach crest.	223	242	1990	84	535	3390	1550	72	1.004
Jabor, well #2, 265' from lagoon beach crest.	207	174	1500	84	473	2890	1230	71	1.003
Mejatto, water from scour pool on lagoon side of islet behind beach crest.	159	415	3570	147	1010	5950	2100	77	1.008
Majurirek, water from mangrove pond.	376	1090	8700	376	2300	14900	5420	76	1.020
Normal seawater.	400	1270	10560	380	2650	18980	6215	79	